"When They Drop the Atomic Bomb" by Jackie Doll and his …

Neutron bomb is out now on iTunes, Amazon, Vimeo and GooglePlay!

11 May 2023 Russian State TV Channel 1 nuclear testing a…

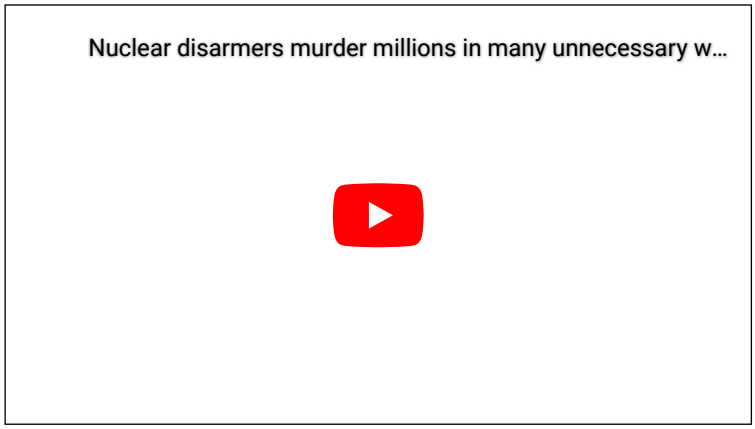
Russian State TV nuclear war propaganda 7 April 2023

ABOVE (VIDEO CLIP): **Russian State TV Channel 1 war enabler, NOT MERELY MAKING "INCREDIBLE BLUFF THREATS THAT WE MUST ALL LAUGH AT AND IGNORE LIKE DR GOEBBELS THREATS TO GAS JEWS AND START A WORLD WAR" AS ALMOST ALL THE BBC SCHOOL OF "JOURNALISM" (to which we don't exactly belong!) LIARS CLAIM, but instead preparing Russians *mentally* for nuclear war (they already have nuclear shelters and a new Putin-era tactical nuclear war civil defense manual from 2014, linked and discussed in blog posts on the archive above), arguing for use of nuclear weapons in Ukraine war in 2023: "We should not be afraid of what it is unnecessary to be afraid of. We need to win. That is all. We have to achieve this with the means we have, with the weapons we have. I would like to remind you that a nuclear weapon is not just a bomb; it is the heritage of the whole Russian people, suffered through the hardest times. It is our heritage. And we have the right to use it to defend our homeland [*does he mean the liberated components of the USSR that gained freedom in 1992?*]. Changing the [nuclear use] doctrine is just a piece of paper, but it is worth making a decision."**

THIS IS NOT ENGLISH LANGUAGE "PROPAGANDA" SOLELY ADDRESSED AS A "BLUFF" TO UK AND USA GOV BIGOTED CHARLATANS (those who have framed photos of hitler, stalin, chamberlain, baldwin, lloyd george, eisenhower, et al., on their office walls), BUT ADDRESSED AT MAKING RUSSIAN FOLK PARTY TO THE NEED FOR PUTIN TO START A THIRD WORLD WAR! Duh!!!!! SURE, PUTIN COULD PRESS THE BUTTON NOW, BUT THAT IS NOT THE RUSSIAN WAY, ANY MORE THAN HITLER SET OFF WWII BY DIRECTLY BOMBING LONDON! HE DIDN'T. THESE PEOPLE WANT TO CONTROL HISTORY, TO GO DOWN THE NEXT "PUTIN THE GREAT". THEY WANT TO GET THEIR PEOPLE, AND CHINA, NORTH KOREA, IRAN, ET Al. AS ALLIES, BY APPEARING TO BE DEFENDING RATIONALITY AND LIBERTY AGAINST WAR MONGERING WESTERN IMPERIALISM. For the KGB mindset here,

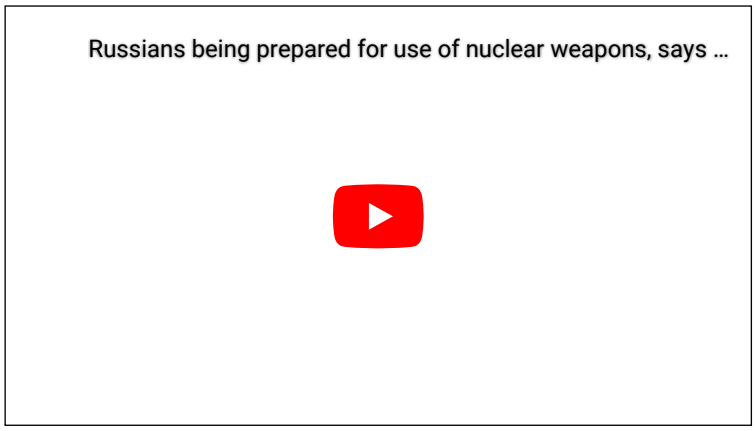
please read Chapman Pincher's book "The Secret offensive" and Paul Mercer's "Peace of the Dead - The Truth Behind the Nuclear Disarmers". **Cheers!**

PLEASE BEAR WITH US - THIS SITE WAS DEVELOPED IN 2006 BEFORE GOOGLE SMARTPHONE BOT CACHING (GOOGLE BOTS CAN'T INDEX THIS FORMAT ANYMORE AS IT IS SIMPLY UNSUITABLE TO SMARTPHONES WHICH DIDN'T EXIST BACK IN 2006 - WILL MOVE TO A NEW DOMAIN SOON TO OVERCOME THIS. (HOPEFULLY THE TEXT WILL ALSO BE EDITED AND RE-WRITTEN TO TAKE OUT TYPING ERRORS AND DEAD LINKS DATING BACK TO 2006 WHEN THE BLOG BEGAN - A LOT HAS CHANGED SINCE THEN!)



Glasstone's Effects of Nuclear Weapons exaggerations completely undermine credible deterrence of war: Glasstone exaggerates urban "strategic" nuclear weapons effects by using effects data taken from unobstructed terrain (without the concrete jungle shielding of blast winds and radiation by cities!), and omits the most vital uses and most vital effects of nuclear weapons: to DETER world war credibly by negating the concentrations of force used to invade Belgium, 1914 (thus WWI) and Poland (WWII). The facts from Hiroshima and Nagasaki for the shielding of blast and radiation effects by modern concrete buildings in the credible nuclear deterrence of invasions (click here for data) which - unlike the countervalue drivel that failed to prevent WW2 costing millions of human lives - worked in the Cold War despite the Western media's obsession with treating as Gospel truth the lying anti-nuclear propaganda from Russia's World Peace Council and its allies (intended to make the West disarm to allow Russian invasions without opposition, as worked in Ukraine recently)! If we have credible W54's and W79's tactical nukes to deter invasions as used to Cold War, pro Russian World Peace Council inspired propaganda says: "if you use those, we'll bomb your cities", ***but they can bomb our cities with nuclear if we use conventional weapons, or even if we fart, if they want - we don't actually control what thugs in dictatorships - it is like saying Hitler had 12,000 tons of tabun nerve agent by 1945, so lying we had to surrender for fear of it.*** **Actually, he had to blow his brains out because he had an incredible deterrent, as retaliation risk plus defence (masks) negated it!**

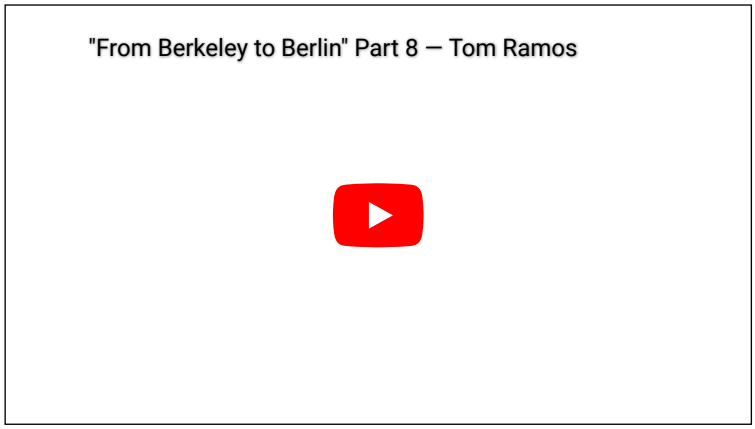
Credible deterrence necessitates simple, effective protection against concentrated and dispersed invasions and bombing. The facts can debunk massively inaccurate, deliberately misleading CND "disarm or be annihilated" pro-dictatorship ("communism" scam) political anti-nuclear deterrence dogma. Hiroshima and Nagasaki anti-nuclear propaganda effects lies on blast and radiation for modern concrete cities is debunked by solid factual evidence kept from public sight for political reasons by the Marx-media which is not opposed by the remainder of the media, and the completely fake "nuclear effects data" sneaks into "established pseudo-wisdom" by the back-door. Another trick is hate attacks on anyone telling the truth: this is a repeat of lies from Nobel Peace Prize winner Angell and pals before WWI (when long-"outlawed" gas was used by all sides, contrary to claims that paper agreements had "banned" it somehow) and WWII (when gas bombing lies prior to the war by Angell, Noel-Baker, Joad and others were used as an excuse to "make peace deals" with the Nazis, again, not worth the paper they were printed on). Mathematically, the subset of all States which keep agreements (disarmament and arms control, for instance) is identical to the subset of all States which are stable Democracies (i.e., tolerating dissent for the past several years), but this subset is - as Dr Spencer Weart's statistical evidence of war proves in his book *Never at War: Why Democracies Won't Fight One Another* - not the bloody war problem! Because none of the disarmaments grasp set theory, or bother to read Dr Weart's book, they can never understand that disarmament of Democracies doesn't cause peace but causes millions of deaths.



PLEASE CLICK HERE for the truth from Hiroshima and Nagasaki for the shielding of blast and radiation effects by modern concrete buildings in the credible nuclear deterrence of invasions which - unlike the countervalue drivel that failed to prevent WW2 costing millions of human lives - worked in the Cold War despite the Western media's obsession with treating as Gospel truth the lying anti-nuclear propaganda from Russia's World Peace Council and its allies (intended to make the West disarm to allow Russian invasions without opposition, as worked in Ukraine recently)! Realistic effects and credible nuclear weapon capabilities are needed for deterring or stopping aggressive invasions and attacks which could escalate into major conventional or nuclear wars. Credible deterrence is through simple, effective protection against concentrated and dispersed invasions and aerial attacks, debunking inaccurate, misleading CND "disarm or be annihilated" left political anti-nuclear deterrence dogma. Hiroshima and Nagasaki anti-nuclear propaganda effects lies on blast and radiation for modern concrete cities is debunked by solid factual evidence kept from public sight for political reasons by the Marx-media.

Glasstone's and Nukemap's fake Effects of Nuclear Weapons effects data for unobstructed deserts, rather than realistic blast and radiation shielding concrete jungles which mitigate countervalue damage as proved in Hiroshima and Nagasaki by Penney and Stanbury, undermine credible world war deterrence just as Philip Noel-Baker's 1927 BBC radio propaganda on gas war knock-out blow lies were used by Nazi propaganda distributing "pacifist disarmers" to undermine deterrence of Hitler's war, murdering tens of millions deliberately through lies (e.g. effective gas masks don't exist) that were easy to disprove, but supported by the mainstream fascist leaning press in the UK. There is not just one country, Russia, which could trigger WW3, because we know from history that the world forms alliances once a major war breaks out, apart from a few traditional neutral countries like Ireland and Switzerland, so a major US-China war over Taiwan could draw in support from Russia and North Korea, just as the present Russian invasion and war against Ukraine has drawn in Iranian munitions support for Russia. So it is almost certain that a future East-vs-West world war will involve an alliance of Russia-China-North Korea-Iran fighting on multiple fronts, with nuclear weapons being used carefully for military purposes (not in the imaginary 1930s massive "knockout blow" gas/incendiary/high explosive raids against cities that was used by the UK media to scare the public into appeasing Hitler and thus enabling him to trigger world war; Chamberlain had read Mein Kampf and crazily approved Hitler's plans to exterminate Jews and invade Russia starting a major war, a fact censored out of biased propaganda hailing Chamberlain as a peacemaker).

Realistic effects and credible nuclear weapons capabilities are VITAL for deterring or stopping aggressive invasions and attacks which could escalate into major conventional or nuclear wars debunk Marx media propagandarists who obfuscate because they don't want you to know the truth, so activism is needed to get the message out against lying frauds and open fascists in the Russian supporting Marx mass media, which sadly includes government officialdom (still infiltrated by reds under beds, sorry to Joe MaCarthy haters, but admit it as a hard fact that nuclear bomb labs in the West openly support Russian fascist mass murders; I PRAY THIS WILL SOON CHANGE!).



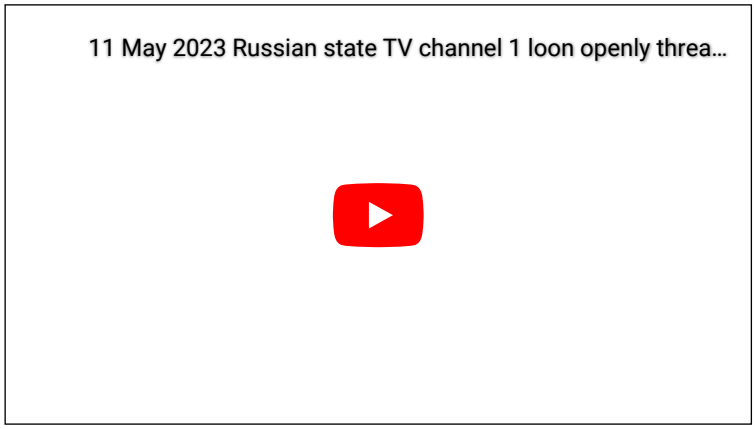
ABOVE: Tom Ramos at Lawrence Livermore National Laboratory (*quoted at length on the development details of compact MIRV nuclear warhead designs in the latest post on this blog*) explains how the brilliant small size primary stage, the Robin, was developed and properly proof-tested in time to act as the primary stage for a compact thermonuclear warhead to deter Russia in the 1st Cold War, something now made impossible due to Russia's World Peace Council propaganda campaigns. (*Note that Ramos has a new book published, called From Berkeley to Berlin: How the Rad Lab Helped Avert Nuclear War which describes in detail in chapter 13, "First the Flute and Then the Robin", how caring, dedicated nuclear weapons physicists in the 1950s and 1960s actually remembered the lesson of disarmament disaster in the 1930s, and so WORKED HARD to develop the "Flute" secondary and the "Robin" primary to enable a compact, light thermonuclear warhead to help deter WWIII! What a difference to today, when all we hear from such "weaponeers" now is evil lying about nuclear weapons effects on cities and against Western civil defence and against credible deterrence on behalf of the enemy.*)

ABOVE: Star Wars filmmaker Peter Kuran has at last released his lengthy (90 minutes) documentary on *The neutron bomb*. Unfortunately, it is not yet being widely screened in cinemas or on DVD Blu Ray disc, so you have to stream it (if you have fast broadband internet hooked up to a decent telly). At least Peter managed to interview Samuel Cohen, who developed the neutron bomb out of the cleaner Livermore devices Dove and Starling in 1958 (Ramos says Livermore's director, who invented a wetsuit, is now trying to say Cohen stole the neutron bomb idea from him! Not so, as RAND colleague and 1993 Effects Manual EM-1 editor Dr Harold L. Brode explains in his recent brilliant book on the history of nuclear weapons in the 1st Cold War (reviewed in a post on this blog in detail) that Cohen was after the neutron bomb for many years before Livermore was even built as a rival to Los Alamos. Cohen had been into neutrons when working in the Los Alamos Efficiency Group on Little Boy in 1944.)

For the true effects in modern city concrete buildings in Hiroshima and Nagasaki, disproving the popular lies for nudes in open deserts used as the basis for blast and radiation calculations by Glasstone and Nukemap, please click here The deceptive bigots protraying themselves as Federation of American Scientists genuine communist disarmers in the Marx media including TV scammers have been suppressing the truth to sell fake news since 1945 and in a repetition of the 1920s and 1930s gas war media lying for disarmament and horror news scams that caused disarmament and thus encouraged Hitler to initiate the invasions that set off WWII!

Glasstone's Effects of Nuclear Weapons exaggerations completely undermine credible deterrence of war: Glasstone exaggerates urban "strategic" nuclear weapons effects by using effects data taken from unobstructed terrain (without the concrete jungle shielding of blast winds and radiation by cities!), and omits the most vital uses and most vital effects of nuclear weapons: to *DETER* world war credibly by negating the concentrations of force used to invade Belgium, 1914 (thus WWI) and Poland (WWII). Disarmament and arms control funded propaganda lying says any deterrent which is not

actually exploded in anger is a waste of money since it isn't being "used", a fraud apparently due to the title and content of Glasstone's book which omits the key use and effect of nuclear weapons, to *prevent* world wars: this is because Glasstone and Dolan don't even bother to mention the neutron bomb or 10-fold reduced fallout in the the Los Alamos 95% clean Redwing-Navajo test of 1956, despite the neutron bomb effects being analysed for its enhanced radiation and reduced thermal and blast yield in detail in the 1972 edition of Dolan's edited secret U.S. Department of Defense Effects Manual EM-1, "Capabilities of Nuclear Weapons", data now declassified yet still being covered-up by "arms control and disarmament" liars today to try to destroy credible deterrence of war in order to bolster their obviously pro-Russian political anti-peace agenda. "Disarmament and arms control" charlatans, quacks, cranks, liars, mass murdering Russian affiliates, and evil genocidal Marxist media exposed for what it is, what it was in the 1930s when it enabled Hitler to murder tens of millions in war .



ABOVE: 11 May 2023 Russian state TV channel 1 loon openly threatens nuclear tests and bombing UK. Seeing how the Russian media is under control of Putin, this is like Dr Goebbels rantings, 80 years past. But this doesn't disprove the world war threat any more than it did with Dr Goebbels. These people, like the BBC here, don't just communicate "news" but attempt to do so selectively and with interpretations and opinions that set the stage for a pretty obviously hate based political agenda with their millions of viewers, a trick that worked in the 1st Cold War despite Orwell's attempts to lampoon it in books about big brother like "1984" and "Animal Farm". *When in October 1962 the Russians put nuclear weapons into Cuba in secret without any open "threats", and with a MASSIVELY inferior overall nuclear stockpile to the USA (the USA had MORE nuclear weapons, more ICBMs, etc.), the media made a big fuss, even when Kennedy went on TV on 22 October and ensured no nuclear "accidents" in Cuba by telling Russia that any single accidentally launched missile from Cuba against any Western city would result in a FULL RETALITORY STRIKE ON RUSSIA. There was no risk of nuclear war then except by accident, and Kennedy had in his 25 May 1961 speech on "Urgent National Needs" a year and a half before instigated NUCLEAR SHELTERS in public basement buildings to help people in cities survive (modern concrete buildings survive near ground zero Hiroshima, as proved by declassified USSBS reports kept covered up by Uncle Sam). NOE THAT THERE IS A CREDIBLE THREAT OF NUCLEAR TESTS AND HIROSHIMA TYPE INTIMIDATION STRIKES, THE BBC FINALLY DECIDES TO SUPPRESS NUCLEAR NEWS SUPPOSEDLY TO HELP "ANTI-NUCLEAR" RUSSIAN PROPAGANDA TRYING TO PREVENT US FROM GETTING CREDIBLE DETERRENCE OF INVASIONS, AS WE HAD WITH THE W79 UNTIL DISARMERS REMOVED IT IN THE 90s! This stinks of prejudice, the usual sort of hypocrisy from the 1930s "disarmament heroes" who lied their way to Nobel peace prizes by starting a world war!*

The facts from Hiroshima and Nagasaki for the shielding of blast and radiation effects by modern concrete buildings in the credible nuclear deterrence of invasions (click here for data) which - unlike the countervalue drivel that failed to prevent WW2 costing millions of human lives - worked in the Cold War despite the Western media's obsession with treating as Gospel truth the lying anti-nuclear propaganda from Russia's World Peace Council and its allies (intended to make the West disarm to allow Russian invasions without overwhelming, effective deterrence or opposition, as worked in Ukraine recently)!

Realistic effects and credible nuclear weapon capabilities are required now for deterring or stopping aggressive invasions and attacks which could escalate into major conventional or nuclear wars. Credible deterrence necessitates simple, effective protection against concentrated and dispersed invasions and bombing. The facts can debunk massively inaccurate, deliberately misleading CND "disarm or be annihilated" pro-dictatorship ("communism" scam) political anti-nuclear deterrence dogma. Hiroshima and Nagasaki anti-nuclear propaganda effects lies on blast and radiation for modern concrete cities is debunked by solid factual evidence kept from public sight for political reasons by the Marx-

media, which is not opposed by the fashion-obsessed remainder of the media, and so myths sneak into "established pseudo-wisdom" by the back-door.

Wednesday, March 29, 2006
Samuel Glasstone and Philip J. Dolan

DR SAMUEL GLASSTONE (**3 May 1897 - 16 November 1986**), founding editor of ***The Effects of Atomic Weapons*** **(U.S. Department of Defense, 1950)**/*The Effects of Nuclear Weapons* (**1957 online browser version, 1957 key pages in high definition PDF,** 1962/1964 **book as 188 MB file here** with **74 pages of key thermal ignition civil defense nuclear tests and civil defense final chapter as 43.8 MB PDF file here**; browser version of **April 1962 edition here**, and browser version of **February 1964 revised edition here**), author of the originally secret reports, WASH-1037/8, *An Introduction to Nuclear Weapons* (**1962**, **1963**, **1972a** and **1972b**) and co-editor - with Philip J. Dolan - of the **1977** ***Effects of Nuclear Weapons,*** **3rd ed.** (high-definition **browser version linked here**), received his PhD and DSc in 1922 and 1926, respectively, in chemistry from London University.

His first book was the 250 pages-long ***Chemistry in Daily Life,*** published in 1929 while he was a Lecturer in Chemistry at the University of Sheffield. In May 1928, he had broadcast five talks on 'Chemistry in Daily Life' for BBC radio.

He wrote in the preface of *Chemistry in Daily Life* that the enthusiastic response of the radio listeners had motivated him to write the book: 'Curiously enough, amongst the letters received one came from a Harley Street doctor and another from a school-girl!'

The diagrams and manuscript were prepared for the press by Violette Collingwood, who later married him, and later **co-authored Glasstone's** ***The Food You Eat*** **(University of Oklahoma Press, 1943).** In America, Glasstone became Professor of Chemistry at the University of Oklahoma and applied quantum mechanics to chemical reaction rates.

Altogether, he authored **40 books,** ranging from chemical textbooks such as ***Thermodynamics for Chemists***, ***Theory of Rate Processes,*** and ***Theoretical Chemistry: An Introduction to Quantum Mechanics, Statistical Mechanics, and Molecular Spectra for Chemists*****,** to physics and engineering textbooks such as ***The Elements of Nuclear Reactor Theory*** **(co-authored with Milton Edlund)**, ***Principles of nuclear reactor engineering***, ***The Book of Mars*** **(1968),** *Sourcebook on the Space Sciences* (both written at the request of NASA) and ***Nuclear Reactor Engineering,*** while his strong conviction against scientific prejudice led him to author the 276 pages-long study ***Public Safety and Underground Nuclear Detonations*** **(published by the U.S. Atomic Energy Commission, 1970),** and to co-author the 400 page-long discussion, *Nuclear Power and Its Environmental Effects* (1980). He also authored **many Los Alamos National Laboratory reports,** and the **1982** ***Energy Deskbook***.

A President of the U.S. National Academy of Sciences, Bruce Alberts, in June 2005 praised Samuel Glasstone highly for his 1,300 pages long ***Textbook of Physical Chemistry,*** **1943:**

'As Bruce Alberts steps down July 1 as one of the most accomplished and distinguished presidents of the National Academy of Sciences (NAS), he is singularly focused on education—specifically, teaching his students about real science. He has been brewing an idea for a

new science course that he would like to teach to graduate students ... Alberts' hopes for more explosions and hands-on experiments were dashed soon after he arrived at Harvard University ... Instead of self-directed learning, he found himself exposed to mind-numbing facts. "Science words are not science," Alberts says. "I always feel that I want to understand things and not just memorize them." In his physical chemistry class during his junior year, Alberts was particularly frustrated by the textbooks. "So I went to the library and found a **big, fat, older physical chemistry book," he says of the 1,300-page tome written by Samuel Glasstone.** "It contained a lot of words. Most of the textbooks in physical chemistry have relatively few words, and they emphasize equations," Alberts says. "But Glasstone was a person who really wanted people to understand the essence of the subject, and he wrote beautifully about it. And I discovered from his book that I could actually get the understanding that I was looking for".'

On another site, **a book reviewer comments:**

'Perhaps one of the best technical writers of the last century was Samuel Glasstone. His volumes on Chemistry and Nuclear Engineering were very easy to read, understand, and use. This is because he endeavored to number every new topic so that easy reference could be made. This also provided logic to the subject matter, which assisted in the flow of the information that the text was providing.'

In 1959, Glasstone was awarded the Worchester Reed Warner Medal by the American Society of Mechanical Engineers for his 'outstanding contribution to permanent engineering literature in writings on atomic energy.' In 1968, Glasstone received the Arthur Holly Compton Award from the American Nuclear Society for his 'distinguished contributions to nuclear science and engineering education.'

In 1972, aged 75, Glasstone wrote ***Inner Space: The Structure of the Atom,*** published as a free education by the U.S. Atomic Energy Commission which explains in detail how the four quantum numbers of each atomic electron under the Pauli exclusion principle allows electron shells which predict the periodic table of chemical elements, before explaining the shell structure of the nucleus and radioactivity.

Glasstone had witnessed the exaggeration of aerial bombardment effects and the resulting appeasement of dictatorships during the 1930s, when all kinds of appeasement, treaties, embargoes, and economic sanctions fooled politicians into believing that they were safe when the dictatorships were secretly preparing for war:

'... history is apparently not among the areas of expertise claimed by IPPNW [*international physicians for the prevention of nuclear war*]. Its spokesmen have yet to comment on the Washington Naval Treaty of 1922, the Kellogg-Briand Pact of 1928 (for which Kellogg and Briand received the Nobel Peace Prize), the Oxford Peace Resolution of 1934, the Munich Agreement of 1938, or the Molotov-Ribbentrop Pact of 1939, and on the effectiveness of these measures in preventing World War II. ...

'Sir Norman Angell (also a Nobel Peace Prize winner), in his 1910 best-seller entitled The Great Illusion, showed that war had become so terrible and expensive as to be unthinkable. The concept of 'destruction before detonation' was not discovered by Victor Sidel (Sidel, V. W., 'Destruction before detonation: the impact of the arms race on health and health care', *Lancet* 1985; ii: 1287-1289), but was previously enunciated by Neville Chamberlain, who warned his Cabinet about the heavy bills for armaments: 'even the present Programmes were placing a heavy strain upon our resources' (Minutes of the British Cabinet meeting, February 3, 1937: quoted in Fuchser, L. W., 'Neville Chamberlain and Appeasement: a Study in the Politics of History', Norton, New York, 1982). ...

'Psychic numbing, denial, and 'missile envy' (Caldicott, H., *Missile envy: the arms race and nuclear war,* New York: William Morrow, 1984) are some of the diagnoses applied by IPPNW members to those who differ with them. However, for the threats facing the world, IPPNW does not entertain a differential diagnosis, nor admit the slightest doubt about the efficacy of their prescription, if only the world will follow it. So certain are they of their ability to save us from war that these physicians seem willing to bet the lives of millions who might be saved by defensive measures if a nuclear attack is ever launched.

'Is this an omnipotence fantasy?'

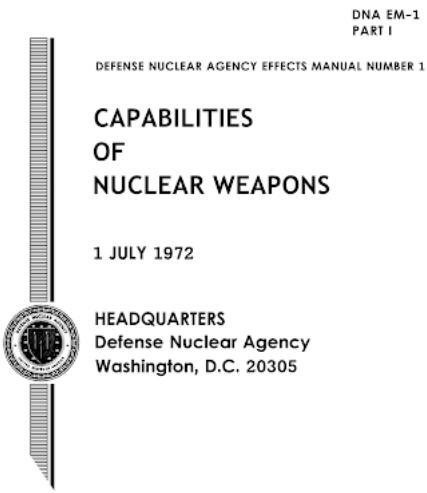
- 'International Physicians for the Prevention of Nuclear War: Messiahs of the Nuclear Age?', ***The Lancet (British medical journal),* 18 November 1988, pp.1185-6, by Jane M. Orient, MD.**

Dr Jane Orient, 'Homeland Security for Physicians', *Journal of American Physicians and Surgeons,* vol. 11, number 3, Fall 2006, pp. 75-9:

'In the 1960s, a group of activist physicians called Physicians for Social Responsibility (PSR) undertook to "educate the medical profession and the world about the dangers of nuclear weapons," beginning with a series of articles in the *New England Journal of Medicine*. **[Note that journal was publishing information for anti-civil defense propaganda back in 1949, e.g. the article in volume 241, pp. 647-53 of *New England Journal of Medicine,* which falsely suggests that civil defense in nuclear war would be hopeless because a single burned patient in 1947 with 40% body area burns required 42 oxygen tanks, 36 pints of plasma, 40 pints of whole blood, 104 pints of fluids, 4,300 m of gauze, 3 nurses and 2 doctors. First, only unclothed persons in direct line of sight without shadowing can get 40% body area burns from thermal radiation, second, duck and cover offers protection in a nuclear attack warning, and G. V. LeRoy had already published, two years earlier, in *J. A. M. A.,* volume 134, 1947, pp. 1143-8, that less than 5% of burns in Hiroshima and Nagasaki were caused by building and debris fires. In medicine it is always possible to expend vast resources on patients who are fatally injured.** The comparison of Hiroshima and Nagasaki flash burns casualties with gasoline-drenched peacetime burns casualties is **inappropriate: the latter heating lasts for much longer than the nuclear flash, causing much deeper burns, because nuclear bombs don't drench people with gasoline! The same applies to the fires in the World Trade Centre; unlike aircraft, nuclear explosions don't flood buildings with gasoline. Clothing and even sheets of white paper provided protection from the thermal flash in Hiroshima and Nagasaki. Even when dark-colored clothing did ignite on the side facing the explosion (usually it didn't ignite because it wasn't as dry as in the ignition experiments during nuclear tests in the extremely low-humidity desert regions of the world), it didn't burn as fast as petrol-soaked clothing in peacetime accidents, so the flames could be rolled out before serious burns resulted in most cases, as documented by the U. S. Strategic Bombing Survey in Hiroshima and Nagasaki.]** On its website, www.psr.org, the group boasts that it "led the campaign to end atmospheric nuclear testing." With this campaign, the linear no-threshold (LNT) theory of radiation carcinogenesis became entrenched. It enabled activists to calculate enormous numbers of potential casualties by taking a tiny risk and multiplying it by the population of the earth. As an enduring consequence, the perceived risks of radiation are far out of proportion to actual risks, causing tremendous damage to the American nuclear industry. ... Efforts to save lives were not only futile, but unethical: Any suggestion that nuclear war could be survivable increased its likelihood and was thus tantamount to warmongering, PSR spokesmen warned. ...

'For the mindset that engendered and enables this situation, which jeopardizes the existence of the United States as a nation as well as the lives of millions of its citizens, some American physicians and certain prestigious medical organizations bear a heavy responsibility.

'Ethical physicians should stand ready to help patients to the best of their ability, and not advocate sacrificing them in the name of a political agenda. **Even very basic knowledge, especially combined with simple, inexpensive advance preparations, could save countless lives**.'


DNA EM-1
PART I

DEFENSE NUCLEAR AGENCY EFFECTS MANUAL NUMBER 1

CAPABILITIES
OF
NUCLEAR WEAPONS

1 JULY 1972

HEADQUARTERS
Defense Nuclear Agency
Washington, D.C. 20305

PHILIP J. DOLAN, editor of the first **two-part edition of the U.S. Department of Defense's 'Secret – Restricted Data' 1,651 pages**

long manual, *Capabilities of Nuclear Weapons* (DNA-EM-1, 1 July 1972) and co-editor of the ***Effects of Nuclear Weapons* 1977** edition, graduated in physics from West Point in 1945 and was assigned to the Manhattan Project, Los Alamos, in 1948. Later U.S. Army assignments included the U.S. Armed Forces Special Weapons Project in Albuquerque and the Defense Atomic Support Agency in Washington, D.C.

In 1956, he received his MSc from the University of Virginia. He later calculated the neutron induced activity in the soil, and predicted the hazard from the rainout of radioactivity from air bursts in thunderstorms. In August 1959, Dolan's secret report, *Theoretical Dose Rate Decay Curves for Contamination Resulting from Land Surface Burst Nuclear Weapons* (DASA-528), was the first study to take account of fission product thermal fractionation and bomb neutron-induced activities (including Np-239, U-240, and U-237) in fallout. Glasstone used Dolan's decay curves in the 1962 and later editions of *The Effects of Nuclear Weapons.* Dolan held posts ranging from 'Instructor in Nuclear Weapons Employment,' at the U.S. Army Command and General Staff College, to 'Nuclear Effects Project Officer' for the Ballistic Missile Defense Office of the Advanced Research Projects Agency.

After retiring from the U.S. Army in 1967, Dolan managed the Nuclear Studies Program at Stanford Research Institute (SRI International), and in 1981 joined Lockheed Missiles and Space Company, by which time he had published over 70 technical papers, reports, and books.

In 1963, Dolan compiled the famous U.S. Army Field Manual, ***Nuclear Weapons Employment,* FM 101-31**. Professor Freeman Dyson reviewed it in his 1984 book, *Weapons and Hope:*

'The military doctrines summarised in **FM 101-31** were valid... when tactical nuclear wars might have been small-scale and truly limited. The handbook represents a sincere attempt to put Oppenheimer's philosophy of local nuclear defence into practice.'

J. Robert Oppenheimer, wartime director of Los Alamos, said: 'I am not qualified, and if I were qualified I would not be allowed, to give a detailed evaluation of the appropriateness of the use of atomic weapons against any or all such (military) targets; but one thing is very clear. It is clear that they can be used only as adjuncts in a military campaign which has some other components, and whose purpose is a military victory. They are not primarily weapons of totality or terror, but weapons used to give combat forces help that they would otherwise lack. They are an integral part of military operations. Only when the atomic bomb is recognized as useful insofar as it is an integral part of military operations, will it really be of much help in the fighting of a war, rather than in warning all mankind to avert it.'

This quotation is from Samuel T. Cohen's book *Shame* **(online 2nd ed., 2005 version, page 99)**. Sam Cohen's earlier book, ***The Truth About the Neutron Bomb: the Inventor of the Bomb Speaks Out,* William Morrow and Co., New York, 1983**, on page 30 gives the source of this quotation as Oppenheimer's speech 'Comments on the Military Value of the Atom', given to the American Bar Association in February 1951. That of course was during the Korean War, which was eventually ended with a cease fire in 1953 due to an indirect threat from President Eisenhower to deploy nuclear weapons against China (which was supporting the war effort of North Korea).

The first U.S. Army Field Manual on tactical nuclear war was FM-100-31, *Tactical Use of Atomic Weapons,* issued in November 1951 and classified Confidential. It was revised in May 1955 (160 pages), and *Nuclear Weapons Employment* was issued in May 1959 (221 pages).

Colonel George Cooper Reinhardt and Lieutenant William Roscoe Kintner, PhD (1915-97) co-authored the first openly published textbook on the combat use of tactical nuclear weapons, *Atomic Weapons in Land Combat* (1st edition 1953, 2nd edition 1954), which stated "atomic weapons, tactically employed, should be incorporated into our first line of defense against any creeping aggression". It was a news story in the *New York Times* of August 17, 1953: "Two in Army Write on Atomic Tactics". Reinhardt in **November 1964 discussed the evolution of the tactics in his RAND Corporation paper P-3011, *Nuclear Weapons and Limited Warfare,* remarking on page 10 that political fears of escalation led to "a growing realization that authority to employ nuclear weapons in 'small' wars might be time consuming and difficult for the field commander to obtain. Instances appeared in war games where that delay ran into a number of days, sometimes permitting aggressor troops to reach densely populated (friendly civilians) areas where tactical nuclear strikes were precluded. ... An illustration of the incredulity with which young officers received these findings can be unearthed at a distinguished military school where the student body labelled a lecturer on these studies 'that genius who could lose a unilateral atomic war'."**

Oppenheimer's outlook on tactical nuclear warfare was echoed by Robert S. McNamara, the U.S. Secretary of Defence, in his 25 September 1961 television interview at the Pentagon during the Berlin crisis (when the Soviet Union aggressively built a wall in Augist 1961 to trap East Berliners in the Soviet sector and murdered any who tried to climb the wall, leaving them to bleed to death after being shot in full view of the world's outraged media):

Interviewer: 'Do you mean to imply, Sir, that you would then perhaps use nuclear weapons in connection with the Berlin situation?'

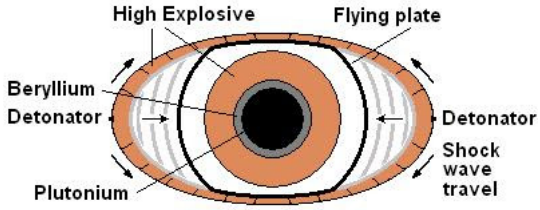
U.S. Defense Secretary McNamara: 'Yes, I definitely do. We will use nuclear weapons whenever we feel it necessary to protect our vital interests. Our nuclear stockpile is several times that of the Soviet Union, and we will use either tactical weapons or strategic weapons in whatever quantities, wherever, whenever it is necessary to protect this nation and its interests.'

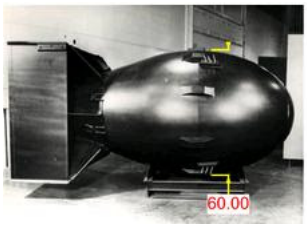
Before election, President John F. Kennedy published a book in 1960 called *The Strategy of Peace* (Harper and Brothers, New York; but note that the page numbers given for the quotations below are for the British edition, published by Hamish Hamilton, London, 1960), where he explained (pages 183-4) why the normal strategic nuclear weapons are not adequate:

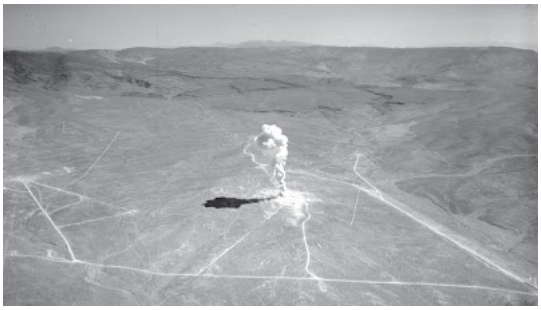
> "We must be prepared in this nation to fight an all-out nuclear war - or else we cannot deter an all-out nuclear attack upon us. ... But it is not the only answer to all threats of Communist aggression. ... It cannot deter Communist aggression which is too limited to justify atomic war. It cannot protect uncommitted nations against a Communist takeover using local or guerrilla forces. It cannot be used in so-called 'brush-fire' peripheral wars. ... In short, it cannot prevent the Communists from gradually nibbling away at the fringe of the Free World's territory and strength, until our security has been steadily eroded in peacemeal fashion - each Red advance being too small to justify massive retaliation with all its risks. And history demonstrates that this is the greater threat - not an all-out nuclear attack."

On pages 166-72 of *The Strategy of Peace*, Kennedy brilliantly pointed out the need for a greater number of physicists and engineers to be educated to compete with Communist education in science, to develop "new scientific weapons" that will deter all aggression and avert WWIII:

> "They attend classes six days a week, ten months a year. ... They have approximately 17 pupils per teacher, we have 27. ... The ten-year curriculum includes, on a compulsory basis, five years of physics, five years of biology, four years of chemistry, one year of astronomy, and ten years of mathematics ... Few, if any, twelve-year curricula in America cover as much. ... In fact, more than half of our high schools do not teach any physics at all. In the last year for which statistics are available, we produced only 125 new physics teachers - although we have at least 28,000 high schools. ... The Russians are graduating ten times as many engineers as they did a generation ago - and at a rate two and one half times greater than the United States. They have enrolled and are graduating more scientists. ... We can sit back and wait for the Russian system to collapse. We can hope that education will be their undoing [leading to rebellion against Communist authority, i.e. dissidents]. We can believe that our system will prevail ... On the other hand, we could compete with the Russians by imitating them."







Above: *Little Feller I*, a Nevada test on 17 July 1962 of the **W54 Davy Crockett warhead (reportedly a scaled down version of the two-point implosion Swan fission device successfully tested as *Redwing-Inca*),** this entire weapon casing was just 30 inches long and 11 inches in diameter at the widest point, and weighing just 51 pounds it was the smallest and lightest fission bomb ever deployed by the United States. In *Little Feller I* a live Davy Crockett warhead was fired from a 155 millimeter launcher Operation Ivy Flats and detonated at a height of burst of 20 feet some 9,357 feet (1.7 miles) from the launch point with a 0.018 kt yield yield. The test was the last atmospheric detonation at the Nevada test site, and was observed by Attorney General Robert F. Kennedy and presidential adviser General Maxwell D. Taylor (seen above in stills from the film of Operation Ivy Flats, which was finally declassified on 22 December 1997).

The 58.6 pound B54 was another application of the same device called the Special Atomic Demolition Munition (SADM), a nuclear land mine deployed in Europe, South Korea, Guam, and the United States from 1964-1989.

The Davy Crockett was launched from either a 120-millimeter (XM-28) or 155-millimeter (XM-29) recoiless rifle with a maximum range of 1.24 miles (120 millimeter) to 2.49 miles (155 millimeter). An identical warhead was tested as *Little Feller II* 10 days earlier yielded 0.022 kt, demonstrating the good reliability of the bomb yield. Kennedy and Taylor were convinced that subkiloton air bursts were necessary to credibly deter dictators without the risk of collateral fallout, blast and thermal injury to innocent civilians and friendly forces in Europe, or the escalation that the use of massive countervalue megaton warheads would inevitably involve. It's obvious that the smaller the warhead, the lower the risk of escalating the war, while you can still deter *military aggression* such as massed tank invasions. At subkiloton yields, initial nuclear radiation (not fallout, blast or heat) predominates, a fact which led to the neutron bomb:

“With regard to atomic weapons ... emphasis should be placed upon developing those of very low yield, which offer no hazards of fall-out nor serious danger to friendly troops and allied populations.”

- **General Maxwell Taylor**, *The Uncertain Trumpet*, Harper, New York, 1959, page 151.

Taylor was the first Allied general to land in France on the D-Day invasion of Normandy, 6 June 1944, heading the 101st Airborne division. A great part of tactical weapons effects training at the Nevada nuclear test site was dedicated to the tactical use of nuclear air bursts with low collateral damage in order to prevent the type of conventional warfare carnage that occurred on D-Day. Kennedy’s “flexible response” nuclear policy (replacing the “massive retaliation” policy of Dulles and Eisenhower), was based on Taylor’s recommendations in his book *The Uncertain Trumpet*. In April 1961, Kennedy appointed Taylor to investigate the failure of the Bay of Pigs invasion of Cuba (a plan inherited from Eisenhower’s administration). On 1 October 1962, Kennedy appointed Taylor as chairman of the Joint Chiefs of Staff, a position in which he served until 1964. The Atomic Battle Group was charged with the protection of Europe from the Warsaw Pact between 1961 and 1971, when 2,100 of the Davy Crockett’s were deployed. They were withdrawn by President Nixon’s administration in 1971, just when the Soviet Union was reaching parity and stockpiling 40,000 main battle tanks in Eastern Europe ready for invasion of the West.

In his speech of 18 September 1967 to the United Press International Editors and Publishers, U.S. Secretary of Defence McNamara explained why such a strong will is required to deter aggression:

‘The point is that a potential aggressor must himself believe that our assured destruction capability is in fact actual, and that our will to use it in retaliation to an attack is in fact unwaivering.’

The determination by Kennedy and McNamara to stand up to fanatical Soviet evil was briefly lost, due entirely to Robert McNamara's Vietnam War financial and military disaster at a time when the Soviet nuclear stockpile and conventional tank stockpile in the Warsaw Pact began to exceed the 1,000 American Minuteman missiles and Western conventional arms (any war of insurgency against snipers is like 'cutting soup with a knife' as T. E. Lawrence said, and is even worse in Vietnamese jungle conditions with camouflaged pitfall traps, regardless of how much is spent in terms of money and human lives), until President Reagan appointed Caspar Weinberger as U.S. Secretary of Defense and went back to outbuilding the Soviet Union by spending money on nuclear deterrence to forcefully preserve peace:

'During the 1950s and 1960s we had a first-strike capability. This was one of the strongest preservatives of peace, and that was lost. Now we have got to regain it.'

- U.S. Secretary of Defense Caspar Weinberger, 1981.

'I think of World War II and how long it took to prepare for it, to convince people that rearmament for war was needed. I fear we will not be ready. I think time is running out ... but I have faith.'

- U.S. Secretary of Defense Caspar Weinberger, *New York Times,* August 1982.

Despite the fact that the BBC still fakes all nuclear explosion films with the sound of the blast falsely superimposed on the explosion flash, to make civil defense duck and cover seem stupid (actually, like thunder after lightning, the blast wave travels slower than light so the flash occurs in silence until the blast arrives, which can be many seconds later for the case of large areas of devastation from a nuclear explosion, giving plenty of time for "duck and cover" action to avoid flying glass when the blast finally arrives), the BBC did make one honest film about the Soviet Union's "peace offensive" propaganda lies, the four-part 1995 "Messengers from Moscow" documentary. **Dimitri K. Simes reviewed "Messengers from Moscow" in the 1 June 1995 issue of *Confirmation Time:***

> **"The end of Soviet communism has given Westerners unprecedented access to Moscow's historical resources. Various archives have been opened and living witnesses to history are suddenly prepared to tell their stories, even in front of foreign television cameras. ... the four-part documentary series Messengers from Moscow, shown in the United States by PBS and in Britain by the BBC, represents a powerful blow to two fundamentals of the liberal dogma - namely, that the Cold War resulted from a Western overreaction to largely defensive, even if rather heavy-handed, Soviet policies and that the preoccupation with the communist menace inside Western democracies amounted to a vicious witch hunt. The series, ably directed by Daniel Wolf and produced by Eugene B. Shirley with Herbert E. Ellision as chief consultant, is based on numerous on-camera interviews with Soviet insiders ranging from Stalin's second-in-command Vyacheslav Molotov to Brezhnev's personal physician. The accounts they present are sobering. Molotov, in a 1972 taped conversation with poet Felix Chuyev, stated point blank that expanding Soviet borders "as far as possible" was his official duty. In Molotov's view, "there could not be a peaceful Germany unless it takes a socialist path." But he cautioned that it had to be accomplished "carefully," without provoking a war with the West."**

After President Nixon's Watergate scandal and failure in Vietnam, to deflect media attacks from Nixon, America began to press ahead with negotiations with the Soviet Union for SALT treaties just when the Soviet threat was reaching parity with the Western arms stockpile, and when Soviet civil defense was being transferred from civilian control to military control with vastly increased spending. If the arms race had been stopped, the Soviet Union might have survived instead of going effectively bankrupt when Reagan manipulated oil prices in the 1980s. In 1975, America signed the Helsinki Act, for the first time agreeing to the borders of the Soviet Union and its Warsaw Pact in Europe. This officially handed over those countries and people to Soviet control. After it was signed, the Chairman of the Soviet KGB (secret police), Yuri Andropov, stated in a letter to the Soviet Central Committee on 29 December 1975: "It is impossible at present to cease criminal prosecutions of those individuals who speak out against the Soviet system, since this would lead to an increase in especially dangerous state crimes and anti-social phenomena." After a succession of appeasers, President Reagan **finally spelled out some of the problems in his famous "evil empire" speech**, much to the **frustration and amusement of the communists who clearly wanted to encourage "peaceful" invasions and war, at the expense of liberty.**

Nuclear winter and related lies debunked by actual firestorm data

Of thousands of nuclear test explosions, the one **"nuclear winter" from the Hiroshima fire storm blocked out the sun for 25 minutes (from burst time at 8:15 am until 8:40) in Hiroshima as shown by the meteorological sunshine records** printed in Figure 6 (3H) of **Drs. Ashley W. Oughterson, Henry L. Barnett, George V. LeRoy, Jack D. Rosenbaum, Averill A. Liebow, B. Aubrey Schneider, and E. Cuyler Hammond, *Medical Effects of Atomic Bombs: The Report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan, Volume 1,* Office of the Air Surgeon, report NP-3036, April 19, 1951, U.S. Atomic Energy Commission.** Nobody is recorded as being a casualty from the 25 minutes of sunlight deprivation!

The reason? The soot is hydroscopic. It absorbs water and falls out in black rain. The firestorm took 30 minutes to start and was at peak intensity 2-3 hours later, so radioactive mushroom cloud been blown many miles downwind before the black rain occurred over Hiroshima, contrary to ignorant lies about "fallout radiation". The soot doesn't freeze the planet. The soot was instead rapidly precipitated in a self-induced rainout as was pointed out back in 1983 by J. B. Knox in Lawrence Livermore National Laboratory report UCRL-89907, which nuclear propaganda ignored. No other nuclear explosion ever created a firestorm. **Even those near naturally forested Pacific islands failed to ignite the vegetation by thermal radiation.**

Targeting oil wells instead of cities reduces the moisture effect, but the soot doesn't rise high enough from burning oil wells, as proved when Saddam set fire to all of Kuwait's oil fields. This has all been intensively researched and documented. Regarding the non-soot dust injected into the stratosphere, unlike soot it's not a strong absorber of sunlight and weather records were intensively studied for signs of both nuclear winter and ozone depletion during hundreds of megatons of atmospheric 1945-62 nuclear tests, with failure.

The initial gamma radiation from a nuclear explosion produces more ozone than it destroys. Gamma radiation produces large amounts of ozone from atmospheric oxygen regardless of the burst altitude, but ozone-destroying nitrogen oxides are only produced by the high-density air blast of low-altitude nuclear explosions. Those nitrogen oxides then combine with water vapour in the turbulent toroidal circulation of the mushroom cloud to form nitric acid, which does not destroy ozone but simply gets deposited, very diluted, in rain. This was proved in the 1970s when aircraft were flown through mushroom clouds from Chinese nuclear tests. In high altitude nuclear explosions, there is no compressed blast wave that forms nitrogen oxides, so you actually get a boost to the ozone layer since the explosion produces vast amounts of ozone due to the gamma radiation.

Even the "nuclear winter" from mass fires, dust, and other effects from the well-established *100 million megatons K-T explosion 65 million years ago* failed to wipe out plants and mammals. Instead, it made extinct the dangerous cold-blooded reptiles that were preventing freedom for peaceful mammal evolution. The idea that there is no protection and no possibility of surviving against a big explosion is false. Claiming that nuclear wars cannot be won if you lie and exaggerate the effects of nuclear weapons and the effects of nuclear war while downplaying countermeasures, is exactly what encouraged the terrorists to exploit the most feared weapons in the 1930s while peace-loving nations disarmed and thus effectively signed the death warrant for six million Jews on "peace treaties" with liars.

One of the Scientific American's Cold War publishers, **Gerard Piel, had a long history of lying and publishing lies about fires from nuclear weapons to attack civil defense readiness**, just as his predecessors did in Britain during the 1930s (which made the Prime Minister appease Hitler, encouraging him to start WWII). Typical example of lie:

"A heading in one recent report concerned with effects of nuclear detonations reads, 'Megatons Mean Fire Storms,' and the report predicts that a 20-megaton nuclear burst is sure to produce a 300-square mile fire storm. [**Reference: Gerard Piel (then the anti-civil defense publisher of the *Scientific American*), 'The Illusion of Civil Defense,' published in the Bulletin of the Atomic Scientists, February 1962, pp. 2-8**.] The report further states that blastproof bomb shelters afforded no protection in World War II fire storms, and the reader is left to conclude that vast fire storm areas in which there will be no survivors are an assured consequence of future nuclear attacks. ... the 40,000-50,000 persons killed by the fire storm at Hamburg constituted only 14 to 18 percent of the people in the fire storm area and 3 to 4 percent of Hamburg's total population at the time of the attack. ... Two of three buildings in a 4.5 square mile area were burning 20 minutes after the incendiary attack began at Hamburg, and similar figures were reported for other German fire storm cities."

- Robert M. Rodden, Floyd I. John, and Richard Laurino, *Exploratory Analysis of Fire Storms,* Stanford Research Institute, AD616638, 1965, pages 1, 5.

Media lying about the thermal ignitions (leading to lies about firestorms and nuclear winter caused by the soot of such fires blocking sunlight) can be traced back to the **secret classification of the full three-volume 1947 report on Hiroshima by the Strategic Bombing Survey, which was edited out of the brief single volume "summary" that the openly published a year earlier, 1946. Here is the key revelation (originally 'secret' May 1947 U.S. Strategic Bombing Survey report on Hiroshima, pp. 4-6):**

'Six persons who had been in reinforced-concrete buildings within 3,200 feet [975 m] of air zero stated that black cotton black-out curtains were ignited by flash heat… *A large proportion of over 1,000 persons questioned was, however, in agreement that a great majority of the original fires were started by debris falling on kitchen charcoal fires* ... There had been practically no rain in the city for about 3 weeks. The velocity of the wind ... was not more than 5 miles [8 km] per hour.... Hundreds of fires were reported to have started in the centre of the city within 10 minutes after the explosion... almost no effort was made to fight this conflagration ... There were no automatic sprinkler systems in building...' [Emphasis added.]

No modern city today is built out of 1945 Hiroshima style wood frame houses with charcoal stoves amid bamboo furnishings and paper screens. **Even Hiroshima is no longer built like that, it's a modern steel, concrete, and brick city and would not suffer a firestorm if a bomb dropped on it again.**

Even where city firestorms *have* actually occurred in obsolete wooden city areas of Japan and Europe, there was not a nuclear winter. What about the theoretical predictions that a nuclear attack on oil supplies will cause a nuclear winter, made by the founder of nuclear winter hype, Paul Crutzen? Saddam Hussein's Iraqi army invaded Kuwait and set all of its oil wells on fire as it was driven back into Iraq by America in 1991.

Peter Aldhous, 'Oil-well climate catastrophe?', *Nature,* vol. 349 (1991), p. 96:

"The fears expressed last week centred around the cloud of soot that would result if Kuwait's oil wells were set alight by Iraqi forces ... with effects similar to those of the 'nuclear winter' ... Paul Crutzen, from the Max Planck Institute for Chemistry in Mainz, has produced some rough calculations which predict a cloud of soot covering half of the Northern Hemisphere within 100 days. Crutzen ... estimates that temperatures beneath such a cloud could be reduced by 5-10 degrees C ..."

Dr Richard D. Small of Pacific-Sierra Research Corporation, California, responded in *Nature,* vol. 350 (1991), pp. 11-12, that 16,000 metric tons of actual soot is produced from 220,000 metric tons of oil burned every day, and anyway:

"My estimates of the smoke produced by destruction of Kuwait's oil wells and refineries and the smoke stabilization altitude do not support any of the purported impacts. The smoke is not injected high enough to spread over large areas of the Northern Hemisphere, nor is enough produced to cause a measurable temperature change or failure of the monsoons."

It turned out that the nuclear winter hype was false, because even if you do somehow manage to start a firestorm in the modern world (the overcrowded fire-hazard wooden medieval areas of Hamburg, Dresden, and **Hiroshima weren't rebuilt with wood after they burned in firestorms**), it simply doesn't produce a stable layer of soot in the stratosphere like the computer simulation. At Hiroshima the soot returned to the ground promptly because it is hydroscopic: it forms water droplets, rain. (It wasn't fallout: the firestorm took over 20 minutes to get doing, by which time the radioactive mushroom cloud had been blown miles downwind.)

President Ronald Reagan - "Evil Empire" Speech

Reagan - Tear Down This Wall

Philip J. Dolan's *Staff Officers Field Manual: Nuclear Weapons Employment Effects Data,* U.S. Army Field Manual FM 101-31-2, classified Secret - Restricted Data, was revised and issued on 20 December 1995 by the Joint Chiefs of Staff (JCS) as Joint Publication 3-12.2. According to an unclassified review of it by Dr David W. Bash in the Spring/Summer 1998 issue of the *NBC Report* (pages 12-13):

'Joint Pub 3-12.2 is a comprehensive presentation of the specifications and performance capabilities of the whole range of U.S. nuclear weapons and, as such, is a major analytical work. About 90 percent of the data used to generate the joint publication has been revised since the late 1980s and is based upon a large body of new research. That research includes work from Defense Special Weapon Agency (DSWA, formerly the Defense Nuclear Agency) documents: EM-1, *Capabilities of Nuclear Weapons; U.S. Nuclear Weapons/Devices Output Handbook*; and *Nuclear Weapon Characteristics Report. ...*

'The new publication considers nuclear weapons effects of all U.S. nuclear weapon systems, and there is a separate chapter for each system. Weapons effects considered are: safety and collateral damage distances, personnel effects, materiel damage effects, exposed personnel coverage, personnel in open foxholes coverage, personnel in tanks coverage, and moderate damage to materiel coverage. The personnel response data are from the new but published Personnel Risk and Casualty Criteria (PRCC) document written by USANCA (U.S. Army Nuclear and Chemical Agency). These new analyses have also led to better definitions and more accurate data about human responses. ... For the first time, Joint Pub 3-12.2 combines thermal radiation injury with nuclear radiation injury for latent ineffectiveness casualties of exposed personnel.

'Joint Pub 3-12.2 also includes a detailed description of all targetting techniques (which were previously published in a separate manual), and thus, the current publication now is a complete stand alone targeteering document. ... An addendum to the Joint Pub 3-12.2 for the earth penetrating modification to the B61 bomb, the mod-11, has been pepared for use by USSTRATCOM.'

Seen in 1999, Sam Cohen holds up a peace medal given to him by Pope John Paul I. He designed the neutron bomb with just pencil, paper and a slide rule. (San Jose Mercury News)

> **"The first objection to battlefield ER weapons is that they potentially lower the nuclear threshold because of their tactical utility. In the kind of potential strategic use suggested where these warheads would be held back as an ultimate countervalue weapon only to be employed when exchange had degenerated to the general level, this argument loses its force: the threshold would long since have been crossed before use of ER weapons is even contemplated. In the strategic context, it is rather possible to argue that such weapons raise the threshold by reinforcing the awful human consequences of nuclear exchange: the hostages recognize they are still (or once again) prisoners and, thus, certain victims."**

- Dr Donald M. Snow (Associate Professor of Political Science and Director of International Studies, University of Alabama), "Strategic Implications of Enhanced Radiation Weapons", *Air University Review,* July-August 1979 issue (online version linked here).

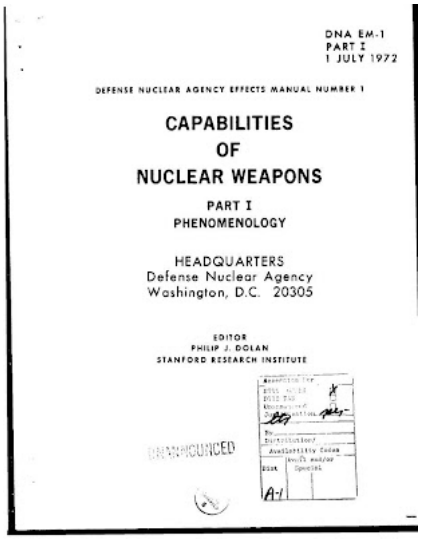
> **'The neutron bomb, so-called because of the deliberate effort to maximize the effectiveness of the neutrons, would necessarily be limited to rather small yields - yields at which the neutron absorption in air does not reduce the doses to a point at which blast and thermal effects are dominant. The use of small yields against large-area targets again runs into the delivery problems faced by chemical agents and explosives, and larger yields in fewer packages pose a less stringent problem for delivery systems in most applications. In the unlikely event that an enemy desired to minimize blast and thermal damage and to create little fallout but still kill the populace, it would be necessary to use large numbers of carefully placed neutron-producing weapons burst high enough to avoid blast damage on the ground [500 metres altitude for a neutron bomb of 1 kt total yield], but low enough to get the neutrons down. In this case, however, adequate radiation shielding for the people would leave the city unscathed and demonstrate the attack to be futile.'**

- Dr Harold L. Brode, RAND Corporation, *Blast and Other Threats*, pp. 5-6 in *Proceedings of the Symposium on Protective Structures for Civilian Populations*, U.S. National Academy of Sciences, National Research Council, Symposium held at Washington, D.C., April 19-23, 1965.

> **"You published an article 'Armour defuses the neutron bomb' by John Harris and Andre Gsponer (13 March, p 44). To support their contention that the neutron bomb is of no military value against tanks, the authors make a number of statements about the effects of nuclear weapons. Most of these statements are false ... Do the authors not realise that at 280 metres the thermal fluence is about 20 calories per square centimetre – a level which would leave a good proportion of infantrymen, dressed for NBC conditions, fit to fight on? ... Perhaps they are unaware of the fact that a tank exposed to a nuclear burst with 30 times the blast output of their weapon, and at a range about 30 per cent greater than their 280 metres, was only moderately damaged, and was usable straight afterwards. ... we find that Harris and Gsponer's conclusion that the 'special effectiveness of the neutron bomb against tanks is illusory' does not even stand up to this rather cursory scrutiny. They appear to be ignorant of the nature and effects of the blast and heat outputs of nuclear weapons, and unaware of the constraints under which the tank designer must operate."**

- C. S. Grace, Royal Military College of Science, Shrivenham, Wiltshire, *New Scientist*, 12 June 1986, p. 62.

FM 101-31 is available in three parts, part 1, 'Nuclear Weapons Employment, Doctrine and Procedures' (FM 101-31-1, unclassified) which in February 1963 was 165 pages with 89 illustrations, part 2, 'Nuclear Weapons Employment Effects Data' (FM 101-31-2, classified Secret - Restricted Data), and part 3, 'Nuclear Weapons Employment Effects Data' (FM 101-31-3, unclassified). Notice that anyone is allowed access to the political side (doctrine and procedural) of nuclear information, and the secrecy is confined to the scientific facts. However, some vital data relevant to making the civil defence aspects of nuclear weapons effects more clearly and scientifically known, has now been declassified and we will discuss the following manual in detail later on in this post:



DNA EM-1
PART I
1 JULY 1972

DEFENSE NUCLEAR AGENCY EFFECTS MANUAL NUMBER 1

CAPABILITIES
OF
NUCLEAR WEAPONS

PART I
PHENOMENOLOGY

HEADQUARTERS
Defense Nuclear Agency
Washington, D.C. 20305

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PHILIP J. DOLAN
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UNANNOUNCED

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DEFENSE NUCLEAR AGENCY, WASHINGTON, D.C.
Declassified on 13 February 1989.

PDF download of Philip J. Dolan (Editor), DNA-EM-1 *Capabilities of Nuclear Weapons, Part 1* preliminary pages and contents pages, Change 2, August 1981 (45 pages, 1.6 MB) These pages are **also available here.**

Part 1. Phenomenology.

Chapter 1. ***Introduction.* 30 pages.**
Chapter 2. *Blast and Shock Phenomena.* 306 pages. **Blast wave section is here** and **ground shock/cratering/water bursts/underwater bursts section is here.**
Chapter 3. ***Thermal Radiation Phenomena.* 114 pages.**
Chapter 4. ***X-Ray Radiation Phenomena.* 30 pages.**
Chapter 5. ***Nuclear Radiation Phenomena.* 151 pages.**
Chapter 6. ***Transient-Radiation Effects on Electronics (TREE) Phenomena.* 16 pages.**
Chapter 7. ***Electromagnetic Pulse (EMP) Phenomena.* 40 Pages.**
Chapter 8. ***Phenomena Affecting Electromagnetic Propagation.* 94 pages.**

PDF download of Philip J. Dolan (Editor), DNA-EM-1 *Capabilities of Nuclear Weapons, Part 2* preliminary pages and contents pages, Change 2, August 1981 (50 pages, 1.7 MB)

Part 2. Damage Criteria.

Chapter 9. ***Introduction to Damage Criteria.* 187 Pages.**
Chapter 10. ***Personnel Casualties.* 38 Pages.**
Chapter 11. ***Damage to Structures.* 50 Pages.**
Chapter 12. ***Mechanical Damage Distances for Surface Ships and Submarines Subjected to Nuclear Explosions.* 147 Pages.**
Chapter 13. ***Damage to Aircraft.* 81 Pages.**
Chapter 14. ***Damage to Military Field Equipment.* 46 Pages.**
Chapter 15. ***Damage to Forest Stands.* 64 Pages.**
Chapter 16. ***Damage to Missiles.* 121 Pages.**
Chapter 17. ***Radio Frequency Signal Degradation Relevant to Communications and Radar Systems.* 32 pages.**

Appendices A-F. 112 pages.

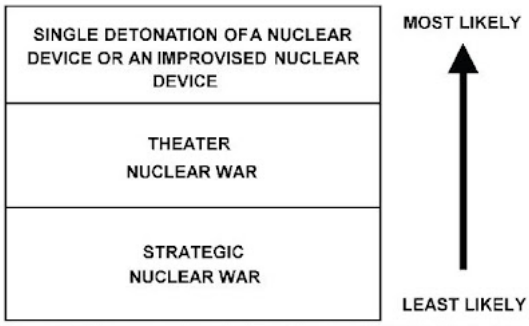
Dolan's *Capabilities of Nuclear Weapons*, U.S. Department of Defense manual EM-1 (1651 pages in two parts, 'Phenomenology' and 'Damage Criteria'; both originally loose-leaf binders to allow page updates) is the massive and complete 'Secret-Restricted Data' classified nuclear weapons effects compendium source used to write the relatively brief and less detailed unclassified book, *The Effects of Nuclear Weapons*. The problem with the latter is that it omits vital nuclear effects data for civil defence, which we will review below. **Now Dolan's massive secret compilation of nuclear test facts and computer simulation results is going online as PDF files**. One thing that is blanked-out in DNA-EM-1 is the graph showing predicted EMP electric field strengths at the earth's surface from high altitude nuclear

detonations of various yields and altitudes, but that graph occurs in another declassified document as explained in a post on high altitude EMP effects, **linked here**.

The contents of DNA-EM-1 has altered greatly since 1981, with the longer chapters being subdivided to produce extra chapters as we shall see later in this post.

Why grossly exaggerating the effects of aerial bombardment caused World War II

Tens of millions died in World War II because of the 1930s efforts to negotiate with totalitarians through a false fear of war due to the quantitative exaggeration of the effects of aerial attack, and a widespread belief that peace could be guaranteed by exaggerating the effects of war into a dogmatic religion of pseudo-science, which would brainwash humanity into avoiding war. This lying only encouraged the proliferation of weapons to the despotic dictatorships which wanted to have the threat of such weapons in order to achieve political intimidation, 'peaceful invasions' and genocide without opposition.



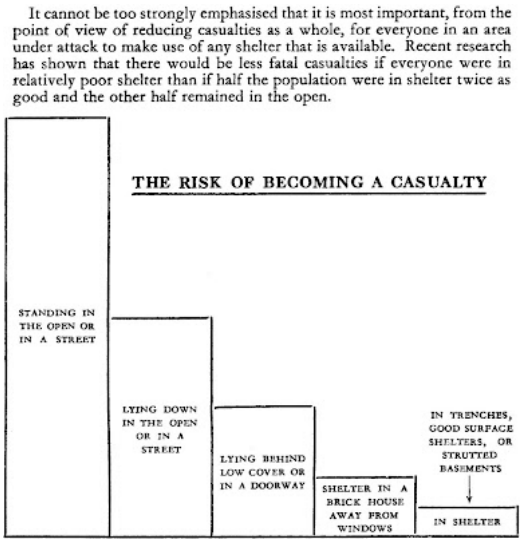
U.S. ARMY FIELD MANUAL FM 4 - 02 . 283, TREATMENT OF NUCLEAR AND RADIOLOGICAL CASUALTIES, 2001 FIGURE 1-1.

There is a need to debunk **general *Planet of the Apes* style nuclear effects exaggeration hype by politicans which simultaneously encourages misguided nuclear proliferation (rogue states, dictators and terrorists think that simply having a nuclear threat will get them anything they want by intimidation, due to the exaggeration in the popular media) and discourages simple civil defense countermeasures from being taken seriously**. If you're in the crater region, you don't need civil defense, but ***even* the crater sizes have been grossly exaggerated** in the public domain: the 'overkill' areas are actually trivial *compared to the areas over which even the simplest informed civil defense countermeasures like duck and cover and getting out of the immediate downwind area (or under cover there) before the wind blows fallout there, is effective at saving lives.*

The tragedy of the exaggeration of the offensive capabilities of aerial attack was plain to see during the 1930s. Public opinion was on British Prime Minister Neville Chamberlain's side (appeasing Hitler) *because the effects of war had been exaggerated in 1938 by the British War Office*: **aerial bombing was (inaccurately) predicted to cause 121 casualties/ton, and the German air force was expected (for no reason other than doom mongering, it seems) to deliver its maximum capacity of 600 tons of chemical incendiary, gas and explosive bombs daily on Britain, killing 2.2 million people per month.**

Chamberlain and the British public were scared by these false "predictions" which were based on the WWI unopposed attacks in daylight and had no relevance for inaccurate nighttime bombing when enemy bombers were subject to AA and fighter defenses.

In World War II a total of 71.27 kilotons (in average units of 175 kg of explosive, according to the British Home Office) of bombs, V1 cruise missiles and V2 supersonic ballistic missiles hit Britain, killing 60,595 and injuring 86,182, a casualty rate of 2 casualties/ton, 60 times fewer than the prediction based on World War I data!


It cannot be too strongly emphasised that it is most important, from the point of view of reducing casualties as a whole, for everyone in an area under attack to make use of any shelter that is available. Recent research has shown that there would be less fatal casualties if everyone were in relatively poor shelter than if half the population were in shelter twice as good and the other half remained in the open.

Above: the data proving the life-saving effectiveness of even poor, improvised protection such as "duck and cover"

countermeasures against blast and blast wind carried flying debris during World War II bombing air raid attacks on U.K. cities; from page 12 of the U.K. Home Office, *Civil Defence Manual of Basic Training, Vol. 2, Pamphlet No. 5, Basic Methods of Protection Against High Explosive Missiles,* H.M. Stationery Office, London, 1949. Pages 12-18 explain:

"It cannot be too strongly emphasised that it is most important, from the point of view of reducing casualties as a whole, for everyone in an area under attack to make use of any shelter that is available. Recent research has shown that there would be less fatal casualties if everyone were in relatively poor shelter than if half the population were in shelter twice as good and the other half remained in the open. ... Protection against blast and splinters from a 500 lb. medium cased bomb exploding 50 ft. away will be afforded by the following materials of the thickness indicated:-

Lateral protection

(i) Mild steel plate - 1.5 inches
(ii) Reinforced concrete - 12 inches
(iii) Brickwork or masonry - 13.5 inches
(iv) Unreinforced concrete - 15 inches
(v) Ballast or broken stone - 24 inches
(vi) Earth or sand - 30 inches
(vii) Solidly stacked timber - 36 inches

Overhead protection

(i) Mild steel plate - 5/16 inches
(ii) Reinforced concrete - 6 inches
(iii) Efficient brick arching - 9 inches
(iv) Earth, sand or ballast - 18 inches
(v) The inside of an existing substantial building having a roof and not less than two storey floors overhead, provided that the floor above the protected space is supported to enable it to resist the debris load. ... Shelters providing protection against medium case type bombs also provide a measure of protection against the atomic bomb."

If Chamberlain and - more important - the general public had *known the true civilian threat in 1938 from aerial attack instead of the hysterical exaggerations officially promoted, then Hitler might have been stopped or effectively deterred earlier on, with less cost in human lives.* Delaying the war gave Germany years to prepare for war, which made the war worse than it would otherwise have been.

Herman Kahn's 1959 testimony to the 22-26 June 1959 U.S. Congressional Hearings on the *Biological and Environmental Effects of Nuclear War* is much more concise than his books on nuclear weapons effects, so I will quote it here to show you the kind of factual arguments Kennedy heard as a Senator attending nuclear weapons effects hearings (which also led Samuel Glasstone to edit the revised 1962/4 edition of *The Effects of Nuclear Weapons* so as to bring out the reasons for civil defense countermeasures in the final chapter *Principles of Protection*):

Page 833:

'Let me start by making some remarks about quantitative computations. The most important reason for being quantitative is because one may, in fact, be able to calculate what is happening. Many of the witnesses have emphasized the uncertainities of thermonuclear war but ... Napoleon ... would have been impressed with the relevance of quantitative calculations; impressed with the accuracy with which people predict what a nuclear war is like. ... This is of some real interest; before World War II, for example, many of the staffs engaged in estimating the effects of bombing over-estimated the effects of bombing by large amounts. This was one of the main reasons that at the Munich Conference and earlier occasions the British and the French chose appeasement to standing firm or fighting. Incidentally, these staff calculations were more lurid than the worst imaginations of fiction. [Air bombing was predicted to destroy whole cities in firestorms in a single air raid, with clouds of poison gas killing everyone for hundreds of miles downwind, like fallout exaggerations from megaton surface bursts which assume that people are constantly outdoors on a smooth infinite unobstructed plane, etc.]'

Page 904:

'I would like to emphasise: Britain declared war on Germany in 1914. Britain declared war on Germany in 1939. If they had not been able to declare war in either of those 2 years, they would have had to let the Germans do whatever they wanted to do. ... I have a book ... which I recommend to those who want to exaggerate the impact of thermonuclear war. It is called *Munich: Prologue to Tragedy,* by Wheeler Bennett [this book is similar in many respects to President John F. Kennedy's own excellent book written from first hand experience in London when World War II broke out, on the perils of appeasement due to exaggeration of the effects of war, ***Why England Slept****;* remember that Hitler was widely praised by pacifists globally after he announced with a lot of hype but of course no sincerity, his grand '25-Year-Peace-Plan' on March 7, 1936]. Among other things Wheeler Bennett discusses why Chamberlain and Daladier folded. When they returned from Munich [where they enjoyed lovely tea and cakes while making useless pacifist treaties on bits of paper not worth a cent with the evil Adolf Hitler in 1938, *being far too fearful of Hitler's ever increasing military power and its exaggerated explosive and poison gas effects to challenge him over his evil treatment of Jews even at that time*] they were cheered by their people in Paris and London, because war had been averted. Over that weekend some people began to understand that war had been averted by a sellout of the worst sort. And on Monday some few were prepared to criticize. But ... The people who critized Chamberlain and Daladier, with a couple of exceptions, did not criticize them for not going to war; they said, "Hitler was bluffing, and you should have stood

your ground".

'As far as we can tell, Hitler was not bluffing. The men who were in the room with him could see he was not bluffing. It was easy for the people back home to say he was bluffing, but not for the men who had the decision to make. The German people did not want war. The German Army did not want war. ... But Hitler seems to have been willing to have a war if he couldn't have his way.'

Pages 909-15:

'Our study distinguishes three types of deterrence in examining the implications for nonmilitary defense:

'Type I - Deterrence of a direct attack on the United States. ... It is not that the Soviets could reliably expect to be untouched, but that a situation might arise in which the Soviets might feel that going to war was the least risky of the available alternatives. ...

'Type II - Deterrence of extremely provocative behavior. The Soviets ... ask themselves if they can force the United States to accept peacefully the consequences of some extremely provocative action (say a large-scale attack on Europe or a Munich-type crisis). ... If the Soviets were not deterred then the United States might actually carry out an evacuation to try to persuade them to desist. If the evacuation did not persuade the Soviets to desist, then in the last resort the United States might decide that it was less risky to go to war than to acquiesce. ...

'Type III - Deterrence of moderately provocative actions. [*Berlin Wall of 1961, Cuban missiles crisis of 1962, the Soviet backed war against South Vietnam, etc*.] In this case it would be wishful thinking to expect deterrence to work most of the time. However, Soviet calculations which contemplate provoking the United States might be influenced by the existence of a U.S. plan for a crash nonmilitary defense program. ... Experience has shown that attempts to conduct large and overcoordinated programs tend to create inflexibility and to stifle new, unproven ideas or independent approaches.'

In the 22-26 June 1959 U.S. Congressional Hearings on the *Biological and Environmental effects of Nuclear War* following Kahn was the Nobel Laureate Willard F. Libby who stated on pages 924-5:

'We are led, when we review the history of man, ancient and modern, to the conclusion that it is wise to take out some insurance for our protection in the event that something goes wrong and peaceful international relations come to an end. The nature of the effects of modern nuclear weapons and the ranges over which these effects can produce casualties may provoke the question: "Is there really anything we can do?" My answer to this question is, "Yes." ...

'The committee will recall that we have announced that the fallout from the [15 megatons *Castle-Bravo* surface burst of] March 1, 1954, detonation at Bikini Atoll would have created radiation casualties in an area estimated at 7,000 square miles if no protective measures were taken. Casualties, seriously injured and dead from the initial effects of this bomb would have occurred in an area of perhaps 250 to 300 square miles [*for people standing up, fully exposed to the effects of flying glass and thermal radiation from a 15 megatons bomb which is now long since obsolete and replaced by bombs with typically 100 times smaller yield, 150 kt*]. There is a great difference between the two areas and I should like to focus on the need for protection and the capability for protecting the people in the 6,700 square miles or more beyond the range of initial blast, thermal and nuclear radiation. We can save them easily. We can lose them easily. ...

'The first action for anyone who does not already possess the knowledge is to learn what these weapons effects are. No one can be expected to act properly or at all for that matter on any problem unless he understands what makes it. It is necessary for people to learn about fallout, about nuclear radiation, about the effects of nuclear radiation on people, animals, plants, food, water: the things that are immutably linked to life.'

Dr Paul Tompkins of the U.S. Naval Radiological Defense Laboratory stated on pages 953-4 of the Hearings:

'I had the experience of being on the Manhattan Division [developing the first nuclear weapons] in 1943. I am very familiar with the psychology of revulsion against the effect these weapons can produce. ... the results are catastropic enough in their own right. They need no imaginary amplification. The facts themselves are bad enough. However, it is crucially important to look those facts squarely in the face if one is going to face the necessity for survival if against your will or despite anything you can do about it, it is imposed on you. As far as I am concerned, if the chips ever go down and avoiding a conflict is not possible in the scheme of human events of the future, I for one do not propose to see this Nation come out the loser. ...

'The world of the future is going to be dangerous. The human capacity to inflict such damage will inevitably be there. The threat of the employment of that damage is something with which we will have to live unless something very drastic changes in our international relations. ... I personally never expect to see consequences of the type displayed on these maps. ...

'As far as I am personally concerned, by looking at the problems, understanding what they are composed of, and by necessity being an incurable optimist, I never expect to see a war of this kind happen. It is possible that more limited engagements of a more sharply defined type will be fought under the sword of Damocles hanging over our heads some time in the future. If so,

let us be prepared for that. So, that at least, is my personal view as to the role that the nonmilitary defense should play, and it will never be perfect.'

Chairman Holifield then concluded the 1959 Hearings on pages 954-5 with the following words:

'These long technical testimonies were necessary in order that the basic record might be presented in as fair a way as we know how. In conclusion I want to say the challenge of the nuclear age is enormous and inescapable.

'The facts of nuclear war and the effects of nuclear war once established will not fade away because they are unpleasant. If we are prudent we will not ignore them.

'They will not disappear. Each of us must accept personal responsibilities because the nuclear war is a personal threat to our survival.

'The problem is too large to leave solely in the hands of the diplomats and the generals.'

As an example, what could happen when Iran gets the U-235, and maybe gets some lithium and heavy water to make lithium deuteride to get a H-bomb (it's now known than lithium-6 deuteride isn't necessary; the 11-Mt Castle-Romeo nuclear test used only natural lithium and was a great success)? It may be just like Munich and Iran will be appeased through fear of a nuclear war, due to lying exaggerations hyped in the media just like the prediction of 2.2 million casualties per month from Nazi air raids.

Update: the nuclear weapons proliferation exaggerated threat is *already* causing Britain to appease Iran and take no notice of violation of human rights, according to Martin Fletcher's front page story in *The Times* newspaper, 24 September 2009.

Britain is appeasing Iran, Nobel laureate Shirin Ebadi says
by Martin Fletcher
The Times online, September 24, 2009

The only Iranian to win the Nobel Peace Prize accused Britain of ignoring the regime's savage suppression of opposition in order to safeguard talks on its nuclear programme.

Shirin Ebadi, the human rights lawyer, said that her worst fears were confirmed when she saw the British Ambassador at President Ahmadinejad's inauguration.

"That's when I felt that human rights were being neglected," she told The Times. "I'm very sorry to say the West cares more about its own security than human rights. I think they're wrong . . . Undemocratic countries are more dangerous than a nuclear bomb. It's undemocratic countries that jeopardise international peace."

Dr Ebadi said that sanctions should have been imposed on the Iranian regime over the alleged theft of the election and the subsequence killing, beating and imprisoning of opponents. She has called for the downgrading of Western embassies, the withdrawal of ambassadors and the freezing of the assets of Iran's leaders.
...

Dr Ebadi plans to go home in two months, daring the regime to arrest the first Muslim woman to win a Nobel prize. In 2000 she spent three weeks in solitary confinement after lodging a complaint against Tehran's police chief for a lethal attack on pro-democracy students.

If not imprisoned, she will fight to secure justice for the families of those killed in the crackdown — a trail that could lead all the way to the Supreme Leader, Ayatollah Ali Khamenei. She has been approached by the mother of Neda Soltan, the student whose death made her an icon of the opposition.

Dr Ebadi said that she was enraged by the crimes that the regime had perpetrated in the name of Islam, but that ordinary Iranians were united as never before, with women at the fore, and that they would not forgive or forget the regime's crimes. "The opposition has gained unstoppable momentum," she said. "The people have reached a point of no return. I am sure they will be victorious, but when? The fall of the Berlin Wall was totally predictable but no one could say when."

Before 9/11, Weinberger was quizzed by skeptical critics on BBC News Talking Point on Friday, 4 May, 2001, *Caspar Weinberger quizzed on new US Star Wars ABM plans:*

'It is like saying we don't like chemical warfare - we don't like gas attacks - so we are going to give up and promise not to have any defences ever against them and that of course would mean then we are perfectly safe. ...

'The **... idea that you are somehow endangering people by having a defence strikes me almost as absurd as saying you endanger people by having a gas mask in a gas attack.** ...

'Now if you tell an aggressive nation that [chemical or nuclear weapons are] the one system of weapons that is never going to be defended against - what are they going to do? They are going to make every effort to get that kind of system of weapons. That is what is happening ...'

Former and future British Prime Minister Stanley Baldwin stated incorrectly to Parliament in 1932: 'I think it is well also for the man in the street to realise that there is no power on earth that can protect him from being bombed, whatever people may tell him.' Samuel Glasstone witnessed the tragic effects of the exaggeration of the effects of weapons in the lead up to World War II: the exaggeration led to a policy of appeasement during which the Nazis terrorised Jews and simultaneously rearmed with impunity. The whole problem was that the grossly exaggerated effects of aerial bombardment of civilian populations with incendiaries, high explosives and poison gas (with predicted results of many millions dead and utter devastation forecast to be far worse than even modern day nuclear weapons could cause!) forced 1930s governments to give a free hand to terrorists, rogue nations, dictatorships, genocidal regimes, etc., rather than risk the threat of war. It was only later that it became clear that this gross exaggeration of aerial bombardment was making the situation worse: if you have some mad Hitler-like terrorist dictatorship threatening to terrorize your nation, you might have to fight even if the cost is relatively high, just to regain stability. Likewise, if you're an ethnic minority and some thugs want to slaughter you, the risks of war might be less than the gains of fighting for survival. The pacifist case asks all the wrong questions, or it assumes that wars are all a giant misunderstanding and that something short of physically hurting evil thugs, like chatting to them or trading with them, will avert war. Nope. That was tried with Hitler, Stalin, Saddam, etc. It's obvious why war can't be averted: absolute power corrupts, so dictators will always be threatening/hurting others unless they are deterred by a credible threat.

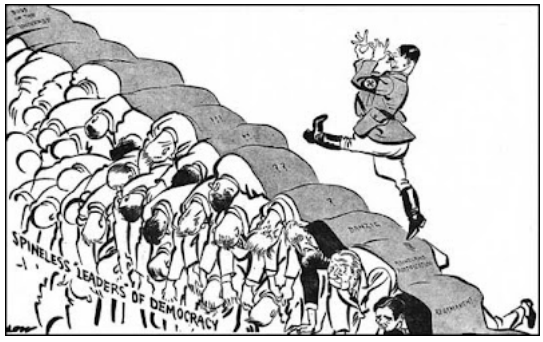
MILITARY EXPENDITURE (MILLIONS OF DOLLARS)

Year	Japan	Germany	Britain	America
1933	183	452	333	570
1934	292	709	540	803
1935	300	1607	646	806
1936	313	2332	892	932
1937	940	3298	1245	1032
1938	1740	7415	1863	1131

Source: A. J. Toynbee and F. T. Ashton-Gwatkin, Editors, The World in 1939, London, 1952.

Above: the recovery of Germany from World War I was impeded by the French imposed punishment of massive reparations, which crippled the Germany economy and led to hyperinflation in the early 1920s. After the global economic crisis of 1929, the extremist politician Hitler gained increasing public sympathy in Germany and became dictator in 1933. He ended unemployment by conscripting a massive army and invaded the Rhineland on 7 March 1936, violating the Treaty of Versailles. Nearly universal pacifism after the destruction and loss of life in World War I, had led to disarmament and a negative public opinion towards military action in other European states, which were therefore unable to block Germany. Fear of annihilation in war led to a reduction in armaments, encouraging dictators to take advantage by building up their power and endlessly testing resolve by taking provocative actions. For example, French journalist **Geneviève Tabouis** wrote on page 8 of the 4th revised Penguin Books (England) edition of her popular *Blackmail or War,* published in May 1938 (the first Penguin edition had been published on 25 February 1938):

'Public opinion takes the point of view that war, which may perhaps be inevitable, would involve the utter ruin of our civilization.'

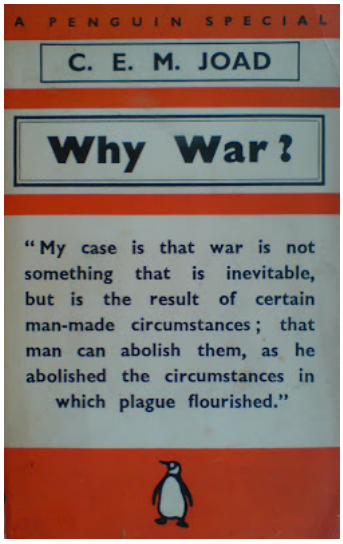


Above: David Low's illustration in the London *Evening Standard* newspaper of July 8, 1936, showing Hitler free to walk over the 'spineless leaders of democracy' (the steps of Hitler are labelled 'Rearmament', 'Rhineland fortified', 'Dantzig' ... 'Boss of the Universe'). After World War I, at the insistence of French officialdom, German was made to pay £1,000,000,000 damages on account immediately, with a final settlement of £6,600,000,000 damages to be paid decided in 1921. The effect on Germany was hyperinflation and economic ruin. The resentment produced was exploited by Hitler. Simultaneously, a generation of pacifist politicians and appeasement supporting journalists were produced in reaction to the carnage of the First World War. John F. Kennedy, the future American President, worked in the American Embassy in London at the outbreak of the war and his thesis on the reasons why British politicians appeased Hitler, *Why England Slept* (published by Hutchinson, London, 1940) concluded:

'I believe, as I have stated frequently, that leaders are responsible for their failures only in the governing sector and cannot be held responsible for the failure of a nation as a whole.'

This is because leaders of democracy are elected to represent the people and are influenced by the free press of a democracy. They are elected to do what the majority of the people want, so instead of blaming the leaders of democracy for the failure to stand up to Hitler, a major part of the blame needs to be placed squarely upon the shoulders of those in the media who spread false propaganda (or did not take the care and trouble to debunk propaganda successfully), and thereby supported pacifism when it was clearly encouraging Nazi aggression. The major Nazi encouraging pacifist of the period was **C. E. M. Joad** who presented the pacifist case in the infamous Oxford

Union Society debate, on 9 February 1933 (ten days after Hitler became Chancellor of Germany), of the proposition: “That this House will in no circumstances fight for its King and Country.” Joad's eloquence led the motion to be passed by a vote of 275 to 153. Joad's argument simply omitted altogether the whole problem that if you don't fight a tyrant, the tyrant is free to massacre in cold blood, to starve ethnic minorities, and so on:



'My case is that war is not something that is inevitable, but is the result of certain man-made circumstances; that man can abolish them, as he abolished the circumstances in which plague flourished.'

- C. E. M. Joad, *Why War?,* Penguin Books, August 1939 (front cover).

Of course, France officially avoided war with Germany by surrendering and allowing a 'peaceful invasion' (although the Resistance fought while under occupation). The problem with simply giving up weapons is that you thereby open your door to all forms of intimidation, thuggery, dictatorship, and are unable to help those in need without being shot yourself. In the 1933 debate, Joad was asked what he would do if an enemy soldier raped his sister, and replied sarcastically (**he was a serial womanizer**).

"When asked what he would do if he saw a German raping his sister, he replied in his famous falsetto voice: 'I should try and come between them'."

- Martin Ceadel, "The ‘King and Country’ Debate, 1933: Student Politics, Pacifism and the Dictators", *The Historical Journal* vol. 22 (1979), pp. 397-422.

> **"Winston Churchill condemned the motion in a speech on 17 February, 1933 to the Anti-Socialist and Anti-Communist Union as "that abject, squalid, shameless avowal... [it] was a very disquieting and very disgusting symptom. One could almost feel the curl of contempt upon the lips of the manhood of Germany, Italy and France when they read the message sent out by Oxford University in the name of Young England".[8] In March 1933 the "Oxford Pledge", as the resolution came to be called, was adopted by the University of Manchester and the University of Glasgow.[8]**
>
> **"Three weeks after it was passed, Randolph Churchill proposed a resolution at the Oxford Union to delete the "King and Country" motion from the Union's records but this was defeated by 750 votes to 138 in a rowdy debate, where Churchill was met by a barrage of hisses and stink bombs. A bodyguard of Oxford Conservatives and police escorted Churchill back to his hotel after the debate.[3][9]**
>
> **"In a speech in the House of Commons on 20 July, 1934, the Liberal MP Robert Bernays described a visit he made to Germany: 'I remember very vividly, a few months after the famous pacifist resolution at the Oxford Union visiting Germany and having a talk with a prominent leader of the young Nazis. He was asking about this pacifist motion and I tried to explain it to him. There was an ugly gleam in his eye when he said, "The fact is that you English are soft". Then I realized that the world enemies of peace might be the pacifists.'[10]" - Wikipedia.**

This is a very important point, because it underlines the point that once the effects of weapons of war have been exaggerated sufficiently to make war seem worse than any imaginable oppression, the pacifist case is invincible and has historically ridden roughshod over all conceivable objections: if you claim that war will destroy everyone and everything, you will have to surrender to terrorism or be destroyed.

German Zeppelin airships and Gotha bombers dropped a total of 0.30 kiloton of bombs on Britain in World War I, killing 1,413 people and injuring 3,407. The most efficient attacks were two daylight air raids in 1917 by Gotha bombers which dropped 6.9 tons of bombs and caused 832 casualties including 216 deaths, i.e. 121 casualties/ton. In World War II a total of 71.27 kilotons of bombs, V1 cruise missiles and V2 supersonic ballistic missiles hit Britain, killing 60,595 and injuring 86,182, a casualty rate of 2 casualties/ton. So in Britain the World War II average casualty rate from aerial bombing was only 1.7% of the most efficient bombing in World War I. Assuming (falsely) that future bombing effects with improved technology would be as efficient as the best World War I bombing, and that the German air force could deliver 600 tons of bombs daily, the 1938 British official predicted horrific effects which were actually very similar to the

effects later predicted for a smaller number of individually more destructive nuclear weapons in a Soviet attack: even the supposedly 'unique' fire and fallout radiation effects were mimicked in conventional bombing by magnesium and phosphorus incendiary bombs and by the delayed effects mustard gas bombs which contaminate areas with slowly evaporating liquid mustard agent. Half of the buildings in London were predicted to be destroyed within a month, over a million people would be dead or injured despite air raid precautions and shelters, three million would be homeless and there would be four million psychiatric casualties. In 1939 the Ministry of Health printed a million burial forms to be ready for war. (Source: Peter Laurie, *Beneath the City Streets: A Private Inquiry into the Nuclear Preoccupations of Government,* Penguin, 1974.)

All of this was wrong, due to quantitative exaggeration and a lack of scientific understanding of the way in which countervalue uses of weapons would be deterred, hindered, and rendered ineffective. Human nature resolutely opposes the hatred manifested by indiscriminate violence by an enemy, and sees it as immoral and insane. This was why countervalue bombing during World War II was a military failure. It was found to increase rather than weaken the resolve of the attacked population to support its leadership in sustaining war against the opposition.

On 1 September 1939, American President Franklin D. Roosevelt issued an 'Appeal against aerial bombardment of civilian populations' which stated:

'The ruthless bombing from the air of civilians in unfortified centers of population during the course of the hostilities which have raged in various quarters of the earth during the past few years [e.g., in the Spanish Civil War in 1937], which has resulted in the maiming and in the death of thousands of defenseless men, women, and children, has sickened the hearts of every civilized man and woman, and has profoundly shocked the conscience of humanity.

'If resort is had to this form of inhuman barbarism during the period of the tragic conflagration with which the world is now confronted, hundreds of thousands of innocent human beings who have no responsibility for, and who are not even remotely participating in, the hostilities which have now broken out, will lose their lives. I am therefore addressing this urgent appeal to every government which may be engaged in hostilities publicly to affirm its determination that its armed forces shall in no event, and under no circumstances, undertake the bombardment from the air of civilian populations or of unfortified cities, upon the understanding that these same rules of warfare will be scrupulously observed by all of their opponents.'

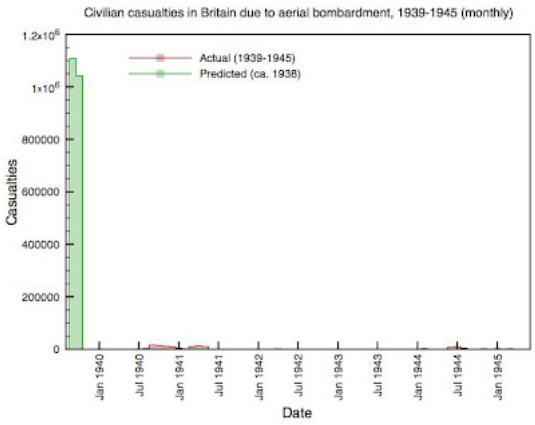
Britain abided until 15 May 1940, due to public opinion after the 'phoney war' period was ended by the German invasion of France on 10 May, and by the German air bombing of Rotterdam on 13 May. Pressure for air bombing of Germany was increased after the Soviet Union was attacked by Germany in 1941, since it was the only action Britain could take to relieve pressure on the German-Russian front, and **'with the technology available at the time, the precision bombing of military targets was only possible by daylight (and difficult even then). Daylight bombing involved unacceptably high losses of British aircraft. Bombing by night led to far lower British losses, but was of necessity indiscriminate.'** The German capital, Berlin, was subjected to 363 air raids and German as a whole received 1,300,000 tons of air dropped bombs (1.3 megatons, although equivalent to a lot more nuclear megatons due to the inefficiency of releasing a similar amount of energy in a single explosion) between 1940 and 1945:

'These raids caused immense devastation and loss of life in Berlin. The 22 November 1943 raid killed 2,000 Berliners and rendered 175,000 homeless. The following night 1,000 were killed and 100,000 made homeless. During December and January regular raids killed hundreds of people each night and rendered between 20,000 and 80,000 homeless each time.[17] Overall nearly 4,000 were killed, 10,000 injured and 450,000 made homeless.[18]

'Despite the devastation they caused, however, these raids failed to achieve their objectives. German civilian morale did not break, the city's defences and essential services were maintained, and war production in greater Berlin did not fall: in fact German war production continued to rise until the end of 1944. Area bombing consistently failed to meet its stated objective, which was to win the war by bombing Germany until its economy and civilian morale collapsed. ... It is generally accepted that the Battle of Berlin was a failure for the RAF ...'

Above: Herman Kahn and Albert Wohlstetter of the RAND Corporation studied the reasons for the 7 December 1941 surprise attack on Pearl Harbor in Oahu, Hawaii. It was a military target, and substantial damage was done to American Naval capabilities by the use of specially designed torpedoes which could operate in the shallow harbour water. America had ignored the torpedo threat because the water was shallower than the usual textbook minimum depth for the use of torpedoes. The reason for the surprise attack was a simple calculation by the Imperial Japanese navy, which predicted that at the end of 1941 Japan would have 70 percent of the warship strength of America, but this strength: 'would fall to 65 percent in 1942, to 50 percent in 1943, and to a disastrous 30 percent in 1944.' (Source: H. P. Willmott, *Empires in the Balance,* Annapolis, 1982, p. 62.) Only the bombing of military targets has achieved success: the effects of the delivery of 1.3 megatons of conventional bombs dropped on Germany in World War II failed to win Germany public support let alone the war, just as German bombing on Britain failed to achieve its objective and was largely counterproductive in hardening resolve.

> **'In all, there were more than 146,000 civilian casualties in Britain during the war ... Now, here's a comparison between what actually happened in 1939-1945 and what British government officials in 1938 predicted might happen if a war started in 1939 — that's the knock-out blow: over a million casualties per month, half of them fatalities, over only two months. Nearly two orders of magnitude more destructive than what actually happened.**



'These estimates were not plucked out of thin air, but they weren't much more than naive extrapolations from the First World War experience: divide the number of casualties between 1914 and 1918 by the tonnage of bombs dropped, and then multiply by the number of bombers the enemy had and the amount of bombs they could carry. This turned out to be a huge exaggeration, but you can see why everyone was so worried! In extreme versions of the knock-out blow, civilisation itself would collapse, as the complex webs of commerce, transport and social control which bind society together break apart, leaving people to fend for themselves as best they could. From the perspective of a later generation, this sounds a lot like the effects of nuclear war.'

- Overview of Brett Holman's PhD thesis.

The Parliamentary Under-Secretary of State, Home Office (Lord Elton) stated in the House of Lords debate on Civil Defence (General Local Authority Functions) Regulations, *Hansard,* vol. 444, cc. 523-49, 1 November 1983:

"As to the interlinking of the defence against an attack and provision to attack in kind, I think all of your Lordships in the House at the moment are old enough to recall our experience with gas in the last world war. There was gas in Germany, there was gas here. We had gas masks as part of our civil defence and gas was never used. I hope that I refer to a fruitful paradigm."

"The Germans did not use gas during the 1939-1945 war [except for hydrogen cyanide gas, used for example in the gas chambers from

1941 at Auschwitz concentration camp, which was stored in solid form called 'Zyklon-B' using a reaction with oxalic acid discovered by German chemist Dr Brune Tesch], but on its conclusion it was found that they held large stocks of both new and old war gases and some of these were ready for use in bombs and shells. [German chemist Dr Gerhard Schrader on December 23, 1936 discovered the first nerve gas, tabun, and the Nazis manufactured 12,000 tons of it between April 1942 and May 1945, but did not use it for fear of mustard gas reprisals, since Germany had a rubber shortage and hence not enough gas masks. Dr Gerhard Schrader and three others also discovered sarin nerve gas in Nazi Germany in 1938. Soman nerve gas was discovered in 1944 in Germany by a Nobel Laureate, vitamin expert Dr Richard Kuhn.] ... it is fair to assume that the knowledge that the population of this country all possessed efficient respirators **[>by September 1939, no less than 38 million gas masks had been issued to civilians]** and were trained in their use, together with the possibility of retaliation, was an important deterrent. **[Note that standard British World War II gas masks with activated charcoal absorbers give protection against all nerve gases; the airborne LDt50 (concentration-time product) dose of tabun needed to kill by unprotected skin absorption is 3,700 times higher than that for inhalation, and 3,100 times higher for sarin. Therefore, wearing a gas mask without protective clothing will give a protection factor of several thousand, vastly increasing the amount of nerve gas needed to kill people even under suitable weather conditions.]**"

- U.K. Home Office, *Civil Defence Manual of Basic Training, Vol. 2, Pamphlet No. 1, Basic Chemical Warfare,* H.M. Stationery Office, London, 1949, p. 3.

'The Hungarian revolution of October and November 1956 demonstrated the difficulty faced even by a vastly superior army in attempting to dominate hostile territory. The [Soviet Union] Red Army finally had to concentrate twenty-two divisions in order to crush a practically unarmed population. ... With proper tactics, nuclear war need not be as destructive as it appears when we think of [World War II nuclear city bombing like Hiroshima]. The high casualty estimates for nuclear war are based on the assumption that the most suitable targets are those of conventional warfare: cities to interdict communications ... With cities no longer serving as key elements in the communications system of the military forces, the risks of initiating city bombing may outweigh the gains which can be achieved. ...

'The elimination of area targets will place an upper limit on the size of weapons it will be profitable to use. **Since fall-out becomes a serious problem [i.e. fallout contaminated areas which are so large that thousands of people would need to evacuate or shelter indoors for up to two weeks] only in the range of explosive power of 500 kilotons and above, it could be proposed that no weapon larger than 500 kilotons will be employed unless the enemy uses it first. Concurrently, the United States could take advantage of a new development which significantly reduces fall-out by eliminating the last stage of the fission-fusion-fission process**.'

- **Dr Henry Kissinger,** *Nuclear Weapons and Foreign Policy,* Harper, New York, 1957, pp. 180-3, 228-9.

Kissinger's 1957 book, *Nuclear Weapons and Foreign Policy,* analyzed Soviet and Chinese military policy and opposed Secretary of State John Foster Dulles's 'Massive Retaliation' policy. Kissenger argued that city bombing was obsolete and dangerous as a policy to either side in a nuclear war due to the risks of retaliation in kind, and that this would make 'countervalue' bombing (Herman Kahn's term for anti-civilian city strikes) unattractive as a political or military strategy. Instead, once the enemy has nuclear weapons (i.e., in the period after the Hiroshima and Nagasaki surprise attacks), the only use beyond deterrence for nuclear weapons is their tactical use against military targets. There would even be pressure on both sides to use nuclear weapons in such a way that collateral damage due to blast and fallout is minimised: the use of relatively clean nuclear air bursts to avert collateral damage to innocent civilians would carry a smaller risk of countervalue retaliation than an attack which caused a large number of civilian casualties and aroused anger and a determination to exact revenge. In his 1962 book *Thinking about the Unthinkable* (Horizon Press, New York, pp. 212-8), Herman Kahn listed the major nuclear threats from the spread of nuclear weapons as:

1. Rogue state use of nuclear weapons for intimidation, revenge, and terrorism.
2. Surprise attacks on military targets like Naval base Pearl Harbor in late 1941.
3. Diffusion of nuclear weapons to 'irresponsible private organizations'.

The credible nuclear threat against civilians is due to small scale terrorist or limited wars. The anti-nuclear politics lobby believes and promotes the false dogma that exaggerating the effects of nuclear weapons will make the world safer. *In fact, that exaggeration fuels all of the threats, making them worse, at the same time as demeaning the value of civil defense countermeasures.* Herbert York, a former weapons designer, claimed in a 1989 international TV series, *The Nuclear Age,* that a world police organization could prevent nuclear threats by analogy to the way that the police prevents crime between individuals. The problem here is obvious: it is that *the police does not prevent crime,* and acannot prevent crime. The objective of the police is not to *prevent* crime (which is a completely unattainable utopian fantasy which nobody who lives in the real world could possibly be deluded about), but to *reduce* crime and support a fair system of justice to avoid the problems of bias, prejudice, lynch mobs and the doctrine that 'might is right' which inevitably prevails where justice cannot be implemented.

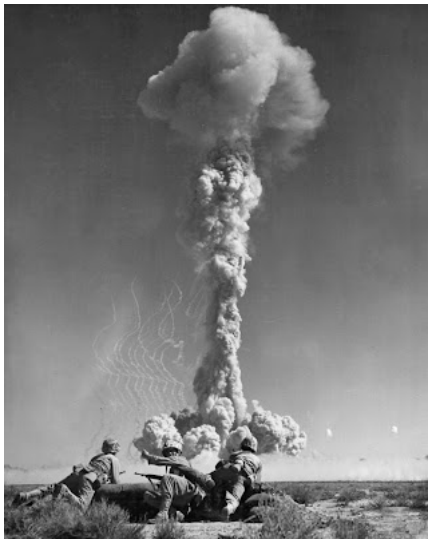
Even in dictatorial police states where individual liberty and freedom is curtained, where people can be detained without charge and tortured to extract information, there are often *unprevented* uprisings by secret and underground organization of dissenters such as the **Hungarian revolution which Khrushchev ruthlessly suppressed in 1956** and the **Prague Spring in 1968**.

In a democracy with any pretense of liberty and freedom, the police have *even less chance* to "prevent" crime than the secret police of dictatorships. The police in a democracy must only act by detaining and charging individuals *after* evidence is obtained: they cannot act before there is evidence of crime without violating the doctrine of innocent until proved guilty. The police do not always prevent crime even where they are authorized to try to do so. Therefore, Western disarmament supported by a world police system as an attempt to prevent rogue and terrorist nuclear threats, would not eliminate the threat. Dr Herbert York's analogy of nuclear safeguards to a police system actually illustrates the fact that disarmament and safeguards will be just as unable to prevent secret nuclear threats as the police is unable to prevent crime.

One of the ramifications for nuclear hysteria and anti-civil defence propaganda for disarmament is the encouragement of nuclear proliferation to dictators and terrorist organizations. The anti-nuclear lobby grotesquely misrepresents the dose-rate and DNA repair mechanism threshold effects of radioactivity and has misled the world with at best only unheard, feeble presentations of the facts from the peacetime nuclear industry and the civil defence authorities. In addition, the propaganda deliberately confuses the various different kinds of nuclear detonation effects, instead of confronting the fact that there are many uses of nuclear weapons and that

none of them can ever duplicate the incendiary effects over the 1945 wood frame cities of Hiroshima and Nagasaki which simply no longer exist as possible targets in the modern world.

Above: the target for Sam Cohen's neutron bomb was these T-54/55 Russian main battle tanks, which had the highest production run of any tank ever made (over 86,000 were manufactured). They were manufactured chiefly for the invasion of Western Europe, once tactical nuclear weapons had been removed by political lobbying of Western disarmament activists via the Kremlin-controlled World Peace Council based in Moscow.



Above: tactical nuclear warfare was rehearsed at Nevada nuclear tests during the Korean War. Here, soldiers survive in trenches and then approach the target area on foot after the May 1, 1952 **deuterium-boosted 19 kt *Operation Tumbler-Snapper DOG* air burst at 1,040 feet altitude**. Soldiers in open (uncovered) two-person foxholes 4.5 feet deep, 6 feet long and 2 feet wide, crouched low enough to avoid direct-line of sight radiation, have a protection factor against initial gamma radiation of 15 if the foxhole is side-on to the detonation, and 7.6 if the foxhole is exposed end-on. The neutron radiation dose protection factor for these foxholes was 3.4. (These data were actually measured at the 37 kt *PLUMBBOB-PRISCILLA* shot at 700 ft altitude: **Nathaniel J. Davis, Jr., *Protection Afforded by Field Fortifications Against Nuclear Weapons Effects,* U.S. Army Engineer Research and Development Laboratories, Report AD860811, 1958, pp. xiii-xiv**. That report also states that 7 by 7 foot machine gun emplacements survived a peak overpressure of 40 psi facing away from that burst but were extremely vulnerable if facing the burst or side on to the burst. **The Confidential *Capabilities of Atomic***

***Weapons* TM 23-200 Table 6-5 on p. 6-11 states that the protection factor for foxholes is 10-20 for initial gamma radiation, 10-50 for fallout gamma radiation, and 3.3 for neutrons**.)

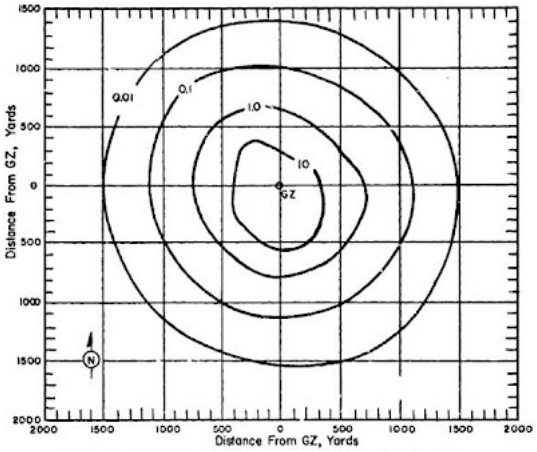
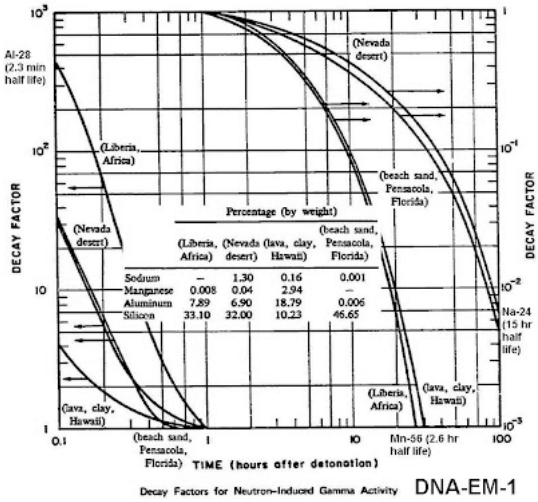


Figure 50. Operation TUMBLER-SNAPPER - DOG On-site dose rate contours in r/hr at H+1 hour. DASA-1251

Above: **the *DOG* shot in 1952 produced no fallout hazards because it was an air burst: the radioactivity at ground zero was due to neutron capture in the soil, as in Hiroshima and Nagasaki**. The neutrons emitted by the bomb are of very high energy (in the MeV range), and are not captured significantly by soil elements of low atomic weight until the neutron energy has been reduced by scattering to about the normal thermal energy of nuclei at ambient temperature, about 0.025 eV. A 1 MeV neutron from the bomb must collide with hydrogen nuclei on average 17.5 times to undergo the 40,000,000 fold loss of kinetic energy needed to thermalize it to 0.025 eV energy. If the material is carbon, 111 nuclei collisions are required; for lead, 1,800 collisions. Once the neutron is thus slowed down, it is liable to be captured by a nucleus via adhesion by the virtual pion-mediated strong attraction, instead of bouncing back (scattering), as is more likely for high energy neutrons. ***For this reason, neutron induced activity is dependent only on soil type and the number of neutrons emited from the bomb; there is no significant effect of the neutron spectrum because the neutrons are all scattered around a lot and degraded to thermal energy, before being captured by the soil.***



Decay Factors for Neutron-Induced Gamma Activity DNA-EM-1

Above: the gamma radiation decay rates of Nevada and other soil and sand neutron induced activity, normalized to identical dose rates at 1 hour after burst. For a given type of nuclear weapon detonated over each of the different kinds of soil, the relative gamma dose rates at ground zero at 1 hour after burst will be 4,540 units/hour for Hawaiian lava clay (due to its massive manganese content, producing a vast amount of Mn-56), 379 units/hour for Nevada desert soil (sodium and manganese), 41.7 units/hour for Liberian soil in Africa, and 1 unit/hour for Pensacola beach sand (which is very nearly pure silicon dioxide, with only a trace of sodium). At times less than 1 hour after burst, aluminium-28 predominates in each case. There was great interest in the neutron induced activity on beaches due to air bursts in the 1950s, because it was realized that nuclear weapons would be used to clear beach defenses prior to an amphibious invasion like the D-Day landings. The main hazard covers a small area and the peak neutron induced activity occurs at a depth of 6-7 cm under the top of the ground, so the radiation emitted by the neutron induced activity is shielded by the ground to a considerable extent. A similar effect occurs in salt water, but the radioactive surface water layer is rapidly mixed by wave action with water at greater depths, diluting the activity and causing a great deal more shielding by the water mass.

Tactical and strategic uses were taken seriously because the one military use of nuclear weapons ever made was to end a war, to *prevent* a million deaths in the conventional invasion of Japan. ***Not even the worst dictators in history like Hitler or Stalin started a war in which they tried immediately to kill as quickly as possible as many of the enemy's civilians as possible by aerial bombardment and poison gas.*** Nuclear war could not consist of an all-out anti-civilian action of the Hiroshima and Nagasaki kind, because nuclear weapons are *no longer* genuinely capable of such action unless somehow they could be used against cities of wood-frame houses with bamboo and paper furnishings plus overturnable breakfast (Hiroshima) or lunch (Nagasaki) charcoal filled braziers:

(1) The very large size of the explosion (compared to conventional explosives) causes the various effects like initial hydrodynamic-enhanced fission product radiation and thermal radiation to be *released slowly enough* - and for blast and fallout to be released *with sufficient delay time during its transit from source to personnel* - for even the slowest people to take simple, cheap and effective protective actions for saving lives. The only exceptions are at distances so close to ground zero that the effects are lethal anyway; we will prove this fact later in this post using data from Hiroshima and Nagasaki which shows the immense value of any form of thermal shadowing in

raising the nuclear radiation LD50 (lethal dose for 50%) due to the synergism mechanism; nuclear radiation proves lethal at small doses in combination with thermal blistering or charring because nuclear radiation can suppress the white blood cell count substantially for two months following exposure, during which infection in burns wounds will easily prove lethal. Avoid infected burns, and the LD50 rises sharply.

(2) Unlike the case of low yield conventional weapons, the areas affected by blast are so large that popularized unobstructed desert data is false due to the scientific fact that blast energy depletion is caused as the blast uses up its energy destroying buildings one after another in any radial line from ground zero, which though not an immense effect in old inflammable wood-frame cities (as measured at Hiroshima and Nagasaki by British investigator Penney in 1945) reduces the blast pressure areas dramatically in modern brick and concrete cities. This blast energy use will be discussed in physical detail later in this post.

(3) **Thermal ablation occurs during exposure, so smoke-shadowing prevents fires.**

(4) **You don't need fallout sheltering downwind if you simply walk in the crosswind direction out of a visibly dangerous fallout area, before getting a sufficient dose to cause injury. This is possible due to the slow diffusive build-up of fallout which isn't all deposited instantaneously. The vertical fallout activity deposition rate is independent of wind speed. Rainout flushes fallout down drains or deep into the ground, where it is shielded by soil.**

Politics is about 'groupthink' and its fashionable consensus; science by contrast is diametrically opposed to any form of ignorant fashionable consensus by definition, for science - unlike consensus and voting - is just about *facts* regardless of the widely held pseudoscientific political consensus and propaganda lies/'expert opinions' to the contrary:

‘Science is the organized skepticism in the reliability of expert opinion.’ - R. P. Feynman (quoted by Smolin, *The Trouble with Physics,* 2006, p. 307).

The issuing of properly tested civil defense countermeasures like general purpose gas masks and air raid shelters to all civilians in Britain before World War II helped to deter Hitler, who was unable to effectively use tabun and sarin nerve gases for fear of retaliation by British mustard gas because of the lack of German gas masks due to rubber shortage. Radar automated anti-aircraft guns and other technology also make enemy attacks less effective than predicted, even in WWI.

Herman Kahn used a 44-rung escalation ladder to explain the facts of history that lead from political disagreement to warfare and then up to anti-personnel attacks in his 1965 book *On Escalation* (Pall Mall, London). A dozen of the most important escalations are:

1. Disagreement over principles (democracy versus dictatorship)

2. Technology race (European arms race of 1914, space race of 1957-69)

3. Declarations of principles (e.g., Marxist world revolution)

4. Confrontations of words (verbal attacks on statements of enemy leaders)

5. Economic sanctions

6. General war talk and civil defense planning (Berlin, 1961)

7. Ultimatums and threats of war (Hitler: Munich, 1938)

8. Mobilization of military forces

9. Naval blockage or arms embargo (Cuban missiles crisis, 1962)

10. Conventional military confrontations (Korea 1953, Vietnam 1975)

11. Limited nuclear warfare within a conventional war or deliberate 'demonstration test' with the media invited to report the effects (Hiroshima and Nagasaki nuclear attacks, 1945; *CROSSROADS* fission air drop demonstration to Soviet Union via the world's media attending Bikini Atoll, 1946; *REDWING-CHEROKEE* thermonuclear air drop demonstration to Soviet Union via world's media attending Bikini Atoll, 1956; ***BOMBA TSAR* 50 Mt thermonuclear air drop demonstration to United States, Novaya Zemlya, 1961**)

12. **Serious civil defense countermeasures analogous to the September 1939 evacuation of children and mothers in England from potential target cities and their dispersal and billeting into the countryside to minimise tragedy in war and to increase the credibility of the military deterrence for political leverage ('this is your last chance to come to the table and negotiate a peaceful settlement, before we destroy you, we're ready for war').**

Although anti-civil defense propaganda always *falsely* presents evacuation as risking a pre-emptive strike, in fact the enemy would *gain nothing* by attacking during evacuation (effects would be much worse if the enemy attacks *before* evacuation begins, i.e. *today*!). A pre-emptive strike is always fruitless where the other side has a protected second-strike (retaliation) capability such as nuclear submarines hidden at sea. This protected second-strike capability takes away any incentive for the other side to strike first (contrary to the propaganda against civil defense). Herman Kahn added in that book that nuclear testing offers a wide range of psychological possibilities short of anti-civilian capabilities:

'Consider ... the use of nuclear weapons to coerce an opponent by means of a spectacular show of force. In this case, it is clear that there is an almost continuous spectrum of alternatives available. They can be ranked as follows:

'1. Testing a large weapon for purely technical reasons almost as part of a normal test programme.

'2. **Testing a very large weapon**, or testing on a day that has particular political significance, or both.

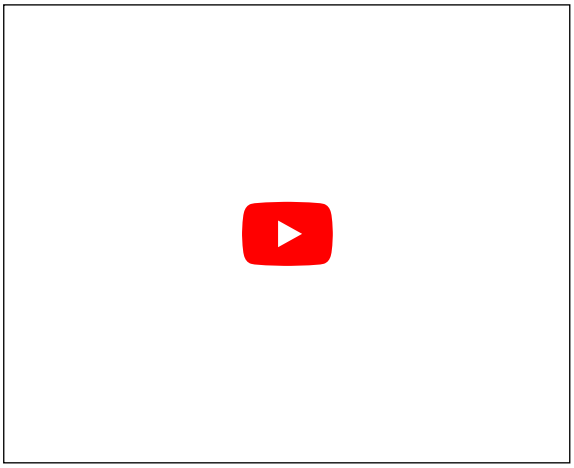
'3. Testing a weapon **off the coast of the antagonist so that the populace can observe it**.

'4. **Testing a weapon high in outer space near the antagonist's airspace [EMP].**

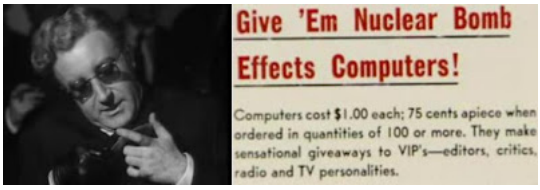
'5. **Testing lower in outer space, or directly over the opponent's country [EMP].**

'6. Testing so low that the shock wave is **heard by everybody, and perhaps a few windows are broken**.'

Above: President John F. Kennedy at the Nevada Test Site on 8 December 1962. Kennedy was the president who authorized the first Nevada test firing of Samuel Cohen's neutron bomb. **The data from the 1962 atmospheric tests authorized by Kennedy led to the vital discovery of the magnetic dipole EMP mechanism from high altitude bursts**, and clarified many other aspects of nuclear effects phenomenology, leading to revised editions of Glasstone's *The Effects of Nuclear Weapons* and Dolan's *Capabilities of Nuclear Weapons*, and providing data which was still being analyzed by increasingly sophisticated mathematical models and computer calculations in the 1990s.



Above: discussion of the Glasstone book based 'Nuclear Bomb Effects Computer' begins at 1 minute 40 seconds in this clip: Stanley Kubrick's 1964 film *Dr Strangelove* was marketed by sending out the plastic circular slide rules from the 1962 edition of Glasstone's *Effects of Nuclear Weapons.* However, there is no relationship between the actual computer's decay rate where the radiation drops by a factor of 10 for every 7-fold increase in time after detonation (which is for fission products, 72% of which have half lives under 24 hours and only 4% of which have half lives exceeding 1 year) and the totally fictional 100 year shelter period Dr Strangelove 'calculates':



Above: Stanley Kubrick's 1964 film, **a classic 1960s satirical attack directed at the American military-political complex in general and - in particular - the ex-Nazi military scientists recruited by the American military-scientific establishment, like Dr Wernher von Braun. *Click here* for Tom Lehrer's 1960s song attacking Dr von Braun's development of Hitler's V2 missile before he developed the Saturn V to put American astronauts on the Moon before that decade was out, in accordance to President Kennedy's space-race against Communism: *'Vee do not care where the rockets come down; vee only care when the rockets go up'***). Kubrick's film deliberately abuses the facts of nuclear weapons effects by including Dr Strangelove (Peter Sellers, who earlier starred in Kubrick's 1962 film *Lolita*) using the 'Nuclear Bomb Effects Computer' from the April 1962 edition of *The Effects of Nuclear Weapons* to lyingly "calculate" that people would need to shelter underground for 100 years from a cobalt-cased bomb. Kubrick had to lie about the effects of nuclear weapons to deliver his 1930s style message about warfare.

Actually, the amount of residual nuclear radiation energy given off by cobalt-60 or anything else that simply captures neutrons is always much less than that given off by the fission products produced by using the same number of neutrons for fission: cobalt-60 only emits two gamma rays, 1.17 MeV and 1.33 MeV (a total of 2.5 MeV of energy), given off in decay per atom, with a 50% decay probability within 5.3 years (the "half-life"). Using the same single neutron to cause fission releases 200 MeV, including 7 MeV of delayed fission product gamma rays. Therefore, you can get more explosive effects plus more residual radiation using a uranium-238 jacket, than you can using cobalt. The low specific activity of cobalt in fallout due to the 5.3 years half-life means it is not a hazard over the short time needed to decontaminate surfaces (by hose pipe flushing or street vacuum cleaning vehicles; radioactivity in drains underground is well shielded from people).

If there is a cobalt or other "salting" jacket, you get a few MeV of radiation energy per neutron captured by cobalt-59, creating cobalt-60; but if the jacket is U-238 you get 200 MeV of prompt blast, heat and cratering energy as well *as more residual radiation energy than you would get from using the same neutron to change cobalt-59 into cobalt-60*. Therefore, you *lose* effects including residual radiation energy by using a cobalt jacket instead of a U-238 (natural uranium) jacket to the bomb's fusion stage, and you don't *gain* anything by having *less* radiation energy given off very slowly, spread over many years by cobalt-60, because the lower dose rate you get from spreading out a fixed amount of energy as radiation exposure over long times rather than having it concentrated into a shorter time interval (higher dose rate). Cobalt-60 is thus less effective than a U-238 jacket on a thermonuclear bomb because it:

(1) permits decontamination (you **sweep** or **flush** it away, where it doesn't get naturally flushed down the drain by rain or washed/plowed deeply into the soil, which shields the radiation) before getting a significant dose, and

(2) spreading out the same few MeV per neutron capture over many years with cobalt-60 allows biological repair to proceed while the dose is accumulated: **low level doses have been observed in properly controlled studies to *not* have the *harmful* short or long effects which can be extrapolated linearly from large doses.** The whole basis of Kubrick's film is a lie, exaggerating the threat and promoting quack civil defense countermeasures. Fallout decontamination was intensively studied in the 1956 *Operation Redwing* nuclear test series at Bikini and Eniwetok Atolls, which despite being the ground zero locale for numerous multimegaton high-fission yield nuclear tests, were successfully decontaminated:

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A nuclear attack cannot be in the form of complete annihilation for basic scientific reasons justified by evidence form Hiroshima, Nagasaki and nuclear tests which we will explain in detail in the post, and it cannot come in the form of a massive fast nuclear war for historically defensible political reasons: an all-out war would by definition use up all second-strike capabilities so both sides would be left without any bargaining chips. The 2005 Nobel Laureate **Thomas C. Schelling** of RAND Corp., a consultant to the U.S. Department of Defense from 1960-64, forcefully argued for the *counterforce* strategy against military targets to replace the older World War II *countervalue* (industrial and city targetting) bombing policy. *Counterforce* became military policy for the capabilities of nuclear weapons (as we will show with extracts from the declassified manuals by Philip J. Dolan), to save the enemy civilians as 'hostages' in order to de-escalate a nuclear war without a massacre of civilians. This was possible as missile accuracy improved. In World War II, aircraft bombing had a very low accuracy and could not target military bases without immense collateral damage. The accuracy of the early V1 missile in World War II was 10 miles, so it was only of use against large city targets. Improvements to the accuracy of missiles permitted a change in bombing strategy toward military targets, accompanied by a *reduction of yield* to reduce and in many cases totally eliminate collateral damage and fallout hazards. As missile accuracy improves, the nuclear explosive yield needed to achieve a constant probability of target destruction is reduced. *So the major threat is from terrorism and limited warfare.*

In 1979, as a result of having seen the appalling consequences of irrational anti-civil defense groupthink scare-mongering in allowing Hitler to build up enough power unopposed to start World War II despite Germany disarmament after World War I (because of irrational fear of even a minor war if Hitler had been opposed before he had enough armaments for a major war!), Glasstone **helped Cresson H. Kearny** to improve the nuclear weapons information in the official Oak Ridge National Laboratory Cold War-focussed civil defence manual, ***Nuclear War Survival Skills:***

> 'Many strategists believe that the United States is more likely to suffer a relatively small nuclear attack than an all-out Soviet onslaught. These possible smaller nuclear attacks include:
>
> ' ° A limited Soviet attack ...

' ° An accidental or unauthorized launching ...

' ° A small attack on the United States by the fanatical ruler of an unstable country that may acquire small nuclear weapons and a primitive delivery system.

' ° A terrorist attack, that will be a more likely possibility once nuclear weapons become available in unstable nations. Fallout dangers could extend clear across America. For example, a single small nuclear weapon exploded in a West Coast city would cause lethal fallout hazards to unsheltered persons for several miles downwind from the part of the city devastated by blast and fire. It also would result in deposition of fallout in downwind localities up to hundreds of miles away, with radiation dose rates hundreds of times higher than the normal background. Fallout would be especially heavy in areas of rain-out; pregnant women and small children in those areas, following peacetime standards for radiation protection, might need to stay sheltered for weeks. Furthermore, in localities spotted across the United States, milk would be contaminated by radioiodine.'

“The foliage making up the crowns [upper branches and leaves] of the trees, while it has a high probability of being exposed to the full free-field radiation environment from air bursts... may, however, materially reduce the exposure of the forest floor by generating quantities of smoke and steam, as well as by direct shading.” - Philip J. Dolan, *Capabilities of Nuclear Weapons,* U.S. Defense Nuclear Agency, 1978 revision, Secret – Restricted Data, Chapter 15, *Damage to Forest Stands,* paragraph 15-9.

"Green leaves and needles on tree crowns smoke and char but do not ordinarily sustain ignition. This smoke production materially reduces the radiant exposure of the ground surface." - *Capabilities of Atomic Weapons,* U.S. Department of Defense, TM 23-200, Confidential, 1960, page 11-2.

“Fuels seldom burn vigorously, regardless of the wind conditions, when fuel moisture content exceeds about 16 percent. This corresponds to an equilibrium moisture content for a condition of 80 percent relative humidity. Rainfall of only a fraction of an inch will render most fuels temporarily nonflammable and may extinguish fires in thin fuels... Surface fuels in the interior of timber stands are exposed to reduced wind velocities; generally, these fuels retain their moisture as a result of shielding from the wind and shading from sunlight by the canopy.” - Philip J. Dolan, *Capabilities of Nuclear Weapons,* U.S. Defense Nuclear Agency, 1978 revision, Secret – Restricted Data, Chapter 15, "Damage to Forest Stands", page 15-60. (This material can also be found in the U.S. Department of Defense's *Capabilities of Atomic Weapons,* TM-23-200, Confidential, 1960, p. 11-3.)

Figure 6.24a. Forest stand after a nuclear explosion, B damage (3.8 psi overpressure).
175 trees/acre. Similar result to 135 miles/hour hurricane winds: 90% trees down; remainder denuded of leaves. Area impassable to wheeled vehicles; progress difficult on foot.

Above: **Figure 6.24a of the 1957 *Effects of Nuclear Weapons*** showing effect of a nuclear explosion giving a peak overpressure of 3.8 psi to a natural Pisonia dominated forest stand (similar to American beech forests) with a mean tree height of 50 feet and a mean diameter at the stem base of 2 feet (note that the test report WT-921 states that at 8,800 feet where the peak overpressure was 4.2 psi some 58% of trees were snapped so the figure of 90% given by Glasstone 1957 is not justified; about 50% of the trees were broken by 3.8 psi not 90%); this photo is identified as Bikini Atoll's Eniirikku (codenamed Uncle by America) Island, at a position just 9,300 feet from the 110 kt *CASTLE-KOON* nuclear surface burst test of 1954 in **Figure 3.8 on page 38 of the originally Secret - Restricted Data report on forest stands exposed at Operation Castle, WT-921**. Notice that the forest was not ignited; it did not burn contrary to anti-civil defense lies which are popularized by propaganda (which we will discuss in detail later).

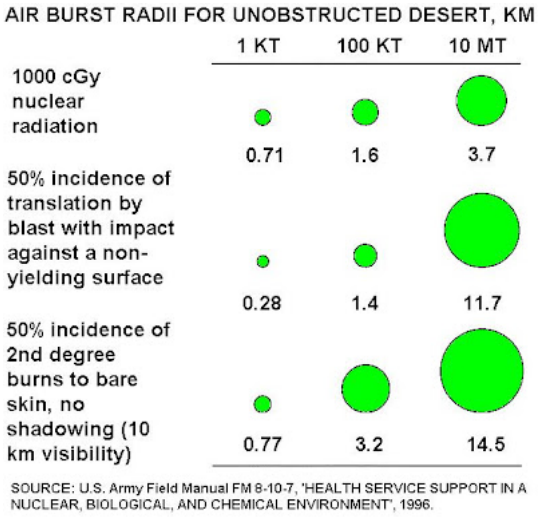
Figure 6.24b. Forest stand after a nuclear explosion, C damage (2.4 psi overpressure).
175 trees/acre Pisona tree stand 12 miles from CASTLE-BRAVO 14.8 Mt ground zero, Bikini Atoll, 1954. Pisona is a beech-like broadleaf tree growing to 80 ft height and 3 ft thick stem. 30% trees down, similar to 95 miles/hr hurricane.

Above: **Fig 6.24b in the 1957 *Effects of Nuclear Weapons:*** 175 trees/acre natural Pisona tree stand on Rukoji (codenamed Victor by America) Island of Bikini Atoll, subjected to 2.4 psi peak overpressure at 62,500 ft or about 12 miles from *CASTLE-BRAVO* 14.8 Mt surface burst ground zero, Bikini Atoll, 1954. This photo is identified for distance and nuclear test at 33 minutes and 17-22 seconds time in the declassified film *Military Effects Studies on Operation Castle,* below. Pisona is a beech-like broadleaf tree and those in this forest stand has an average height of 80 feet with an average stem diameter at its base of 3 feet. Where 30% of the trees are blown down by the blast wind pressure, the overall effect is similar to the much longer-lasting 95 miles/hour winds of a natural hurricane. ***Notice that neither natural forest stand at Bikini Atoll was incinerated by fire!***

According to Glasstone 1957, this forest stand suffered 30% tree stem breakage, but report WT-921 page 43 states that 65% of the tree stems in this stand were snapped. Glasstone 1957 just used the photographs to illustrate its predictive system which is based on 30% and 90% tree breakage, instead of reporting the actual percentage damage reported in WT-921. The *CASTLE-BRAVO* shot also produced light tree damage (no stem breakage, just 30% branch breakage) to a Pisonia forest on Eniirikku (codenamed Uncle by America) Island, 75,400 feet or about 14 miles from ground zero, where the peak overpressure was 1.7 psi, according to page 28 of W. L. Fons and Theodore G. Storey, *Operation Castle, Project 3.3, Blast Effects on Tree Stand,* U.S. Department of Agriculture, Forest Service, Division of Fire Research, Secret - Restricted Data, report WT-921, March 1955.

Other reports on Nevada effects on trees and forest stands are Operation Tumbler-Snapper report WT-509, 1953, and Operation Upshot-Knothole report WT-731, 1954. The Upshot-Knothole experiment exposed a coniferous tree stand of 145 ponderosa pine trees 51 feet in average height to 4.5 psi peak overpressure. The forest stand smoked during the thermal pulse, but did not ignite. Hence, both in Pacific and Nevada tests, trees did not burn even relatively close to ground zero. E. H. Engquist C. W. Forsthoff of Chemical and Radiological Labs., Maryland, reported in *Operation Upshot-Knothole, Project 8.4-2, Evaluation of a Thermal Absorbing Carbon Smoke Screen,* WT-769, February 1954, that a smoke screen similar in height to that produced by thermal radiation on a forest canopy, 80-90 feet above the ground, produced by burning about 275 gallons of carbon containing material per square mile, absorbed 78-90% of the thermal radiation on the ground.

These photos were both published in the **1957 edition of *The Effects of Nuclear Weapons,*** but they were deleted from all subsequent editions of that unclassified book: they appeared ultimately in the highly classified (Secret - Restricted Data) film of the military effects of the test series and the locations are also identified in the report ***Operation Castle, Project 3.3, Blast Effects on the Tree Stand,* weapon test report WT-921, U.S. Forest Service, W. L. Fons (Project Officer).** The lack of thermal ignition of forests even using very high yield nuclear weapons was deemed secret. This hindered civil defense, by obfuscating the facts. Flawed thermal ignition tests and a thermal radiation transmission theory which grossly exaggerated the thermal effects both combined to exaggerate effects and make civil defense appear useless. (*The nuclear test data was secret, with limited print runs that nobody in a position to repudiate anti-civil defense propaganda had proper access to - or if they did have access to it - they were prevented from publishing it by the severe penalties laid down in laws such as the Atomic Energy Act of 1954.*)



Above: the gross exaggeration of the effects of nuclear weapons in mainstream, **groupthink literature:**

'Groupthink is a type of thought exhibited by group members who try to minimize conflict and reach consensus without critically testing, analyzing, and evaluating ideas. Individual creativity, uniqueness, and independent thinking are lost in the pursuit of group cohesiveness, as are the advantages of reasonable balance in choice and thought that might normally be obtained by making decisions as a group. During groupthink, members of the group avoid promoting viewpoints outside the comfort zone of consensus thinking. A variety of motives for this may exist such as a desire to avoid being seen as foolish, or a desire to avoid embarrassing or angering other members of the group. Groupthink may cause groups to make hasty, irrational decisions, where individual doubts are set aside, for fear of upsetting the group's balance.'

Figure 7.34a. Thermal effects on wood frame house almost immediately after explosion (about 25 cal/sq cm).

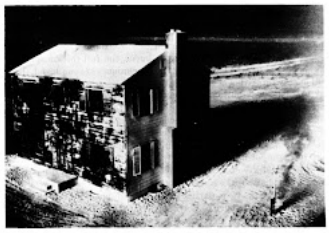


Figure 7.34b. Thermal effects on wood frame house 2 seconds later.

Above: a page from the **1957 *Effects of Nuclear Weapons*** indicating the reason why the trees didn't burn is the same as the reason why this wooden house didn't burn: the thermal pulse from a nuclear weapon is too brief to do more than ablate a thin surface layer of the material, literally creating a smoke screen which immediately protects the underlying material from ignition. Dolan explains this in the 1,651 pages long 1972 Secret - Restricted Data U.S. Department of Defense *Capabilities of Nuclear Weapons* but - although he and Glasstone explained it clearly in the 1977 *Effects of Nuclear Weapons* - the point was not widely grasped. There were *relatively few fires in nuclear tests,* compared to what propaganda forecasts by the use of totally naive assumptions concerning thermal radiation transmission through the atmosphere, and the energy needed to ignite materials. Hiroshima and Nagasaki were burned entirely by means of the *blast wave* overturning charcoal cooking braziers in thousands of homes at the breakfast and lunch times of the bombings, as was revealed in polls of survivors when the secret volumes of the U.S. Strategic Bombing Survey were eventually declassified, which we will discuss later in this post.

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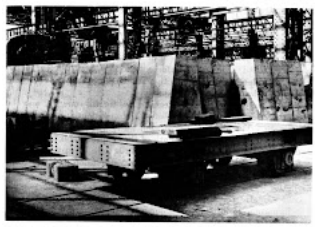

Figure 12.37a. Precast, reinforced-concrete blast walls (0.85 mile from ground zero at Nagasaki).

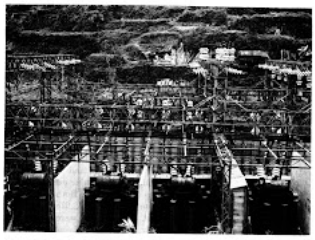

Figure 12.37b. Reinforced-concrete blast walls protecting transformers (1 mile from ground zero at Nagasaki).

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Figure 12.37c. Earth-filled, wooden blast walls protecting machinery (0.85 mile from ground zero at Nagasaki).

PROTECTION BY TRENCHES AND EARTH REVETMENTS

12.38 Although they are not strictly structures, in the sense used above, attention should be called to the significant protection that can be afforded by trenches and earth revetments, especially to drag-sensitive targets. A shallow pit provides little shielding, but pits or trenches that are deeper than the target have been found to be very effective in reducing the magnitude of the drag forces impinging on any part of the target. In these circumstances, the lateral loading is greatly reduced and the damage caused is restricted mainly to that due to the crushing action of the blast wave.

12.39 The only types of shielding against drag forces which have been found to be satisfactory so far are those provided by fairly extensive earth mounds (or revetments) and deep trenches, since these are themselves relatively invulnerable to blast. Such protective trenches are not recommended for use in cities, however, because of the damage that would result from debris falling into them. Although sandbag mounds have proved satisfactory for protection against conventional high explosives and projectiles, they are inadequate against nuclear blast because they may become damaging missiles.

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Figure 12.40a. Earth-moving equipment subjected to nuclear blast in open terrain (30 psi overpressure).

Figure 12.40b. Earth-moving equipment subjected to nuclear blast in open terrain (30 psi overpressure).

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Figure 12.40c. Earth-moving equipment protected in deep trench at right angles to blast wave motion (30 psi overpressure).

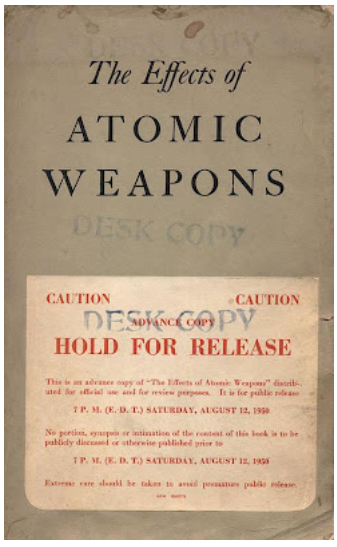
12.40 The destruction caused by a nuclear explosion to two pieces of earth-moving equipment, which are largely drag-sensitive, is shown in Figs. 12.40a and b. Two similar pieces of equipment located in a deep trench, at the same distance from the explosion, are seen in Fig. 12.40c to have been essentially unharmed. It is important to mention that the main direction of the trench was at right angles to the motion of the blast wave. If the wave had been traveling in the same direction as the trench, the equipment would probably have been severely damaged. Consequently, in order to provide protection from drag forces, the orientation of the trench or earth revetment, with respect to the expected direction of the explosion, is of great importance.

FIRE PROTECTION

12.41 It was noted in Chapter VII that fires following a nuclear explosion may be started by thermal radiation and by secondary effects, such as overturning stoves and furnaces, rupture of gas pipes, and electrical short circuits. Fire-resistive construction and avoidance of fabrics and other light materials of inflammable character are essential in reducing fire damage. As shown by the tests described in § 7.82, a well-maintained house, with a yard free from inflammable rubbish, was less easily ignited by thermal radiation than a house that has not had adequate care.

Above: pages 514-517 (click on pages to enlarge) from the 1957 edition of *The Effects of Nuclear Weapons,* showing the terrific effectiveness of simple civil defense countermeasures against blast damage in Nagasaki and the terrific effectiveness of simple countermeasures against the dynamic pressure (air drag or wind pressure) in Nevada nuclear tests: any terrain feature like a ditch or a shallow trench will protect you from the wind pressure of the blast wave which causes displacement! The wind of the blast wave is directional and just blows over the top of a ditch because it can't be deflected into it, unlike the overpressure which diffracts into the trench but then isn't accompanied by displacement-causing wind pressure. These simple facts were removed from future editions of the book. Unfortunately, the only way to get a complete understanding of the problem is to plough through all the different editions and also Dolan's declassified 1,651 pages long *Capabilities of Nuclear Weapons*. This is what we will do in this blog post, to expose the facts.

Editions of U.S. nuclear weapons effects publications



Above: Proof-copy of Glasstone's 1950 *Effects of Atomic Weapons,* which as the label states (click image for larger view) was strictly embargoed until publication time, 7 pm (E.D.T.) on Saturday, August 12, 1950, more than five years after the nuclear attacks on

Hiroshima and Nagasaki. **It was summarized briefly by the Chairman of the Board of Editors, Professor Joseph O. Hirshfelder, in the August 1950 issue of the *Bulletin of the Atomic Scientists*, "Special Issue on Civil Defense Against Atomic Attack" (linked here).**

Samuel Glasstone was the **Executive Editor of this 456 pages long Los Alamos Scientific Laboratory book *The Effects of Atomic Weapons,* published by the U.S. Department of Defense in June 1950 and revised in September 1950.** Based on kiloton-range explosion data on blast, thermal and radiation effects from the 16 July 1945 *TRINITY* nuclear test in New Mexico, the nuclear air bursts on Hiroshima and Nagasaki in August 1945 and the *CROSSROADS-ABLE* and *-BAKER* tests in 1946. Includes radiation dose patterns showing base surge and contamination from the 1946 *CROSSROADS-BAKER* underwater test (deleted from later editions), and the upwind fallout pattern from the first ever nuclear test, *TRINITY* shot (but is misleading and does not include the secret downwind pattern).

A Secret - Security Information supplement with further information, called *Capabilities of Atomic Weapons,* TM 23-200, was issued July 1951 and revised editions were issued in October 1952, June 1955, and November 1957 (when it was regraded Confidential - Restricted Data). It started out as the **162 pages long 1945 classified *Handbook on the Capabilities of Atomic Weapons*, AD511880 (PDF version located here**):

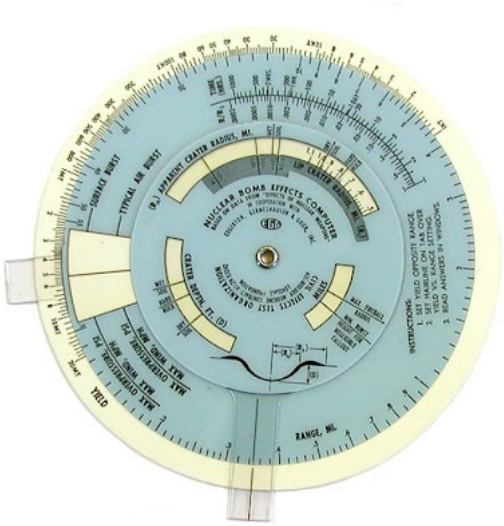
"The purpose of this handbook is to set forth, in a concise and simple manner, criteria for estimating the effects of atomic weapons for use by the Services. It is designed to serve as a handy reference to aid Field Commanders and their staffs in determining the capabilities and effects of atomic weapons in respect to specific targets. The scope of this handbook includes thermal and nuclear radiation and blast effects of atomic weapons on items of military interest such as structures, materiel and personnel. These effects are analyzed with respect to Air, Surface, Underground, and Underwater Bursts. Sufficient information is presented to allow Field Commanders to determine the best type of Weapon and Burst to be employed to obtain maximum desired effects on various types of targets."

A new edition of this supplement was renamed *Capabilities of Nuclear Weapons* on 16 November 1964 and the final single volume edition appeared in January 1968. On 1 July 1972 a major 1,651 pages two-volume revision of *Capabilities of Nuclear Weapons*, Defense Nuclear Agency Effects Manual Number 1, DNA-EM-1, classified Secret - Restricted Data, edited by Philip J. Dolan, was published, which we shall discuss in detail.

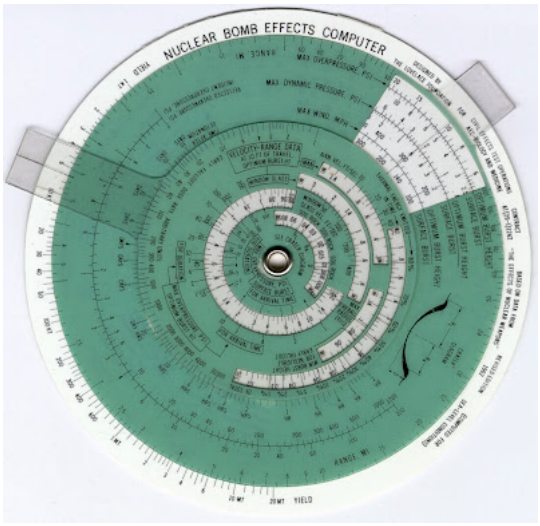
These secret manuals became the basis for the revisions of Glasstone's 579 pages long unclassified book, *The Effects of Nuclear Weapons,* first published June 1957, the rewritten and expanded 730 pages long edition published in April 1962, and the revision containing corrected thermal ignition data in February 1964.

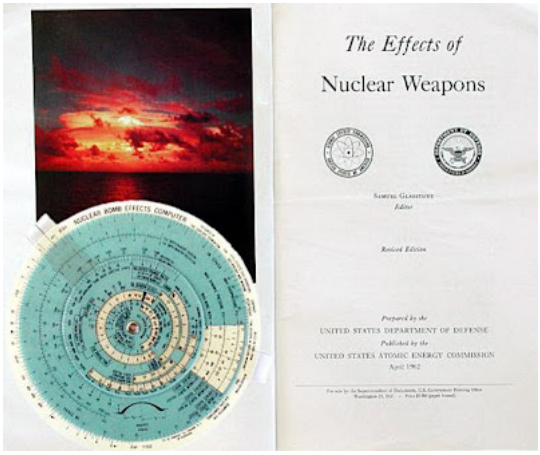
The June 1957 edition 'Acknowledgement' page by the U.S. Atomic Energy Commission states: 'Dr. Samuel Glasstone was responsible for the compiling, writing, and editing and, largely, for its successful completion.' The Foreword by Charles E. Wilson (U.S. Secretary of Defense) and Lewis L. Strauss (Chairman, U.S. Atomic Energy Commission) states: 'This handbook, prepared by the Armed Forces Special Weapons Project ... is a comprehensive summary of current knowledge on the effects of nuclear weapons.'

This was incorrect: the June 1957 edition only contained data for Japan-type air bursts and surface bursts. Full blast data as a function of burst altitude, plus the known thermal 'precursor' effect on the blast waves in Nevada tests, and data on the radio-flash (radiated electromagnetic pulse, EMP) were all excluded even a brief mention until the April 1962 edition. Even then, all data on damage caused by EMP during nuclear tests was still excluded. Research into the **damage from EMP had begun in 1945, when the *TRINITY* electronic piezo-electric blast pressure waveform gauges were overloaded by EMP induced currents in cables (as reported in K. T. Bainbridge, editor, Trinity, Los Alamos report LA-1012, 1946, declassified and released as LA-6300-H, p. 53, in 1976), although the terrific collection of data on EMP induced damage at later tests was accidentally withheld from the U.S. Department of Defense by testing electronics contractor E.G. and G. until B. J. Stralser's Secret - Restricted Data report of 30 April 1961, *Electromagnetic effects from nuclear tests,* Edgerton, Germeshausen and Grier, Inc; while the dust loading of the blast wave was known from the *TRINITY* films in 1945 and the actual blast precursor was first photographed at the low-altitude shot *DOG* of *TUMBLER-SNAPPER* in the Nevada in 1952**. Precursor effects on increasing drag damage by dust loading of the blast winds over a certain range of distances where the ground thermal popcorning coincides with the passage of the blast wave (like a sandstorm with hurricane winds) were later proved by comparison of the *ENCORE* and *GRABLE* test data in 1953. The second test was at lower altitude so the thermal radiation was able to popcorn the desert effectively, creating a hot dust layer through which the blast was modified into a precursor, with high density (due to the dust) and therefore vastly greater effects than *ENCORE* at the same overpressures for drag effects on jeeps, trucks, and other dynamic-pressure sensitive targets.



Above: in 1960, E. G. & G. developed this 4-inch diameter 'Nuclear Bomb Effects Computer', a plastic circular slide rule based on the data in the 1957 edition of *The Effects of Nuclear Weapons,* with an instruction leaflet stating: 'As a convenience to those interested in the effects of nuclear weapons, this circular computer was designed to make data easily available on various weapon effects - some as functions of both yield and range and others on yield alone ... The weapons data incorporated in this computer were taken from the very informative and useful text, *The Effects of Nuclear Weapons,* edited by Samuel Glasstone for the Armed Forces Special Weapons Project of the Department of Defense.'





Above: the April 1962 and February 1964 reprint contained a pocket inside the back cover for a double-sided plastic circular slide rule, the *Nuclear Bomb Effects Computer,* for quickly calculating (for both surface bursts and for effect-optimising air bursts over ideal terrain) the main blast, thermal, initial nuclear radiation, cratering, and fallout decay effects. The slide rule was not included in the $3 price of the book in 1962/4 but was sold separately for $1 by the U.S. Government Printing Office for those years (there was no computer issued with the 1950 or 1957 editions, although E. G. & G. developed one based on the 1957 edition in 1960, which was the forerunner to the ones developed by the Lovelace Foundation and issued for the 1962/64/77 printings). The December 1977 hardback edition came boxed, complete with a revised version of the slide rule inside the back cover. See the **report by E. Royce Fletcher, Ray W. Albright, Robert F. Perret, Mary E. Franklin and I. G. Bowen, *Nuclear Bomb Effects Computer (Including Slide-Rule Design and Curve Fits for Weapons Effects),* U.S. Atomic Energy Commission, Civil Effects Tests Operations, report ADA384998, February 1963:**

'Based on data from the 1962 edition of *The Effects of Nuclear Weapons,* a circular slide rule was designed to evaluate 28 different effects of nuclear weapons. Of these 28 different effects, 13 relate to blast, 5 to thermal radiation, 1 to initial nuclear radiation, 2 to early fallout, 6 to crater dimensions, and 1 to fireball dimensions. Most of the parameters are presented as functions of range and yield (1 kt to 20 Mt). Simple techniques are described which make it possible to estimate most of the effects parameters for yields greater than 20 Mt or smaller than 1 kt. The report presents (1) curve fits of weapons-effects data, (2) design analysis for the slide rule, and (3) instructions for use of the rule along with some of the implications of the data in regard to biological and structural damage. The machine techniques are mentioned which were used to prepare the original graphs necessary for the production of the slide rule.'

The 1962 edition Preface by Glasstone states: 'After the cessation of U.S. nuclear tests at the end of October 1958, it was decided to prepare a revision ... A new chapter has been included on the effects of nuclear explosions on radio communications and radar ...' The Foreword to the 1962 edition, signed by Robert S. McNamara (U.S. Secretary of Defense) and Dr Glenn T. Seaborg (Chairman, U.S. Atomic Energy Commission) states: 'There is a need for widespread public understanding of the best information available on the effects of nuclear weapons.'

The 1962 edition was first to disclose in passing that, in 50% fission nuclear weapons, the low-energy (easily shielded) gamma rays from neutron capture activities (like Np-239 and U-237) contribute up to 40% of the radiation dose rate during the critical sheltering period of 20 hours to 2 weeks after burst.

Unfortunately, today all the hard facts from World War II conventional and nuclear weapons effects experience are ignorantly dismissed by cynical and anti-civil defence exaggerations of nuclear phenomenology for political purposes which have become fashion. The popular idea today is that people should have no knowledge of the facts which would make the free world better prepared and therefore stronger against terrorists. In fact, today the U.S. 'Triad' of nuclear silos, bombers and submarine missile platforms permitted the tactics of 'cross-targeting' (using different delivery platforms like aircraft and missiles) and 'layering' (multiple hits with very low yield weapons). Such tactics limit the risk of individual failures and simultaneously *reduces individual bomb yields to a minimum, which minimises or eliminates civilian collateral damage altogether,* a fact not understood *or rather not wanted* by the enemies of freedom, but well emphasized by President John F. Kennedy in his television broadcast to the American public, 26 July 1963:

'It is true that the Soviets have tested nuclear weapons of a yield higher than that which we thought necessary, but the 100-megaton bomb of which they spoke two years ago does not and will not change the balance of strategic power. The United States has chosen, deliberately, to concentrate on more mobile and more efficient weapons, with lower but entirely sufficient yield ...'

To give an idea of how Glasstone's collaborative editorship worked, there is an account of Glasstone's role in preparing for the press the book *Theory of Rate Processes* (which was published in 1941 and was the first book to apply quantum mechanics to chemical reaction rates, which up to that time had been empirically formulated as the exponential **Arrhenius rate equation**) in the journal ***Current Contents,* No. 46 (November 14, 1988), 'This Week's Citation Classic: Glasstone S, Laidler K J & Eyring H., The theory of rate processes: the kinetics of chemical reactions, viscosity, diffusion and electrochemical phenomena, New York: McGraw-Hill, 1941. 611 pages.'**

This article is by Glasstone's co-author Keith J. Laidler, an Oxford graduate who went to Princeton University aged 22 in 1938 to do a PhD under Henry Eyring. Erying had come up with a controversial theory of chemical reaction rates in 1935, which had been initially rejected by the *Journal of Chemical Physics*. As a result of the lack of comprehension with which his radical theoretical paper was greeted, Laidler realised that he would need to write a book in order to: 'present the basic theory in a fairly detailed way, discuss its implications and assumptions, and apply it to rate processes of various kinds. Eyring knew that he would find it difficult to settle down to long sessions of writing, which are necessary to produce a book. He therefore invited me to collaborate with him on the book, with the arrangement to be that I would do the actual writing, in regular consultation with him.'

Laidler undertook the writing of the book while working on his PhD, but Samuel Glasstone took over the editing in 1939 after arriving at Princeton:

'In the summer of 1939 Samuel Glasstone arrived in Princeton as a research associate in the Department of Chemistry. Glasstone, then aged about 40, had already had a successful research career at the University of Sheffield and was the author of several very successful books on physical chemistry. In view of his background, it was natural to enlist his help with the writing of the book, especially since it would be necessary for me to leave Princeton in 1940 to carry out war research. I provided Glasstone with everything I had written and continued to give him material as I wrote it during my second year at Princeton. At the same time, Glasstone, Erying, and I collaborated on research on overvoltage, a subject on which Glasstone had previously worked.

'Glasstone greatly supplemented the material I gave him for the book, and he put everything into final form. Eyring himself did hardly any of the writing, but he made numerous and valuable comments on everything we wrote, and I well remember many vigorous but always very friendly arguments on a number of fundamental points. Although World War II interrupted most basic scientific work for a few years after the book's publication in 1941, the book attracted much attention from the start, particularly as it was the first comprehensive treatment of the new rate theory and of its applications to a variety of chemical and physical processes; it also contained a good deal of previously unpublished material. ... In 1948 a pirated Russian translation of the book appeared, and there have also been Japanese and Spanish editions.'

The hydrogen or thermonuclear bomb was first tested in 1952, and on 2 December 1954 Dr **Willard F. Libby**, on the board of the U.S. Atomic Energy Commission, announced openly that a new revised edition of ***The Effects of Atomic Weapons*** was being prepared.

In the February 1955 U.S. Congressional Hearings presided over by **Senator William Stuart Symington** on the hydrogen bomb's fallout and other effects, Dr **Willard Libby** (who won the Nobel Prize in 1960 for the discovery of how naturally radioactive carbon-14 can be measured to accurately find the age of dead objects thousands of years old) was interrogated on the reason why the nuclear test effects reports on fallout were remaining secret:

Senator Symington: 'Do you believe that the Soviets have exploded a hydrogen bomb?'
Dr W.F. Libby: 'Yes, I believe so.'
Senator Symington: 'Well, then, most of this information is available to them, isn't it?'
Dr W.F. Libby: 'It is a hard job to collect it.'

(Ref.: page 183 of the May 1955 issue of *Bulletin of the Atomic Scientists*.

Almost all of the Soviet nuclear weapons tests were *air bursts,* and therefore produced no local fallout information. Soviet military planners well recognised that an effect like fallout, depending on the wind direction after the explosion, was not a dependable military capability and so they concentrated on measuring the heat, blast, initial radiation and EMP effects from air bursts. Most of the nuclear effects subjects of greatest importance, therefore, were irrelevant to the enemy and need not have been kept secret, as Dr **Willard F. Libby's argued to the U.S. Congressional *Hearings on the Biological and Environmental Effects of Nuclear War,* 22-26 June 1959, pp. 924-5:**

'No one can be expected to act properly, or at all for that matter, on any problem unless he understands what makes it. It is necessary for people to learn about fallout, about nuclear radiation, about the effects of nuclear radiation on people, animals, plants, food, water: the things that are immutably linked to life.'

For a good idea of the sort of careful checking Glasstone did before including suggestions from scientists in the book, see his letter dated 1 February 1957 to Colonel Dent L. Lay, Chief, Weapons Effects Division, U.S. Armed Forces Special Weapons Project, Washington, D.C., **a PDF file on the U.S. Government Opennet**, on the topic of proposed revision of the ***Worldwide Fallout* chapter in the draft for the June 1957 edition of *The Effects of Nuclear Weapons.*** On **page 4 of that letter**, Glasstone writes of some calculations of global fallout of Sr-90 in children's bones, with various assumptions about the continued rate of atmospheric nuclear testing: 'The extrapolation beyond June 1956 is terrifying! I wonder if it is correct, and if so how wise it would be to put out anything of this kind. This requires careful consideration.'

The new edition of *The Effects of Atomic Weapons* was delayed, since it took time to assemble and evaluate the effects of the early hydrogen bombs, and in **June 1957 the revised handbook, clearly renamed *The Effects of Nuclear Weapons,* was published containing an Acknowledgement by the U.S. Atomic Energy Commission**:

'At the request of the Atomic Energy Commission, the Armed Forces Special Weapons Project prepared this book with the assistance of the Commission. Dr. Samuel Glasstone was responsible for the compiling, writing, and editing and, largely, for its successful completion.'

The Foreword to the book was jointly signed by Charles E. Wilson, U.S. Secretary of Defence, and Lewis L. Strauss, Chairman of the U.S. Atomic Energy Commission:

'This handbook, prepared by the Armed Forces Special Weapons Project of the Department of Defence in coordination with other cognizant governmental agencies and published by the Atomic Energy Commission, is a comprehensive summary of current knowledge on the effects of nuclear weapons. The effects information contained herein is calculated for yields up to 20 megatons and the scaling laws for hypothetically extending the calculations beyond this limit are given. The figure of 20 megatons however is not to be taken as an indication of capabilities or developments.'

In the Preface, Dr Glasstone stated:

'The main purpose of this new handbook is to describe, within the limitations set by national security, the basic phenomena and the most recent data concerning the effects associated with explosions of nuclear weapons ... It is for use in planning against possible nuclear attack that this volume is intended.'

Herman Kahn of the RAND Corporation stated in his 1960 book *On Thermonuclear War,* Princeton University Press, p 24:

'... those waging a modern war are going to be as much concerned with bone cancer, leukemia, and genetic malformations as they are with the range of a B-52 or the accuracy of an Atlas missile.'

'[There is] a tendency in our planning to confuse the unfamiliar with the improbable. The contingency we have not considered looks strange; what looks strange is therefore improbable; what seems improbable need not be considered seriously.'

- Thomas C. Schelling, in Roberta Wohlstetter, *Pearl Harbor: Warning and Decision,* Stanford University Press, 1962, p. vii.

In February 1962, a revised edition of *The Effects of Nuclear Weapons* was issued, in the Preface of which Dr Glasstone (then based at Los Alamos) stated:

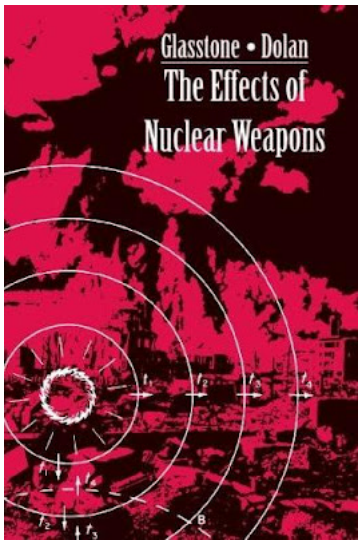
'When 'The Effects of Atomic Weapons' was published in 1950, the explosive energies of the atomic bombs known at that time were equivalent to some thousands of tons (i.e., kilotons) of TNT. The descriptions of atomic explosions and their effects were therefore based on a so-called 'nominal bomb' with an energy release equivalent to 20 kilotons of TNT. With the development of thermonuclear (hydrogen) weapons, having explosive energies in the range of millions of tons (i.e., megatons) of TNT, it became necessary to provide an entirely new presentation, 'The Effects of Nuclear Weapons.' The first edition of this work, issued in 1957, gave the best information then available concerning the effects on man and materials of nuclear weapons with explosive energy yields up to the equivalent of 20 megatons of TNT. After the cessation of U.S. nuclear tests at the end of October 1958, it was decided to prepare a revision of 'The Effects of Nuclear Weapons' incorporating new information which had become available. Although the testing of nuclear weapons has since been resumed, the time is nevertheless opportune for the publication of this revised edition ...

'The material on the protection against nuclear explosions has been rewritten from a new standpoint so as to bring out the principles involved ... A new chapter has been included on the effects of nuclear explosions on radio communications and radar, and appendices

dealing with nuclear weapons safety and methods for detecting distant nuclear explosions have been added. A list, with dates, times, and other unclassified information, of announced weapons tests, made by all countries prior to September 1961, is also provided.'

The Foreword to the 1962 edition by Robert S. McNamara, U.S. Secretary of Defence, and Dr Glenn T. Seaborg, Chairman of the U.S. Atomic Energy Commission, states:

'There is a need for widespread public understanding of the best information available on the effects of nuclear weapons.'



The Effects of Nuclear Weapons

'I think it probably is inevitable that a nuclear device will be used by terrorists at some time in the future, either as a serious threat or with an actual explosion ...' – Philip J. Dolan, 1984, in J. C. Greene and D. J. Strom (Editors), *Would the Insects Inherit the Earth?* (Pergamon Press, London, 1988).

Since 1977, the secret *Capabilities of Nuclear Weapons* is the most important book to have undergone further revisions and updates, although various summaries of it have appeared such as J. A. Northrop, Editor, *Handbook of Nuclear Weapon Effects: Calculational Tools Abstracted from DWSA's Effects Manual One (EM-1),* 1996. A revised version of *The Effects of Nuclear Weapons* has been issued for

official use only, and is not publically available. In addition, **an excellent far more technical 535 pages long book called *Introduction to the Physics of Nuclear Weapons Effects* by Professor Charles J. Bridgman of AFIT was published in hardback in July 2001 by the Defense Threat Reduction Agency, and although it contains three chapters on weapons design principles and is 'Distribution Limited', I was able to buy an original complete with dustwrapper on Amazon.com! It is very useful for providing a summary of American defense establishing knowledge on nuclear effects as of 2001, but it concentrates on the fundamental mathematical physics of nuclear explosion design principles of relevance for predicting various types of radiation outputs and physical phenomena, rather than focussing on summarizing and reconciling all of the weapons effects data from the thousands of nuclear test effects reports, which EM-1 focusses on and which is generally more relevant for the civil defense countermeasures we need.**

Northrop's compilation

The 1950s-60s *Capabilities of Atomic Weapons* was a handy, relatively small, single volume confidential paperback; Dolan's 1972 revision was a two volume loose-leaf binder manual, *Capabilities of Nuclear Weapons,* effects manual EM-1, while Brode's 1992 revision of EM-1 was a massive, not-so-handy technical encyclopedia of 22 separate massive binders each containing hundreds of pages (which would be a nightmare to attempt to wade through and use in combatting a nuclear weapons emergency).

The first version to be declassified under the Freedom of Information Act in early 1989 (with a few "deletions" of the most sensitive weapons data) was Dolan's 1972 edition as revised to August 1981 (page changes 2). (*Capabilities of Atomic Weapons* was only declassified in 1997). The many thousands of pages of the 1992 edition became subject to a fresh Freedom of Information Act request almost immediately, and John Northrop decided to take advantage of the declassification of much of the basic information from to produce a relatively brief, single volume of essential declassified data, to supplement Glasstone and Dolan's unclassified 1977 *Effects of Nuclear Weapons;* John Northrop, *Handbook of Nuclear Weapon Effects: Calculational Tools Abstracted from DSWA's Effects Manual One (EM-1),* DSWA (U.S. Defense Special Weapons Agency, now the DTRA – Defense Threat Reduction Agency), 736 pages, 1996.

Northrop's handbook is unclassified but distribution is limited to U.S. government agencies and prohibited from transport outside the U.S.A., which is not helpful to civil defense outside the U.S.A. This is because, with improving American ABM efforts and anti-nuclear smuggling airport security, it is quite possible that terrorist nuclear threats will occur outside the U.S.A., for example in Europe or Asia, and up to date factual data on nuclear weapons effects for widespread civil defense appreciation is therefore required outside the U.S.A.

In addition, it's clear that Russia has been given the Northrop handbook (or key information from it), as **indicated in the online-available report by Mariana Eneva, Jeffry L. Stevens, and Jack Murphy (Maxwell Technologies/Systems Division) and Boris D. Khristoforov (Institute for Dynamics of the Geospheres, Russian Academy of Sciences), *Effect of Charge Depth in Russian Hydroacoustic Data from Nuclear and HE Explosions*, which compares data from the three shallow (under 60 m water depth) Russian nuclear tests at the Bay of Chernaya, Novaya Zemlya, on October 10, 1957 (10 kt at 30 m depth underwater, 7 measurements of peak pressure averaging 300 kg/cm^2 at 235 m distance and 10-50 m depth), October 23 and 27, 1961 (4.8 kt at 20 m depth underwater and 16 kt at 1.1 m above water), to Northrop's data which is based on American nuclear tests.**

In addition, **Robert W. Nelson (Council on Foreign Relations and Program on Science and Global Security, Princeton University, Princeton, NJ) has reprinted an important up to date crater volumes diagram from Northrop's handbook in articles such as "Nuclear 'Bunker Busters' Would More Likely Disperse Than Destroy Buried Stockpiles of Biological and Chemical Agents", published in *Science and Global Security,* 2004, Volume 12, pp. 69-89, which has been translated into Russian, as the report, ЯДЕРНЫЕ «УБИЙЦЫ БУНКЕРОВ» СКОРЕЕ РАЗБРОСАЮТ, ЧЕМ УНИЧТОЖАТ ПОДЗЕМНЫЕ ЗАПАСЫ БИОЛОГИЧЕСКИХ И ХИМИЧЕСКИХ АГЕНТОВ, as linked here (Figure 1 in this paper** can be compared to **Figure 2-82 on page 2-185 of Dolan's EM-1**.)

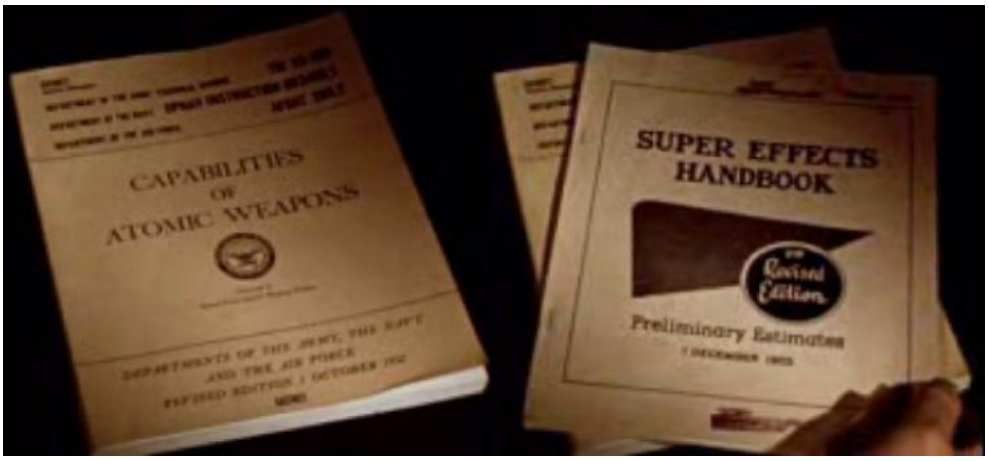
Furthermore, a summary of the most important features of Northrop's volume are to be found in **Bridgman's *Introduction to the Physics of Nuclear Weapons* and unclassified research reports from various American government agencies.**

The Nuclear Threat by President Eisenhower which ended the Korean War

On 1 May 1948, communists in Pyongyang, North Korea, proclaimed a People's Republic for the whole of Korea. On 10 May 1948, United Nations supervised elections were held in South Korea; delegates from North Korea were invited too, but the invitation was ignored. America foolishly withdrew combat troops and vital military hardware from Korea, leaving just 472 advisers to train an army of 50,000 South Korean soldiers without any tanks or aircraft; while the Soviet Union provided 7,000 advisers to train an army of 250,000 North Koreans, including pilots for the MIG-15 jet fighter-bombers they gave the North Koreans together with T-34 tanks! (France in 1954 in Vietnam copied the American act that had led to the Korean War, by withdrawing all its troops from Vietnam, sowing the seeds of the Vietnam War.) North Korea also had 38,000 experienced soldiers who had just seen service with the Chinese communists in the Chinese revolution that overthrew Chiang Kai-skek. On 9 September 1948, Kim Il Sung became President of the communist Korean People's Democratic Republic, and modelled North Korea on the Soviet Union. On 25 June 1950, his 90,000 soldiers using 150 Soviet made T-34 tanks invaded South Korea (the border consisted of one American adviser and 12,000 South Koreans who simply broke rank and ran away under attack). The next day President Truman ordered American military support for South Korea, but it was too late to prevent Seoul, the capital of South Korea, being seized by the communists on 28 June.

As a result, Truman had to sign a bill to extend the U.S. military draft (conscription) in order to provide sufficient ground troops. General Douglas MacArthur recaptured Seoul on 26 September, then with United Nations support he invaded the North and captured Pyongyang on 20 October. However, a 100,000-strong Chinese force then entered the battle and recaptured Pyongyang from the United Nations on 5 December, then they invaded the South and recaptured Seoul on 4 January 1951. A United Nations offensive then recaptured Seoul on 14 March. General MacArthur threatened to resign if President Truman would not authorize the use of nuclear weapons and radiological warfare (a belt of radioactive waste between North and South Korea, to prevent further invasions). Truman then fired MacArthur from command of the United Nations force. Tragically, President Truman had made a secret promise to the half-witted British Prime Minister Clement Attlee not to use nuclear weapons in Korea without authority from Britain (which would refuse). This secret promise was leaked to the Soviets and thus to the North Koreans by the communist spies Philby, Burgess and MacLean who had infiltrated the British government. As a result, the communists were assured that Truman would not use nuclear weapons in Korea. President Eisenhower was elected in November 1952 and ended the Korean War on 27 July 1953 by threatening to use the 1,350 nuclear weapons in the American

stockpile against North Korea, which was ten times the Soviet stockpile. A total of 116,000 United Nations troops (including 54,000 Americans) and a million North Koreans and Chinese had been killed. Today, North Korea is ruled by Kim Jong-il, the late president Kim Il-sung's son, and has 6 nuclear reactors producing plutonium and a plutonium extraction (reprocessing) plant.



The secret 'Capabilities' series was published by the American nuclear weapons effects organisation. To oversimplify the history a little, from 1945-7 this was the Manhattan Engineering District (MED); from 1947-59 it was the Armed Forces Special Weapons Project (AFSWP); from 1959-71 it was the Defence Atomic Support Agency (DASA) [with the longer-term Defence Atomic Support Information Analysis Centre (DASIAC)]; from 1971-96 it was the Defence Nuclear Agency (DNA); from 1996-98 it was the Defence Special Weapons Agency (DSWA); and from 1998 it is the Defence Threat Reduction Agency (DTRA). Until the U.S. Atomic Energy Act of 1954 defined the designator Restricted Data, 'Security Information' was used. The prefixes remained Top Secret, Secret and Confidential. Top Secret was reserved for weapons design information, Secret for weapons effects data which could not be shared even with allies like Britain, and Confidential was used for weapons effects data which could not be openly published but could be exchanged allies for foreign weapon test effects data. **There is a 467-pages long history of the Defense Nuclear Agency and related organizations published online by the Defence Threat Reduction Agency in 2002 covering the period 1947-97**. According to page 318 of this report, in 1993: 'Integration and declassification of effects knowledge was underway in the new *Handbook of Nuclear Weapons Effects* (Calculational Handbook), that drew upon the agency's authoritative 22-volume *Effects Manual One* (EM-1).' Page 380 states:

'*Nov. 16, 1964.* Research on weapons effects summarized in the classified publication *Capabilities of Nuclear Weapons.* Publication later replaced by January 1968 edition and later by new manual, *Effects Manual 1 (EM-1)* in 1972.'

There is also a briefer, full colour-illustrated 35 pages long summary brochure, *Defense Special Weapons Agency 1947-1997,* online which was published in 1997, covering the period of 1947-97, which contains a photograph of the SAGE group which studied nuclear weapons effects and states on page 15:

'With DDR&E assent in October 1964, the DASA Director began sponsorship of the McMillan Panel. From 1966 to 1993, the panel was referred to as the Scientific Advisory Group on Effects (SAGE). The SAGE Panel was disbanded after its 1993 meeting as part of a government-wide move to reduce the number of federal advisory groups. [Presumably, Philip J. Dolan was the Chair of the SAGE Panel during his editorship of the first two-part *Capabilities of Nuclear Weapons* issued in 1972 with page changes 1 in 1978 and page changes 2 in 1981; **Harold L. Brode was a member of the Scientific Advisory Group (SAGE) to DASA/DNA, serving from 1961 to 1992, and chairing it from 1980-91 when he edited a major revision of *Capabilities of Nuclear Weapons, DNA-EM-1* expanding it to 22 chapters**]. ... The SAGE Panel recommended priorities for HA [high altitude detonation] effects analysis. In the 1960s, DASA advanced the understanding of both weapons effects and planetary physics through analyses of tests conducted in 1958-1962. The SAGE Chairman also served as Chairman of the Special Weapons Effects Group (SWEG), which **analyzed the 1962 Soviet high altitude tests. Suspected nuclear effects, such as EMP disruption of buried communication links, were confirmed by Russian scientists in 1995**.'

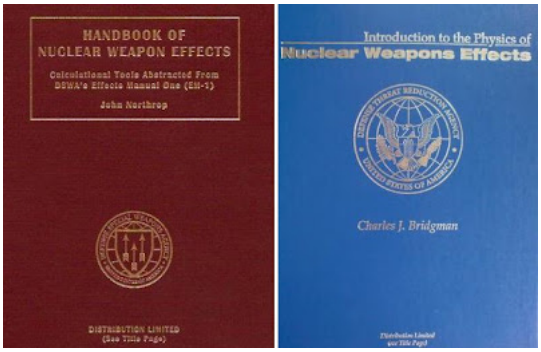
Above: SAGE Panel in August, 1966.

Page 16 states: '*Information Systems:* Beginning in 1960, DASA sponsored the Defense Atomic Support Information Analysis Center (DASIAC). The initial purpose for the DASIAC program was to ensure the collection and preservation of the HA[High Altitude] nuclear test data and the establishment of a center of knowledge on it. Subsequently, DASIAC's mission expanded to include similar activities for all types of nuclear effects. ... *Tools for War Plans:* In the 1960s, DASA maintained and refined models of nuclear effects and radioactive transport, which helped SAC develop options for a strategy of controlled response. ...

'*Integrating Nuclear-Based Science and Technology:* Under DASA's July 1964 charter, a civilian Deputy Director (Science and Technology) oversaw radiation, blast and shock, biomedical, and test plans and programs activities. With just four percent of DASA staff

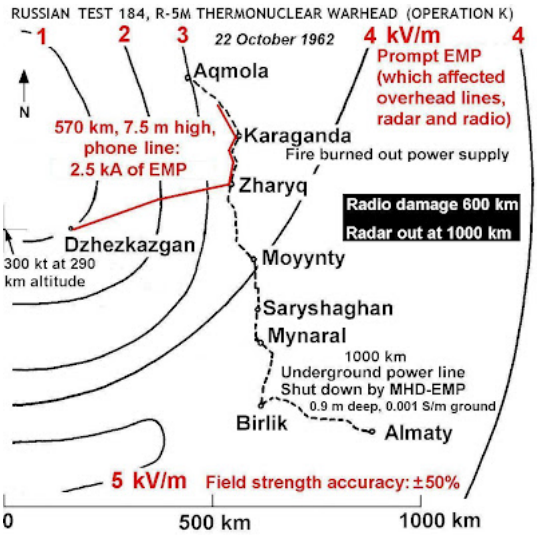
in 1965 (290 positions), science and technology research and test staff managed more than three-quarters of the agency's budget. In November 1964, DASA consolidated nuclear effects knowledge in the classified publication, *Capabilities of Nuclear Weapons.* A revised edition was published in 1968. These publications preceded the two-volume *Effects Manual-1 (EM-1),* first published in 1972.'

Page 29 states: 'Integration and declassification of effects knowledge is underway in the new *EM-1 Technical Handbook,* scheduled for release in early 1997 [this manual, *Handbook of Nuclear Weapon Effects: Calculational Tools Abstracted from DSWA's Effects Manual One (EM-1)* was edited by John Northrop, and was in fact published by the Defense Special Weapons Agency in September 1996]. This handbook will draw upon the authoritative 22-volume *EM-1.*'



Above: **John Northrop's 736 pages long *Handbook of Nuclear Weapon Effects: Calculational Tools Abstracted from DSWA's Effects Manual One (EM-1)* in September 1996 briefly summarized the formulas from the multi-thousand pages long 22-volume *Capabilities of Nuclear Weapons, DNA-EM-1,*** while in July 2001 the 535 pages long first edition of **Charles Bridgman's *Introduction to the Physics of Nuclear Weapons Effects* summarized the physics behind the formulae in Northrop's book**.

In December 1992, a year before SAGE was disbanded, the U.S. Defence Nuclear Agency spent $288,500 on contracting 200 Russian scientists to produce a 17-chapter analysis of effects from the Soviet Union's nuclear tests, which included vital data on **three underwater nuclear tests in the arctic,** as well three 300 kt high altitude tests at altitudes of 59-290 km over Kazakhstan. In **February 1995, two of the military scientists, from the Russian Central Institute of Physics and Technology, lectured on the electromagnetic effects of nuclear tests at Lawrence Livermore National Laboratory**.



Above: *USSR Test '184' on 22 October 1962, 'Operation K' (ABM System A proof tests) 300-kt burst at 290-km altitude near* ***Dzhezkazgan****. Prompt gamma ray-produced EMP induced a current of 2,500 amps measured by spark gaps in a 570-km stretch of 500 ohm impedance overhead telephone line to Zharyq, blowing all the protective fuses. The late-time MHD-EMP was of low enough frequency to enable it to penetrate the 90 cm into the ground, overloading a shallow buried lead and steel tape-protected 1,000-km long power cable between Aqmola and* ***Almaty****, firing circuit breakers and setting the* ***Karaganda*** *power plant on fire.*

The Soviet Union had first suffered electromagnetic pulse (EMP) damage to electronic blast instruments in their 1949 test. Their practical understanding of EMP damage eventually led them, on Monday 22 October 1962, to detonate a 300 kt missile-carried thermonuclear warhead at an altitude of 300 km (USSR test 184). That was at the very height of the Cold War and the test was detected by America: at 7 pm that day, President John F. Kennedy, in a live TV broadcast, warned the Soviet Union's Premier Khrushchev of nuclear war if a nuclear missile was launched against the West, even by an accident: 'It shall be the policy of this nation to regard any nuclear missile launched from Cuba against any nation in the Western hemisphere as an attack by the Soviet Union on the United States, requiring a full retalitory response upon the Soviet Union.' That Russian space missile nuclear test during the Cuban missiles crisis *deliberately* instrumented the civilian power infrastructure of populated areas, unwarned, in Kazakhstan to assess EMP effects on a 570 km long civilian telephone line and a 1,000 km civilian electric power cable! This test produced the worst effects of EMP ever witnessed (**the more widely publicised 1.4 Mt, 400 km burst *STARFISH* EMP effects were trivial by comparison, because of the weaker natural magnetic field strength at Johnston Island**). The bomb released 10^{25} MeV of prompt gamma rays (0.13% of the bomb yield). The 550 km East-West telephone line was 7.5 m above the ground, with amplifiers every 60 km. All of its fuses were blown by the induced peak current, which reached 2-3 kA at 30 microseconds, as indicated by the triggering of gas discharge tubes. Amplifiers were damaged, and lightning spark gaps showed that the potential difference reached 350 kV. The 1,000 km long Aqmola-Almaty power line was a lead-shielded cable protected against

mechanical damage by spiral-wound steel tape, and buried at a depth of 90 cm in ground of conductivity 10^{-3} S/m. It survived for 10 seconds, because the ground attenuated the high frequency field, However, it succumbed completely to the low frequency EMP at 10-90 seconds after the test, since the low frequencies penetrated through 90 cm of earth, inducing an almost direct current in the cable, that overheated and set the power supply on fire at Karaganda, destroying it. Cable circuit breakers were only activated when the current finally exceeded the design limit by 30%. This limit was designed for a brief lightning-induced pulse, not for DC lasting 10-90 seconds. By the time they finally tripped, at a 30% excess, a vast amount of DC energy had been transmitted. This overheated the transformers, which are vulnerable to short-circuit by DC. **Two later 300 kt Soviet Union space tests, with similar yield but low altitudes down to 59 km, produced EMPs which damaged military generators**.

1 MT DETONATIONS AT VARIOUS HOB's (CO-Altitude)

	N 10^{12} n/cm^2	N 10^{15} n/cm^2	$\dot{\gamma}$ 10^{9} rad/sec	$\dot{\gamma}$ 10^{13} rad/sec	X-ray 20 cal/cm^2	X-ray 130 cal/cm^2	Thermal 4 cal/cm^2	Thermal 80 cal/cm^2	Over 2 psi	Over 10 psi	Over 3000 psi
Exoatmospheric	157	5.6	760	2.4	56.8	22.2	-----	-----	-----	-----	-----
100,000 ft	12.5	5.5	190	2.3	10.4	6.0	98	22	8.5	4.6	.7
1,800 ft	6.2	2.5	9.0	1.3	-----	-----	49	19	29.5	10.8	.8
Surface	5.6	2.3	8.5	1.3	-----	-----	40.4	12.1	25	10	1.1

Distances to Effect Levels in kilo-feet

•CAPABILITIES OF NUCLEAR WEAPONS, DNA EM-1
PARTS I & II, SRD RS-3141 8798

Above: the **formerly secret report 'Survey of Weapons Development and Technology', WR708,** releases this highly useful summary of quantitative nuclear weapons effects data for various burst altitudes, which is partially blanked out in the earlier (1989) declassified version of *Capabilities of Nuclear Weapons,* EM-1. By collecting various sources, it is possible to collect odds and ends and thereby build up declassified data into a complete mosaic. E.g., that document using *Capabilities of Nuclear Weapons,* EM-1, states that 3.5 psi peak overpressure overturns a typical missile launcher while 49 psi destroys a tank. While this is not of direct concern to civil defense, it is indirectly useful because tactical nuclear weapons would be used against such targets, and these figures prove what overpressures are needed and thereby indicate the risk of collateral damage to the nearby civilian infrastructure near the target areas. This shows the threats that people would need to mitigate by expedient countermeasures, to avoid being hurt. This kind of background knowledge of how such weapons might be used is useful for civil defence in limited, tactical nuclear warfare, such as would possibly occur in the situation of an attack by rogue states.

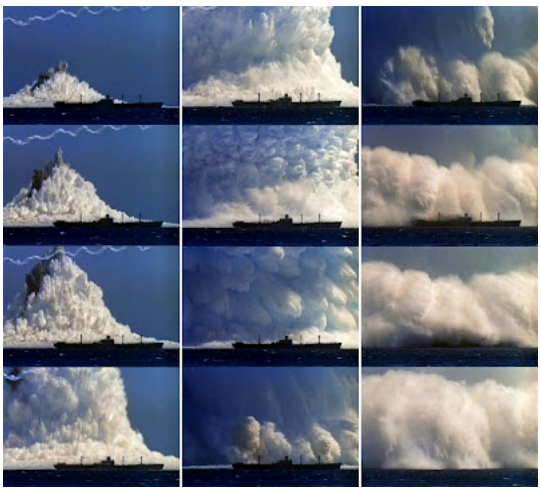
In the following review, we will explain the changes which have since been made to this edition of *Capabilities of Nuclear Weapons*. The report **here** shows that progress is still being made towards a complete analysis of all the nuclear test data.

Chapter 1: Introduction

***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Chapter 1. Introduction. - Effects manual no. 1,* Defense Nuclear Agency, Washington, DC. 30 pages, August 1981, 1.5 MB download, report AD-A955404**.

How To Photograph an Atomic Bomb

Nuclear Bomb - First H Bomb test



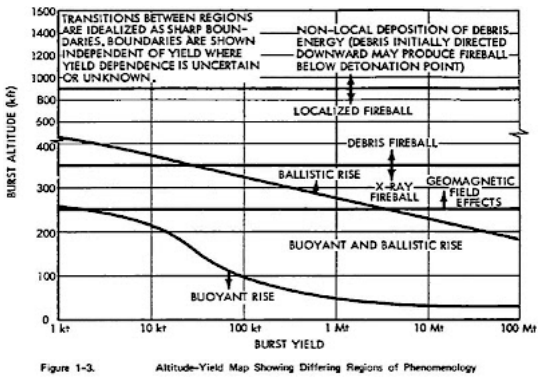
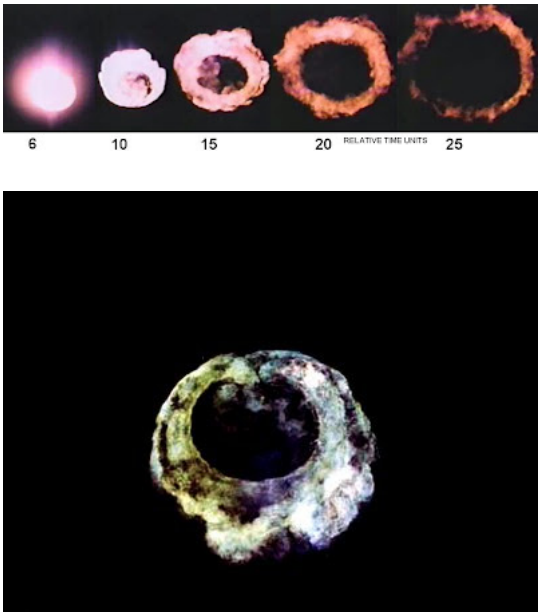


Figure 1-3. Altitude-Yield Map Showing Differing Regions of Phenomenology

This chapter begins with a summary of information similar in style, but with better nuclear test photographs (showing the *same* detonation at a number of different times after burst without changing the camera zoom, so that you can see how the fireball transforms into the cloud, and the correct relative scale), to the **first couple of chapters in Glasstone and Dolan 1977**; then it differs by moving on to discuss then-classified aspects of specific high altitude nuclear detonations: 7 kt, 148 km burst altitude *CHECKMATE,* 3.8 Mt, 77 km burst altitude *TEAK,* and 410 kt, 48 km burst altitude *BLUEGILL;* comparing photographs of each shot taken 100 seconds after detonation, and giving the dimensions of each fireball at that time, as well as explaining the effects sequence from each detonation. The *CHECKMATE* fireball at 100 seconds after detonation was already being striated

along Earth's magnetic field, while the *BLUEGILL* fireball at that time was a torus; *TEAK* was a gigantic fireball rising ballistically. It also has a diagram which shows the high altitude phenomenology as a function of yield and burst altitude, such as the heights of burst required for ballistic as opposed to buoyant fireball rise as a function of yield (when the fireball's vertical diameter is bigger than the relaxation length of the atmosphere, i.e. the height over which air density falls by a factor of $e \sim 2.718$, the fireball rises ballistically, much faster than predicted by buoyant rise theory).

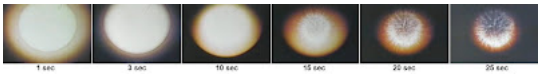
Above: as a multimedia supplement to the *Capabilities of Nuclear Weapons*, this excellent originally secret U.S. Defense Nuclear Agency film, *High-Altitude Nuclear Weapons Effects: Part One, Phenomenology* (20 minutes) discusses in detail, using nuclear test film clips, the effects of 1962 high altitude nuclear tests *BLUEGILL, KINGFISH,* and *STARFISH*. It is mainly concerned with fireball expansion, rise, striation along the Earth's natural magnetic field lines, and air ionization effects on radio and radar communications, but it also includes a section at the end explaining the high altitude EMP damage mechanism.

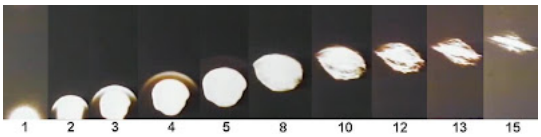


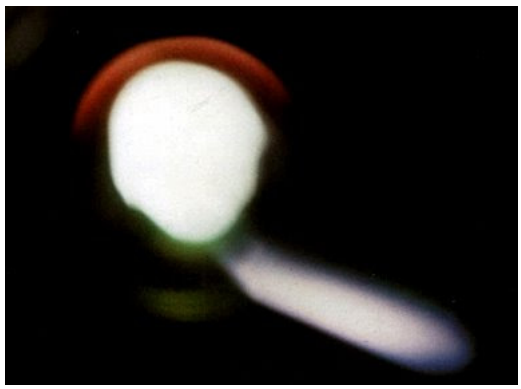
Above: *BLUEGILL* (410 kt, 48 km detonation altitude, 26 October 1962) fireball was still fully ionized at a temperature of about 10,000 K and 'several kilometres in diameter' when the shock wave departed from the fireball at 0.1 second. The fireball expanded to 10 km in diameter at 5 seconds, at which time it was buoyantly rising at 300 m/sec. It was filmed from below and within a minute transforms while rising into a torus or doughnut shape, as shown in the photograph above. It attained a diameter of 40 km at 1 minute, and stabilised at an altitude of 100 km a few minutes later. (The sequence of still frames is from a speeded-up film, but indicates the relative time of each frame from detonation time. It should be possible to work out the absolute time of each frame using the published photo taken at 100 seconds after burst in *Capabilities of Nuclear Weapons,* but that will have to wait for a while, as we have severe time limitations.)

When *BLUEGILL* was detonated during the **Cuban missiles crisis**: 'Observers at Johnston Island saw a brilliant white flash, and a noticeable thermal pulse could be felt on bare skin. A slightly distorted bright moon-like sphere was observed - yellow at first and gradually showing hues of green, pink, and violet - and blue-purple streamers were formed. At 10 minutes the glow was bright enough that a watch could be read in the dark and it persisted for at least 30 minutes. At Samoa, observers saw a pink band at the horizon, which faded after about 10 minutes to gray. ... Two men on Johnston Island sustained burns on the retinas of their [accidentally unprotected eyes, either by watching the missile without goggles or by seeing the reflection of the bright immediate flash by a metal or glass surface] ... One Air Force enlisted man ... observed blurring and a dark spot in front of each eye. ... initially his vision was 20/400 O.U. His vision improved [over 29 days to] 20/30 in both eyes ... his vision continued to improve and was 20/25 O.U. for distance and 20/20 O.U. for near in 1963 [reference: DASA-544]. A Navy enlisted man ... had an immediate after-image of a large, round, white ball, which lasted for an hour but returned when he awoke early the next morning. ... his central visual acuity was less than 20/400. The best visual acuity was 20/60 to 20/70

looking off-center. His vision did not improve ... However, the patient noticed an increased ability to compensate for the loss of central visual acuity [reference: DASA-1576].' (**Defense Nuclear Agency report DNA-6040F, AD-A136820, pp. 242-4**.)

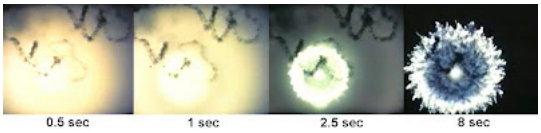


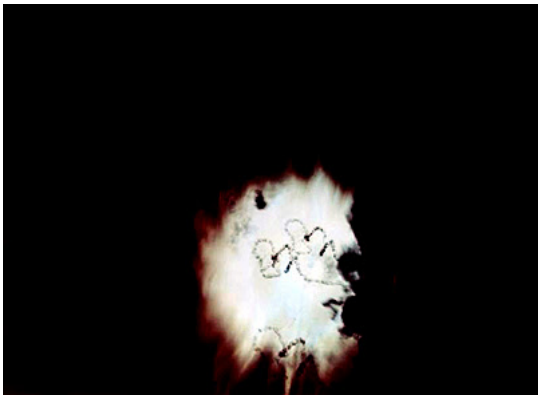




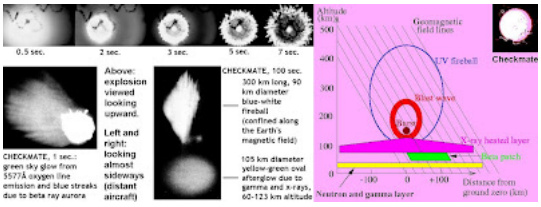
Above: *KINGFISH* (410 kt, 95 km detonation altitude, 1 November 1962) initially had a fireball size is 10 times bigger than *BLUEGILL,* because of the lower air density at the higher detonation altitude. The *KINGFISH* fireball rises ballistically (not buoyantly) at 1,500 m/sec (which is 5 times faster than the buoyant rise speed of the lower altitude detonation *BLUEGILL*). The fireball diameter longways is 300 km at 1 minute, and it is elongated along the natural geomagnetic field lines while expanding. It reaches a maximum altitude of 1,000 km in 7.5 minutes before falling back to 150-200 km (it falls back along the magnetic field lines, not a simple vertical fall). The settled debris has a diameter of 300 km and a thickness of 30 km, emitting beta and gamma radiation which ionize the air in the D-layer, forming a 'beta patch'. Photographs of beta radiation aurora from the fireball are included in the film: beta particles spiral along the Earth's magnetic field lines and shuttle along the field lines from pole to pole. The film above has a speeded-up film showing the development of the magnetically striated fireball from the *KINGFISH* fireball (the frames in the photo of the *KINGFISH* striation sequence shown above is only labelled with *relative* time units from the time of first flash, because it was obtained from the speeded-up film).

When *KINGFISH* was detonated: 'Johnston Island observers saw a yellow-white, luminous circle with intense purple streamers for the first minute. Some of these streamers displayed what appeared to be a rapid twisting motion at times. A large pale-green patch appeared somewhat south of the burst and grew, becoming the dominant visible feature after 5 minutes. By one hour, the green had become dull gray, but the feature persisted for 3 hours. At Oahu a bright flash was observed and after about 10 seconds a great white ball appeared to rise slowly out of the sea and was visible for about 9 minutes.' (**Defense Nuclear Agency report DNA-6040F, AD-A136820, p. 247**.)



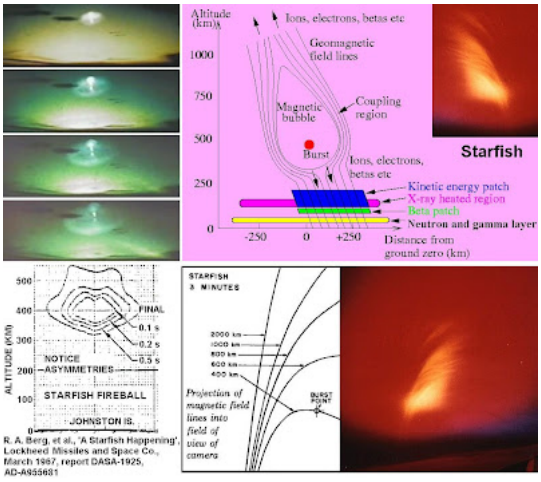


Above: **the *CHECKMATE* (7 kt, 147 km detonation altitude, 19 October 1962) fireball after it has just started to become striated along the natural magnetic field** (vertically aligned in this photo taken from below the detonation). **The dotty lines near the middle are the wind-blown exhaust trails left behind, below the fireball, by the rocket delivery system that carried the warhead up to the detonation altitude.**



Above: *CHECKMATE* detonation horizontal view (seen from a distant aircraft) compared to the view looking upwards from Johnston Island. The analysis of *CHECKMATE* on the right was **done by the Nuclear Effects Group at the Atomic Weapons Establishment, Aldermaston, and was briefly published on their website,** with the following discussion of the 'UV fireball' regime which applies to bursts at altitudes of 100-200 km: 'the debris blast wave expands and sweeps up air which becomes very hot. This then radiates UV, which is readily absorbed by the cold air in front of the blast wave, resulting in ionised air which is approximately transparent to further UV radiation from the blast wave. These bursts are therefore characterised by two "fireballs" - the debris air blast wave expansion is preceded by a radiation/ionisation front. The radiation front will be up/down asymmetric since mean free paths are longer in the less dense air above the detonation altitude. An example is the *CHECKMATE* event where both fronts are clearly visible in the photograph taken from Johnston Island.'

When *CHECKMATE* was detonated during the **Cuban missiles crisis**: 'Observers on Johnston Island saw a green and blue circular region surrounded by a blood-red ring formed overhead that faded in less than 1 minute. Blue-green streamers and numerous pink striations formed, the latter lasting for 30 minutes. Observers at Samos saw a white flash, which faded to orange and disappeared in about 1 minute.' (**Defense Nuclear Agency report DNA-6040F, AD-A136820, p. 241**.)



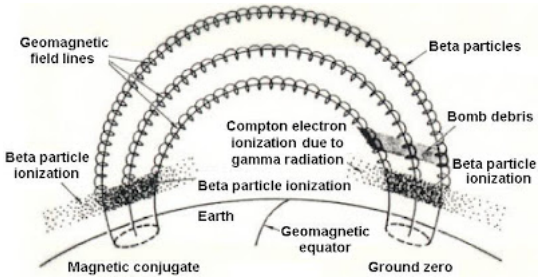
Above: the *STARFISH* (1.4 Mt, 400 km detonation altitude, 9 July 1962) detonation, seen from a mountain above the low-level cloud cover on Maui, consisted of a luminous debris fireball expanding in the vacuum of space with a **measured initial speed of 2,000 km/sec**. (**This is 0.67% of the velocity of light and is 179 times the earth's escape velocity. Compare this to the initial upward speed of only 6 times earth's escape velocity, achieved by the 10-cm thick, 1.2 m diameter steel cover blown off the top of the 152 m shaft of the 0.3 kt *Plumbbob-Pascal B* underground Nevada test on 27 August 1957. In that test, a 1.5 m thick 2 ton concrete plug immediately over the bomb was pushed up the shaft by the detonation, knocking the welded steel lid upward. This was a preliminary experiment by Dr Robert Brownlee called 'Project Thunderwell', which ultimately aimed to launch spacecraft using the steam pressure from deep shafts filled with water, with a nuclear explosion at the bottom; an improvement of Jules Verne's cannon-fired projectile described in *De la Terre à la Lune,* 1865, where steam pressure would give a more survivable gentle acceleration than Verne's direct impulse from an explosion. Some 90% of the radioactivity would be trapped underground**.) The film: 'shows the expansion of the bomb debris from approximately 1/3 msec to almost 10 msec. The partition of the bomb debris into two parts ... is shown; in particular the development of the "core" into an upwards mushroomlike expansion configuration is seen clearly. The fast moving fraction takes the shape of a thick disc. Also the interaction of the bomb debris with the booster at an apparent distance (projected) of approximately 1.5 km is shown.' (**Page A1-38 of the quick look report**.)

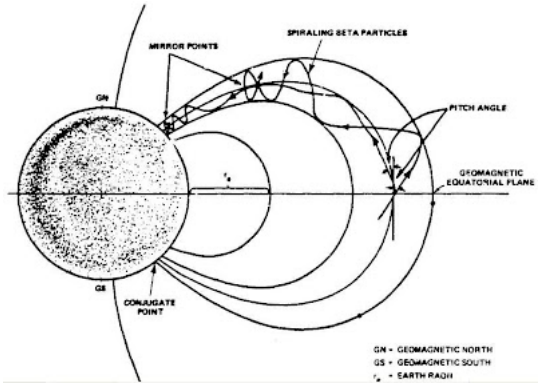
In this side-on view the fireball expansion has a massive vertical asymmetry due to the effects of the device orientation (**the dense upward jetting is an asymmetric weapon debris shock wave, due to the missile delivery system and/or the fact that the detonation deliberately occurred with 'the primary and much of the fusing and firing equipment' vertically above the fusion stage, see page A1-7 of the quick look technical report linked here**): 'the *STARFISH* test warhead was inverted prior to the high-altitude test over Johnston Island in 1962 because of concerns that some masses within the design would cause an undesirable shadowing of prompt gamma rays and mask selected nuclear effects that were to be tested.' (**April 2005 U.S. Department of Defense *Report of the Defense Science Board Task Force on Nuclear Weapon Effects Test, Evaluation, and Simulation,* page 29**.). The earth's magnetic field also played an immediate role in introducing asymmetric fireball expansion as seen from Maui: 'the outer shell of expanding bomb materials forms ... at ... 1/25 to 1/10 sec, an elongated ellipsoidal shape with the long axis orientated along the magnetic field lines.' (**Page A1-12 of the quick look report**.)

The *STARFISH* test as filmed from Johnston Island with a camera pointing upwards could not of course show the vertical asymmetry, but it did show that the debris fireball: 'separated into two parts ... the central core which expands rather slowly and ... an outer spherically expanding shell ... The diameter of the expanding shell is approximately 2 km at 500 microseconds ...'

(**William E. Ogle, Editor, *A 'Quick Look' at the Technical Results of Starfish Prime,* August 1962, report JO-600, AD-A955411, originally secret-restricted data**, p. A1-7.) Within 0.04-0.1 second after burst, the outer shell - as filmed from Maui in the Hawaiian Islands, had become elongated along the earth's magnetic field, creating an ellipsoid-shaped fireball. Visible 'jetting' of radiation up and southward was observed from the debris fireball at 20-50 seconds, and some of these jets are visible in the late time photograph of the debris fireball at 3 minutes after burst (above right).

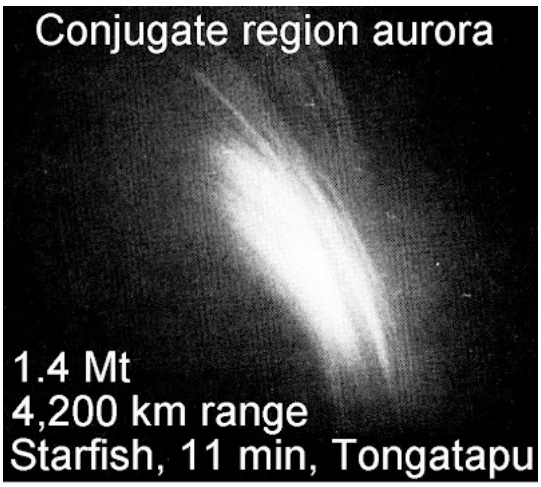
The analysis of *STARFISH* on the right was **done by the Nuclear Effects Group at the Atomic Weapons Establishment, Aldermaston, and was briefly published on their website,** with the following discussion of the 'patch deposition' phenomena which applied to bursts above 200 km: 'the expanding debris compresses the geomagnetic field lines because the expansion velocity is greater than the Alfven speed at these altitudes. The debris energy is transferred to air ions in the resulting region of tightly compressed magnetic field lines. Subsequently the ions, charge-exchanged neutrals, beta-particles, etc., escape up and down the field lines. Those particles directed downwards are deposited in patches at altitudes depending on their mean free paths. These particles move along the magnetic field lines, and so the patches are not found directly above ground zero. Uncharged radiation (gamma-rays, neutrons and X-rays) is deposited in layers which are centered directly under the detonation point. The *STARFISH* event (1.4 megatons at 400 km) was in this altitude regime. Detonations at thousands of kilometres altitude are contained purely magnetically. Expansion is at less than the local Alfven speed, and so energy is radiated as hydromagnetic waves. Patch depositions are again aligned with the field lines.'





The Atomic Weapons Establishment site also showed a Monte Carlo model of *STARFISH* radiation belt development, indicating that the electron belt stretched a third of the way around the earth's equator at 3 minutes, and encircled the earth at 10 minutes. The averaged beta particle radiation flux in the belt was 2 x 10^{14} electrons per square metre per second at 3 minutes after burst, falling to a quarter of that at 10 minutes. As the time goes on, the radiation belt pushes up to higher altitudes and becomes more concentrated over the magnetic equator. For the first 5 minutes, the radiation belt has an altitude range of about 200-400 km and spans from 27 degrees south of the magnetic equator to 27 degrees north of it. At 1 day after burst, the radiation belt height has increased to the 600-1,100 km zone and the average flux is then 1.5 x 10^{12} electrons/m^2/sec. At 4 months the altitude for this average flux (plus or minus a factor of 4) is confined to altitudes of 1,100-1,500 km, and it is covering a smaller latitude range around the magnetic equator, from about 20 degrees north to about 20 degrees south. At 95 years after burst, the remaining electrons will be 2,000 km above the magnetic equator, the latitude range will be only plus or minus 10 degrees from the equator, and the shell will only be 50 km thick.

When *STARFISH* was detonated: 'The large amount of energy released at such a high altitude by the detonation caused widespread auroras throughout the Pacific area, lasting in some cases as long as 15 minutes; these were observed on both sides of the equator. In Honolulu an overcast, nighttime sky was turned into day for 6 minutes (*New York Times,* 10 July 1962). Observers on Kwajalein 1,400 nautical miles (about 2,600 km) west reported a spectacular display lasting at least 7 minutes. At Johnston Island all major visible phenomena had disappeared by 7 minutes except for a faint red glow. The earth's magnetic field [measured at Johnston] also was observed to respond to the burst. ... On 13 July, 4 days after the shot, the U.K. satellite, Ariel, was unable to generate sufficient electricity to function properly. From then until early September things among the satellite designers and sponsors were "along the lines of the old Saturday matinee one-reeler" as the solar panels on several other satellites began to lose their ability to generate power (reference: *The Artificial Radiation Belt,* Defense Atomic Support Agency, 4 October 1962, report DASA-1327, page 2). The *STARFISH* detonation had generated large quantities of electrons that were trapped in the earth's magnetic field; the trapped electrons were damaging the solar cells that generated the power in the panels.' (**Defense Nuclear Agency report DNA-6040F, AD-A136820, pp. 229-30**.)



Above: the conjugate region aurora from *STARFISH,* 4,200 km from the detonation, as seen from Tongatapu 11 minutes after detonation. (Reference: W. P. Boquist and J. W. Snyder, 'Conjugate Auroral Measurements from the 1962 U.S. High Altitude Nuclear Test Series, in *Aurora and Airglow,* B. M. McCormac, Ed., Reinhold Publishing Corp., 1967.) **A debris aurora caused by fission product ions travelling along magnetic field lines to the opposite hemisphere requires a burst altitude above 150 km, and in the *STARFISH* test at 400 km some 40% of the fission products were transported south along the magnetic force field into the conjugate region (50% was confined locally and 10% escaped into space).** The resulting colourful aurora was filmed at Tongatapu (21 degrees south) looking north, and it was also seen looking south from Samoa (14 degrees south). The *STARFISH* debris reached an altitude of about 900-km when passing over the magnetic equator. The debris in the conjugate region behaves like the debris remaining in the burst locale; over the course of 2 hours following detonation, it simply settles back down along the Earth's magnetic field lines to an altitude of 200 km (assuming a burst altitude exceeding 85 km). Hence, the debris is displaced towards the nearest magnetic pole. The exact 'offset distance' depends simply upon the angle of the Earth's magnetic field lines. The ionisation in the debris region is important since it can disrupt communications if the radio signals need to pass through the region to reach an orbital satellite, and also because it may disrupt radar systems from spotting incoming warheads (since radar beams are radio signals which are attenuated).

In the Pacific nuclear high altitude megaton tests, communications using ionosphere-reflected high frequency (HF) radio were disrupted for hours at both ends of the geomagnetic field lines which passed through the detonation point. However, today HF is obsolete and the much higher frequencies involved do not suffer so much attenuation. Instead of relying on the ionosphere and conducting ocean to form a reflecting wave-guide for HF radio, the standard practice today is to use microwave frequencies that penetrate right through the normal ionosphere and are beamed back to another area by an orbital satellite. These frequencies can still be attenuated by severe ionisation from a space burst, but the duration of disruption will be dramatically reduced to seconds or minutes.

'Recently analyzed beta particle and magnetic field measurements obtained from five instrumented rocket payloads located around the 1962 *Starfish* nuclear burst are used to describe the diamagnetic cavity produced in the geomagnetic field. Three of the payloads were located in the cavity during its expansion and collapse, one payload was below, and the fifth was above the fully expanded cavity. This multipoint data set shows that the cavity expanded into an elongated shape 1,840 km along the magnetic field lines and 680 km vertically across in 1.2 s and required an unexpectedly long time of about 16 s to collapse. The beta flux contained inside the cavity was measured to be relatively uniform throughout and remained at 3×10^{11} beta particles/cm^2 s for at least 7 s. The plasma continued to expand upward beyond the fully expanded cavity boundary and injected a flux measuring 2.5×10^{10} beta particles/cm^2 s at H + 34 s into the most intense region of the artificial belt. Measured 10 hours later by the Injun I spacecraft, this flux was determined to be 1×10^9 beta particles/cm^2 s.' - Palmer Dyal, 'Particle and field measurements of the *Starfish* diamagnetic cavity', *Journal of Geophysical Research,* volume 111, issue A12, page 211 (2006).

Palmer Dyal was the nuclear test Project Officer and **co-author with W. Simmons of *Operation DOMINIC, FISH BOWL Series, Project 6.7, Debris Expansion Experiment,* U.S. Air Force Weapons Laboratory, Kirkland Air Force Base, New Mexico, POR-2026 (WT-2026), AD-A995428, December 1965:**

'This experiment was designed to measure the interaction of expanding nuclear weapon debris with the ion-loaded geomagnetic field. Five rockets on *STARFISH* and two rockets on *CHECKMATE* were used to position instrumented payloads at various distances around the burst points. The instruments measured the magnetic field, ion flux, beta flux, gamma flux, and the neutron flux as a function of time and space around the detonations. Data was transmitted at both real and recorded times to island receiving sites near the burst regions. Measurements of the telemetry signal strengths at these sites allowed observations of blackout at 250 MHz ... the early expansion of the *STARFISH* debris probably took the form of an ellipsoid with its major axis oriented along the earth's magnetic field lines. Collapse of the magnetic bubble was complete in approximately 16 seconds, and part of the fission fragment beta particles were subsequently injected into trapped orbits. ...

'At altitudes above 200 kilometres ... the particles travel unimpeded for several thousands of kilometres. During the early phase of a high-altitude explosion, a large percentage of the detonation products is ionized and can therefore interact with the geomagnetic field and can also undergo Coulomb scattering with the ambient air atoms. If the expansion is high enough above the atmosphere, an Argus shell of electrons can be formed as in the 1958 and 1962 test series. ... If this velocity of the plasma is greater than the local sound or Alfven speed, a magnetic shock similar to a hydro shock can be formed which dissipates a sizable fraction of the plasma kinetic energy. The Alfven velocity is $C = B/(4*\{Pi\}*\{\text{Ion density, in ions per cubic metre}\})^{1/2}$,

where ... *B* is the magnetic field ... Since the *STARFISH* debris expansion was predicted and measured to be approximately 2 x 10^8 cm/sec and the Alfven velocity is about 2 x 10^7 cm/sec, a shock should be formed. A consideration of the conservation of momentum and energy indicates that the total extent of the plasma expansion proceeds until the weapon plasma kinetic energy is balanced by the $B^2/(8\{Pi\})$ magnetic field energy [density] in the excluded region and the energy of the air molecules picked up by the expanding debris. ... An estimate of the maximum radial extent of the STARFISH magnetic bubble can be made assuming conservation of momentum and energy. The magnetic field swept along by the plasma electrons will pick up ambient air ions as it proceeds outward. ...'

Conservation of momentum suggests that the initial outward bomb momentum, $M_{BOMB}V_{BOMB}$ must be equal to the momentum of the total expanding fireball after it has picked up air ions of mass $M_{AIR\ IONS}$:

$M_{BOMB}V_{BOMB} = (M_{BOMB} + M_{AIR\ IONS})V$,

where V is the velocity of the combined shell of bomb and air ions. The expansion of the ionized material against the earth's magnetic field slows it down, so that the maximum radial extent occurs when the initial kinetic energy $E = (1/2) M_{BOMB}V_{BOMB}^2$ has been converted into the potential energy density of the magnetic field which stops its expansion. The energy of the magnetic field excluded from the ionized shell of radius R is simply the volume of that shell multiplied by the magnetic field energy density $B^2/(8\{Pi\})$. By setting the energy of the magnetic field bubble equal to the kinetic energy of the explosion, the maximum size of the bubble could be calculated, assuming the debris was 100% ionized.

For *CHECKMATE,* they reported: 'Expansion of the debris was mostly determined by the surrounding atmosphere which had a density of 4.8 x 10^{10} particles/cm^3.

Chapter 2: Blast and Shock Phenomena

Chapter 2. *Blast and Shock Phenomena.* 306 pages. **Blast wave section is here** and **ground shock/cratering/water bursts/underwater bursts section is here.**

The first 150 pages are document AD-A955405 and deal with blast wave phenomenology including non-ideal blast waves like precursor predictions which are not available in the Glasstone and Dolan book, which only has the height of burst curves for 'nearly ideal conditions'. In addition, it includes curves showing the overpressure and dynamic pressure impulses and the height of the Mach stem to the triple point as the blast from low air bursts at various altitudes progress outward. This is not included in Glasstone and Dolan 1977, but it is useful for determining whether the upper parts of a tall building will experience two separate shock waves or the fused Mach stem from an air burst (download here: 8.3 MB PDF file).

Section 2, *Airblast Over Real (Non-Ideal) Surfaces*, of chapter 2 on blast has recently been expanded in the later (still classified) version of the manual, to include an appendix which describes a methodology to construct non-ideal (precursor-type) dynamic pressure waveforms as well as non-ideal static pressure waveforms using thermal radiation transmission, thermal blow-off of the ground surface, thermal layer growth, blast wave modification and resulting precursed air blast environments. This was accomplished by the synthesis of the non-ideal (precursor) pressure waveforms from Nevada nuclear explosions *MET, PRISCILLA,* and *HOOD,* to give the blast dynamic pressure environment over desert surfaces for events ranging in yields from 8 to 74 KT and scaled (1-kt) heights of burst from 140 to 340 scaled feet (using reports WT-1109, *Operation TEAPOT, Airblast Overpressure and Dynamic Pressure over Various Surfaces,* WT-1110, *Operation Teapot, Special Measurements of Dynamic Pressure Versus Time and Distance,* WT-1155, *Operation TEAPOT, Measurements of Air-Blast Phenomena with Self Recording Gages,* WT-1401, *Operation PLUMBBOB, Basic Airblast Phenomena,* WT-1403, *Operation PLUMBBOB, Air-Blast Phenomena in the High Pressure Region,* WT-1472, *Operation PLUMBBOB, Effects of a Precursor Shock Wave on Blast Loading of a Structure,* and the compendium DASA 1200, *Nuclear Weapons Blast Phenomena*).

See also: *Real Surface (Non-Ideal) Effects on Nuclear Explosion Airblast from PRISCILLA-Type Events, Part 1: Comparison and Evaluation of Ideal and Non-Ideal Airblast from PRISCILLA Computations; and Part 2: SHARC Hydrocode Calculations of the PRISCILLA Event (Phase 1),* Report **ADA302079 online** by Noel H. Ethridge, John H. Keefer, Joseph E. Crepeau, Robert G. Ekler, and Lynn W. Kennedy of Applied Research Associates Inc., October 1, 1995, 367 Pages. See also *Extended Desert Calculation Results with Comparisons to PRISCILLA Experimental Data and a Near-Ideal Calculation,* **ADA298300**, and *Extended Grassland Calculation Results With Comparisons to PRISCILLA Experimental Data and a Near-Ideal Calculation,* **ADA298081**.

An important blast wave update in EM-1 manual was data on height-of-burst effects on dynamic pressure *impulse* from a 1981 report with its vital 1983 Supplement of height-of-burst curves by E. J. Bryant and F. J. Allen, *Dynamic Pressure Impulse for Near-Ideal and Non-Ideal Blast Waves - Height of Burst Charts* and *Supplement,* Kaman Tempo, Santa Barbara, California, reports ADC275040 (May 1981) and ADC041417 (December 1983). Online versions: **ADC040572 abstract** (PDF: **ADC040572**), and **ADC041417** (PDF: **ADC041417**):

> Blast wave data for all past field tests have been reviewed. Some previously unused gage data of sufficiently good quality for determining dynamic pressure impulse have been found and the data reduced. Dynamic pressure impulse has been inferred from tank displacement data using the curve of dynamic pressure impulse versus displacement as a calibration curve (with the tank playing the role of a gage). This allowed extension of dynamic pressure impulse results to higher values than previously available and also provided data points at additional scaled burst heights. Following this, Height of Burst Charts, i.e. , iso-scaled dynamic pressure impulse contours in the scaled height of burst - scaled ground range plane, were constructed using the totality of the useable dynamic pressure impulse data.

> The charts, are for two cases: Near-Ideal - Lightly/Moderate Dust and Near-Ideal - Moderate/Heavy Dust. The former is the better determined of the two. It is believed that these charts are the most accurate obtainable from the totality of all existent blast wave measurements.
>
> Dynamic pressure impulse, I sub q was evaluated as a function of wheeled vehicle displacement (1/4 ton and 2-1/2 ton trucks) for ideal/near ideal and nonideal blast environments. Good correlation was obtained between dynamic pressure impulse and vehicle displacements using least squares fits. Using the quadratic equations derived by least squares fit the I sub q were calculated from known vehicle displacements and these were averaged with initial estimates of I sub q (ideal/near-ideal) and measured I sub q (non-ideal) to obtain iterated values of I sub q. Least square fits were also applied to I sub q versus scaled ground range and displacement versus scaled ground range for various values of n, the exponent of yield. The values of n providing the best fits were between 0.4 and 0.43 for displacements and n = 0.42 or 0.43 for I sub q as a function of scaled range.

The remaining 156 pages of chapter 2 is document **AD-A955386**, and deals with ground shock, cratering analysis, and the water shock, base surge, etc., from underwater bursts. It also includes a valuable analysis of test data on water surface wave heights from water surface burst nuclear tests. However, the crater size scaling law for yield, used by Glasstone and Dolan, does not properly model gravity effects, as discovered in 1987:

'Data on the coral craters are incorporated into empirical formulas used to predict the size and shape of nuclear craters. These formulas, we now believe, greatly overestimate surface burst effectiveness in typical continental geologies ... coral is saturated, highly porous, and permeable ... When the coral is dry, it transmits shocks poorly. The crushing and collapse of its pores attenuate the shock rapidly with distance ... Pores filled with water transmit the shock better than air-filled pores, so the shock travels with less attenuation and can damage large volumes of coral far from the source.'

– L.G. Margolin, et al., *Computer Simulation of Nuclear Weapons Effects,* Lawrence Livermore National Laboratory, UCRL-98438 Preprint, 25 March 1988, p. 5.

'DNA [Defense Nuclear Agency, which has since evolved into the DTRA] has recently completed an "end-to-end" cratering validation program that resulted in dramatic reduction of the crater size thought to result from the surface detonation of modem strategic weapons.'

- Appendix A of Ernest Bauer's report *Variabilities in the Natural and Nuclear Endoatmospheric Environment* (Institute for Defense Analyses, Virginia, IDA Document D-1085, April 1992).

This reduction is in part due to a switch over from the predominance of hydrodynamic to gravitational work energy as the crater mass and depth increases with increasing yield. At low yields, gravitational work energy in ejecting soil mass M from depth d to the lip is trivial, $E = gdM$, but at high yields this use of energy is massive due to the large mass and depth of the crater, so gravitational work energy competes with the energy available to hydrodynamically excavate the soil.

It turns out that if the crater's apparent radius to depth ratio is constant, this gravitational work effect makes the linear dimensions scaling law vary from 1/3 power of yield at low yields to 1/4 power of yield at high yields. There are also other factors involved in reducing crater dimensions at high yield which Glasstone and Dolan ignored, such as a fall in bomb case shock energy for high yield-to-mass ratio devices, where most the initial energy is released as X-rays which are less efficient at cratering than dense bomb vapours. The revised model circa 1991 for a 1 Mt surface burst on dry soil predicts a crater radius of 58 m, compared to 148 m in Glasstone and Dolan 1977.

The original 306 pages-long chapter 2 in DNA-EM-1 has been broken up into separate chapters on blast and cratering: since 1984 Chapter 3 has been, *Cratering, Ejecta, and Ground Shock,* and is prepared by Titan Research and Technology Division (TRT) of the Titan Corporation. The latest major revision (since which there have merely been page changes) is the 1 January 1992 edition edited by by Anne V. Cooper et al., *Capabilities of Nuclear Weapons,* DNA-EM-1, *Chapter 3, Cratering, Ejecta and Ground Shock,* Titan Corporation, Defense Nuclear Agency, Washington, D.C., report DNA-EM-1-CH-3. It is classified secret-restricted data, but the abstract is unclassified:

'A methodology is presented for predicting crater dimensions and ejecta characteristics resulting from near-surface and deeply buried explosions of nuclear weapons. This chapter contains the description of ground shock associated with nuclear weapon bursts. Material properties and the parameters important to estimating ground shock are discussed. Formulas for peak values of pressure, acceleration, velocity and displacement are presented along with methods for estimating waveforms. Airblast-induced, outrunning and surface wave ground shock are all treated herein. The Dug method for down-axis motions is included. The effect of slightly elevated or shallow buried bursts is also discussed in terms of an effective yield factor. Finally, a description of block motion, tilt and rotation is included.'

Section III of that chapter is 'Nuclear Ground Shock Effects' by E. Rinehart, A. V. Cooper, and S. H. Schuster. The engineer and computer programmer Anne V. Cooper is currently the primary editor of Chapter 3 revisions. At Titan, she was the main compiler and also joint editor (with S. H. Schuster and F. Sauer) of the June 1987 revision of the U.S. *Air Force Manual for the Design and Analysis of Hardened Structures,* AFWL-TR-87-57. She authored the interactive computer program INEES which computes nuclear effects using the methods presented in that Air Force manual.

In the spring of 1992, Tony Frederickson and Ed Tremba of the Defense Nuclear Agency were chartered to assemble a set of numerical models of nuclear weapon effects from *Capabilities of Nuclear Weapons* in a usable computer program format. They set up the Model Development Working Group (MDWG) consisting of Ed Tremba of DNA, Tom Dowler of LANL, Jim Drake of ARA, Archie Farnsworth of SNL, Ted Harvey of LLNL, Rob Managan of LLNL, Rob Managan of LLNL, Shel Schuster of

TRT, Dev Srinivasa of RDA, Bill Woolson of SAIC, Joe Zelasko of WES, and A. V. Cooper of Titan who also wrote the resulting computer code, appropriately named NEMESIS (Nuclear Effects Models for Estimating Sensitivities to Input Scenarios): Anne V. Cooper, *et al., NEMESIS - Nuclear Effects Models for Estimating Sensitivities to Input Scenarios,* report WES-CR SL-95-1, February 1995. NEMESIS includes air blast, cratering, ejecta, fallout, radiation, thermal and ground shock algorithms. NEMESIS replaces the obsolete computer programs called 'Blast Effects' and 'Weapons Effects' which were developed in December 1984 by Horizons Technology, Inc., of California for the Defense Nuclear Agency. She now runs a **helpful programming assistance internet site which states:**

> 'Cooper Internet Services is available to help you with programming solutions. From nuclear weapons effects programs to a Wordsearch Generator and Trivia Quizzes to search engines for Reading Counts book lists, we can design the right application for you.'

Useful extracts from revised versions of EM-1 are given on page 1-37 (crater dimensions for 10 kt surface bursts on various types of soil, giving 27 m diameter and 11 m depth for dry soft rock) of the White House civil defence planning manual **here**. The latest crater scaling laws are given in the report:

> **R. M. Schmidt, K. R. Housen and K.A. Holsapple, *Gravity Effects in Cratering,* DNA-TR-86-182, Defense Nuclear Agency, Washington D.C., 1988**.

In the range of 1 kt – 10 Mt there is a transition from cube-root to fourth-root scaling, and the average scaling law suggested by Nevada soil and Pacific coral Atoll data, $W^{0.3}$ (used by Glasstone and Dolan) was shown to be wrong in 1987 because empirical data was too limited (the biggest Nevada cratering test was Sedan, 104 kt) and the $W^{0.3}$ empirical law ignored energy conservation at high yields, where gravity effects kick in and curtail the sizes predicted by hydrodynamic cratering physics.

The $W^{0.3}$ scaling law used in Glasstone and Dolan 1977 is false because it violates the conservation of energy, used by the explosion in ejecting massive amounts of debris from the crater against gravity. The yield-dependent scaling for crater dimensions (radius and depth) transitions from the cube-root of yield scaling at low yields (below 1 kt) to fourth-root at high yields, because of gravity. At low yields, the fraction of the bomb energy used to physically dump ejecta out of the crater *against gravity* (to produce the surrounding lip and debris) is trivial compared to the hydrodynamic energy being used used to physically break up the soil. But at higher yields, the fact that the crater is deep means that a significant amount of bomb energy must now be employed to do work excavating earth against gravity.

Consider the energy utilisation in cratering. The total energy done by cratering is the sum of the hydrodynamic energy and gravitational work energy. The hydrodynamic term is shown to be proportional to the cube of the crater radius or depth, as shown by the reliability of cube-root scaling at subkiloton yields: the energy needed to hydrodynamically excavate a unit volume of soil by hydrodynamic cratering action is a constant, so the energy required for hydrodynamic pulverization of crater mass m is $E = mX$ where X is the number of Joules needed in cratering for the hydrodynamic excavation of 1 kg of soil.

But where the crater is deep in bigger explosions, the gravitational work energy $E = mgh$ needed to eject crater mass m the vertical distance h upwards out of the hole to the lip, against gravitational acceleration g (9.8 ms^{-2})*becomes larger than the hydrodynamic energy needed to merely break up the matter,* so the gravity work effect then governs the crater scaling law. The total energy used in crater formation is the sum of two terms, hydrodynamic and gravitational: $E = (mX) + (mgh)$.

The (mX)-term is proportional to the *cube of the crater depth* (because m is the product of volume and density, and volume is proportional to depth-cubed if the crater radius/depth ratio is constant), while the (mgh)-term is proportional to the *fourth-power of the crater depth* because m is proportional to the density times the depth *cubed* (if the depth/radius ratio is constant) and h is always directly proportional to the crater depth (h is roughly half the crater depth), so the product mgh is proportional to the product of depth cubed and depth, i.e., to the fourth-power of crater depth. So for bigger craters and bigger bomb yields, a larger fraction of the total cratering energy then gets used to overcome gravity, causing the gravity term to predominate and the crater size to scale at most by $W^{1/4}$ at high yields. **This makes the crater size scaling law transition from cube-root ($W^{1/3}$) at low yields to fourth-root ($W^{1/4}$) at higher yields!**

It's fascinating that, *despite the best scientific brains working on nuclear weapons effects for many decades* - the Manhattan Project focussed a large amount of effort on the problem, and utilised the top physicists who had developed quantum mechanics and nuclear physics, and people like Bethe were still writing secret papers on fireball effects into the 1960s - such fundamental physical effects were simply ignored for decades. This was due to the restricted number of people working on the problem due to secrecy, and maybe some kind of 'groupthink' (psychological peer-pressure): not to upset colleagues by 'rocking the boat' with too much freethinking, radical questions, innovative ideas.

The equation $E = mgh$ isn't a speculative theory requiring nuclear tests to confirm it, it's a basic physical fact that can be experimentally proved in any physics laboratory: you can easily measure the energy needed to raise a mass (the amount of electric energy supplied to an electric motor while it winches up a standard 1 kg mass is a simple example of the kind of physical fact involved). In trying to analyse the effects of nuclear weapons, false approximations were sometimes used, which then became imbedded as a doctrine or faith about the 'correct' way to approach or analyze a particular problem. People, when questioned about a fundamental belief in such analysis, then are tempted respond dogmatically by simply referring to what the 'consensus' is, as if accepted dogmatic religious-style authority is somehow a substitute science, which is of course the unceasing need to keep asking probing questions, checking factual details for errors, omissions and misunderstandings, and forever searching for a deeper understanding of nature.

For example, **in the case of a 10 Mt surface burst on dry soil**, the 1957, 1962, and 1964 editions of Glasstone's *Effects of*

Nuclear Weapons predicted a crater radius of 414 metres (the 10 Mt Mike test in 1952 had a radius of over twice that size, but that was due to the water-saturated porous coral of the island and surrounding reef, which is crushed very easily by the shock wave at high overpressures). This was reduced to 295 metres in Glasstone and Dolan, 1977, when the scaling law was changed from the cube-root to the 0.3 power of yield. The 1981 revision of Dolan's DNA-EM-1 brings it down to 145 metres, because of the tiny amount of energy which goes into the bomb case shock for a modern, efficient 10 Mt class thermonuclear warhead (**Brode and Bjork discovered this bomb design effect on cratering in 1960**; high-yield efficient weapons release over 80% of their yield as X-rays which are inefficient at cratering because they just cause ablation of the soil below the bomb, creating a shock wave and some compression, but far less cratering action than the dense bomb case shock wave produces in soil). Then in 1987, the introduction of gravity effects reduced the crater radius for a 10 Mt surface burst on dry soil to just 92 metres, only 22% of the figure believed up to 1964!

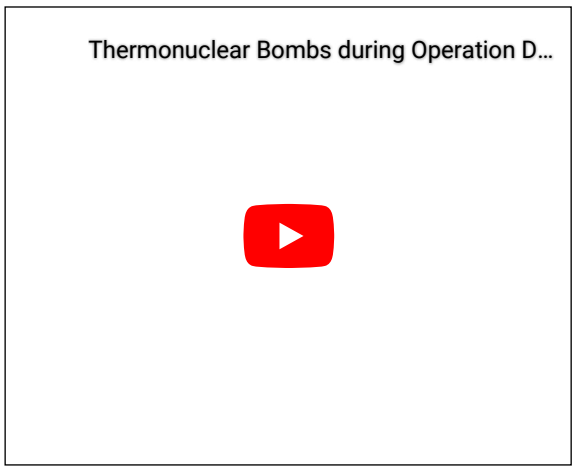
'It is shown that the primary cause of cratering for such an explosion is not "airslap," as previously suggested, but rather the direct action of the energetic bomb vapors. High-yield surface bursts are therefore less effective in cratering by that portion of the energy that escapes as radiation in the earliest phases of the explosion. [Hence the immense crater size from the 10 Mt liquid-deuterium *Mike* test in 1952 with its massive 82 ton steel casing shock is irrelevant to compact modern warheads which have lighter casings and are more efficient and produce smaller case shocks and thus smaller craters.]' - **H. L. Brode and R. L. Bjork, *Cratering from a Megaton Surface Burst,* RAND Corp., RM-2600, 1960**.

Above: even with a relatively heavy design and casing (thus maximum cratering action relative to modern lighter weapons of comparable yield), the *TRINITY* (19 kt, 30 m altitude, 16 July 1945) test left the foundations of the steel tower behind in the middle of the crater, as photographed on 11 September 1945. A wide shallow crater was scoured out by the shock wave, but hardened underground structures could have survived, which is why surface bursts are required to destroy such targets.

Above: The Apollo 16 astronauts safely using the 8 December 1968, 31 kt *SCHOONER* nuclear test crater at the Nevada test site in November 1970 to simulate the South Ray crater which was their intended target on the Moon, complete with nicely enhanced nuclear radiation (the radioactivity level on the Moon like outer space generally is 100 times that on the Earth even at solar minimum, due to the lack of any atmosphere to absorb most cosmic radiation!). Niel Armstrong and Buzz Aldrin, the first people to land on the Moon (20 July 1969), spent time at Nevada studying the geology of the 1962 Nevada *SEDAN* nuclear test crater in February 1965. The *SEDAN* crater was caused by a 104 kt, 30% fission nuclear explosion in July 1962, and the lip had a dose rate of 500 R/hr at 1 hour after detonation. The decay rate of *SEDAN* radioactivity was influenced by large quantities of radioactive tungsten produced by neutron capture in the tungsten pusher in the weapon, which replaced the usual uranium tamper of such thermonuclear fusion stages. The *SEDAN* lip was first approached on foot 27 days after detonation, when it had a radioactivity level of 500 mR/hr (1000 times less than at 1 hour after burst). The first human visit to the bottom of the crater occurred 167 days after detonation, when the radioactivity level there was 35 mR/hr. In 1990, the dose rate at the visitors box on East side of the crater was 0.020 mR/hr (little more than the natural background radioactivity in London), although the West side of the crater still gave a reading of 0.053 mR/hr. (These data are from the sign at the visitors box on the crater lip.)

Chapter 3: Thermal Radiation Phenomena

***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 3. Thermal Radiation Phenomena.* 114 pages, DNA-EM-1, July 1978, AD-A955387, 3.2 MB PDF file.**



Above: American toroidal fireball nuclear test films.

Above: British toroidal fireball nuclear test films.

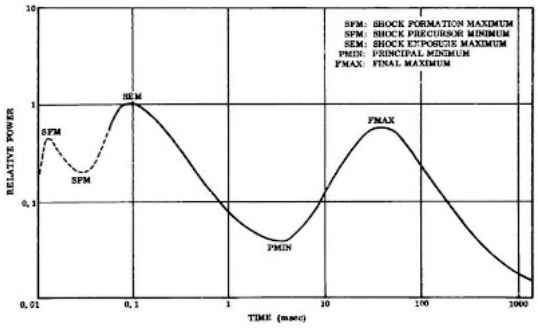
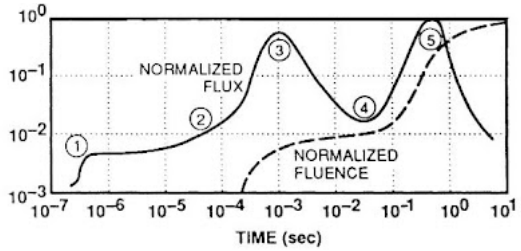


FIG. 2-1 THERMAL POWER RADIATED FROM ONE KILOTON AT SEA LEVEL

Harold L. Brode, Richard W. Hillendahl, and Rolf K. Landshoff, "Thermal Radiation Phenomena, Vol. 5, Radiation Hydrodynamics of High Temperature Air", Lockheed Missiles & Space Co., report DASA-1917-5, 1967



(1) Fireball shielded by ionised air and ozone from the air ionization due to X-ray and gamma radiation
(2) Shock wave forms, expanding past ozone shell
(3) Shock wave thermal radiation peaks
(4) Nitrogen dioxide formed in compressed hot air behind shock front absorbs radiation from core
(5) Shock wave decays: expanding fireball radiates

Above: effect of ozone on early thermal radiation emission from a nuclear explosion. The first graph above shows the thermal radiation calculated by computer when ozone is ignored, while the second shows how it reduces the (mainly ultraviolet) radiation emission from the very hot fireball at early times, before the shock wave has formed and penetrated through the 'veil' or shell of ozone caused by the intense high energy X-ray and gamma radiation interacting with the air just around the fireball. (*Thermal Radiation From Nuclear Weapons,* Defense Nuclear Agency, February 1991.)

The fact that nuclear explosions *produce* ozone was first published in paragraph 6.26 on page 190 of the 1950 U.S. Department of Defense book, *The Effects of Atomic Weapons:* 'there may be some absorption of ultraviolet radiation by ozone which is produced by interaction of gamma rays from the atomic explosion with atmospheric oxygen.' **Herman Hoerlin states on page 43 of his 1976 Los Aamos report LA-6405 *United States High Altitude Test Experiences:* 'significant amounts of ozone are produced in sea-level explosions.'** (Hoerlin cites as reference: **H. E. DeWitt, *A Compilation of Spectroscopic Observations of Air Around Atomic Bomb Explosions,* Los Alamos Scientific Laboratory report LAMS-1935, June 1955**.) However, since the time that was written, full calculations have been performed which show that high altitude nuclear detonations (above 100 km altitude) produce large excess amounts of ozone, strengthening rather than depleting the ozone layer. Finally, sampling of the cloud of a 1976 atmospheric Chinese megaton range test showed confirmed that there was no ozone depleting nitrogen dioxide: it reacts with water vapour to form nitric acid, instead of destroying ozone! Anyway, nitrogen dioxide is only formed in high pressure shock waves from low altitude detonations, not from high altitude bursts, which produce an excess of ozone. This debunks the claims of ozone depletion by nuclear warfare made in the 1977 edition of *The Effects of Nuclear Weapons*.

Nitric acid (HNO_3) production from the mixing with nitrogen dioxide and water vapour in the fireball is described by the reaction:

$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$

then the nitrogen oxide, NO, itself gets oxidized into nitric acid by the reaction:

$4NO + 3O_2 + 2H_2O \rightarrow 4HNO_3$

It was a bigger hoax than Piltdown Man to suggest that nitrogen oxides from nuclear bomb tests could break down ozone; they instead get oxidised into nitric acid by atmospheric moisture and oxygen *before they can reach the ozone layer.* For a published discussion of the nitric acid production in the air around the fireball from an atmospheric nuclear explosion, see Murray Scheibe, *The Increased Attachment Due to Ionization-Induced Smog in EMP Environments,* Mission Research Corporation, California, MRC-R-532, DNA5077F, ADA087850, 1979: 'The increased electron attachment due to HNO_3 production in the EMP source region is investigated. The HNO_3 produced is found to be roughly linear with the total ionization up to an ionization value of about 2 x 10 to the 16th power ion pairs. Above this, the HNO_3 production is less than linear.'

This chapter on thermal phenomenology is very different from the material given in Glasstone and Dolan 1977, which made no attempt to show the thermal pulse shapes quantitatively from high altitude bursts. It shows how the thermal pulse shape varies with burst altitude and also goes into detail about how to calculate the thermal yield from any nuclear explosion, including allowance for the efficiency of the bomb in initially radiating energy: i.e., the distinction between 'hot' X-ray efficient compact

nuclear weapons which reach up to 400 million Kelvin and emit hard X-rays of typically up to 10 keV or so, and inefficient very heavy, low yield-to-mass ratio old bomb designs which were relatively 'cold' X-ray sources, reaching temperatures of only 1 million Kelvin or so and emitting X-rays of typically only 1 keV or so. These nuclear bomb design differences are generally very important for early-time thermal phenomena, cratering and blast, and are particularly important for thermal effects from high altitude bursts since many modern nuclear weapons are more efficient than the bomb designs tested in the atmosphere back in 1962.

'As stated ... weapons that have enhanced radiation outputs, i.e., weapons that produce a large fraction of their output in the form of neutrons, gamma rays, or X-rays ... will, in most cases, generate a weaker blast wave than a nominal weapon of the same yield. Similarly, the thermal pulse from such special weapons may be weaker than that from a nominal weapon. The explanation for the reduced thermal output is the same explanation for a weaker blast wave: neutrons, gamma rays, and high energy X-rays travel much farther through the atmosphere than the energy from a conventional [nuclear] weapon; therefore, a large portion of the weapon energy may be absorbed by air far from the burst. This air will not become sufficiently hot to contribute effectively to either the blast wave or to the thermal pulse.

'The terms "nominal weapon" and "conventional weapon" used in the preceding paragraph refer to a nuclear weapon that radiates 70 to 80 percent of its energy as X-rays ... and retains nearly all of the remaining energy as thermal and kinetic energy of the weapon debris ... The modified thermal effects produced by weapons with enhanced outputs may be calculated in terms of an effective thermal yield. This is defined as the yield that a nominal warhead would have in order to radiate the same thermal energy as the special weapon. ... Effective thermal yield means *the effective value of total yield to be used in thermal calculations. ...*

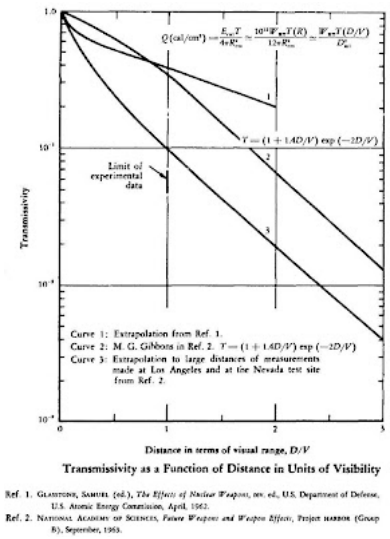
'Effective thermal yield is roughly th amount of energy that the nuclear source deposits within a sphere the size of the fireball at the time of the principal minimum [in the radiating thermal power versus time curve]. This radius is

$R_{min} = 29W^{0.36}$/{ratio of air density at burst height to air density at sea level, i.e. about $e^{-H/6.9}$) where H is burst altitude in km} metres,

where W is the weapon yield in kilotons ... Energy that is deposited beyond the radius R_{min} is assumed to make a negligible contribution to the energy radiated by the fireball.' - Philip J. Dolan, Editor, *Capabilities of Nuclear Weapons,* Chapter 3, *Thermal Radiation Phenomena,* DNA-EM-1, 1972, pp. 3-56 to 3-58.

In order to calculate the amount of energy contained within that radius (29 metres for 1 kt), Dolan states that you should assume that 100% of the debris is within that radius, and then calculate the amount of radiation energy deposited within the radius. For each type of radiation, the fraction of that radiation deposited within a radius R is equal to: $f = 1 - e^{-R/X}$ where X is mean free path (if all the energy is effectively deposited upon first scatter for the radiation in question) or absorption relaxation length, which has different values for initial gamma rays, neutrons and soft X-rays. After the total amount of energy deposited within 29 metres from a 1 kt sea level air burst is determined for both a nominal nuclear weapon (70-80% energy in soft X-rays) and the special weapon in question (e.g., a neutron bomb), then the ratio of these energy deposits is equal to the ratio of thermal energy yields for the two weapons being compared, and allows the thermal yield of the neutron bomb to be determined.

The thermal transmission controversy in DNA-EM-1 and related manuals



Transmissivity as a Function of Distance in Units of Visibility

Ref. 1. Glasstone, Samuel (ed.), *The Effects of Nuclear Weapons*, rev. ed., U.S. Department of Defense, U.S. Atomic Energy Commission, April, 1962.
Ref. 2. National Academy of Sciences, *Future Weapons and Weapon Effects*, Project harbor (Group 8), September, 1963.

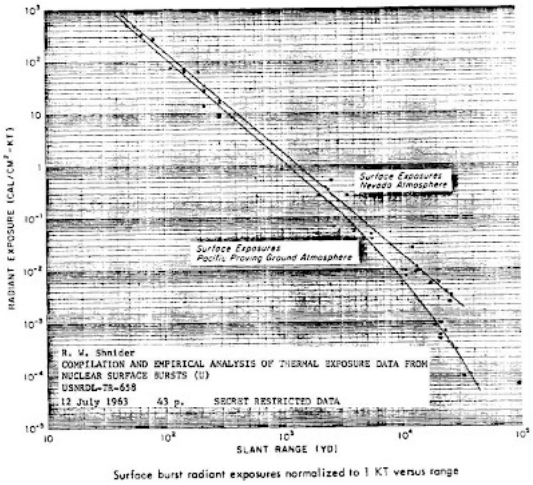
Above: some early thermal transmission curves comparison by **H. L. Brode, *A Review of Nuclear Explosion Phenomena Pertinent to Protective Construction,* the RAND Corporation, Santa Monica, California, Report R-425-PR, May 1964.** Brode reproduces the Glasstone 1962/4 thermal transmission curves on **page 15 of his report *Thermal Radiation from Nuclear Explosions,* RAND Corp. paper P-2745, 1963.** These Glasstone 1962/64 edition curves were originally taken from the curves for air bursts in **Figure 3-5B on page 3-15 of the Confidential manual *Capabilities of Atomic Weapons*, TM 23-200, November 1957, which states on page 3-3 that the 50 miles visibility curve is for a water vapour concentration in the air of 5 grams/cubic metre, the 10 miles visibility curve is for 10 grams/cubic metre of water vapour, and 2 miles visibility corresponds to 25 grams/cubic metre (water molecules have a band absorption which is elatively effective at absorbing red light and *infrared* radiation, but is less effective at absorbing other wavelengths)**.

These Glasstone 1962/64 thermal transmission curves can be summarised by the formula $T = \exp[-(R/V)^{1/2}]$ where R is distance from ground zero and V is visibility distance in similar units. The **earlier Glasstone 1957 *Effects of Nuclear Weapons* massively exaggerated the transmission at long distances by using the theoretical curve T = 0.48 + [0.52*exp(-4R/V)].** The theoretical basis for the thermal transmission curve in the **1957 edition of *The Effects of Nuclear Weapons*** is given by A. G. McDonald of the U.K. Home Office Scientific Advisory Branch in his paper on thermal radiation in the July 1957 National Archives report **HO 228/21 *Report of a course given to university physics lecturers at the Civil Defence Staff College 8-11 July 1957*** (this is an originally classified set of lectures on nuclear weapons effects which also included a detailed paper by Frank H. Pavry on the then-secret thermal precursor blast wave mechanism and the height-of-burst effects on blast optimization in Nevada tests; the Home Office Scientific Advisory Branch by then had access by to secret American research on the effects of nuclear weapons). It is basically just a simple adjustment of the transmission formula used for the curves in the still earlier Glasstone 1950 *Effects of Atomic Weapons* which used T = exp(-4R/V), underestimating the long range transmission! Glasstone's 1950 T = exp(-4R/V) formula is valid for infrared and ultraviolet radiation because infrared is rapidly absorbed by water vapour and carbon dioxide in the air while ultraviolet is rapidly absorbed by oxygen and ozone, but it does not adequately represent visible radiation which is far more penetrating. Hence, Glasstone's June 1957 edition tried to correct T = exp(-4R/V) by having it represent only the 52% of the total radiation consisting of the infrared and ultraviolet from a fireball with a time-averaged radiating temperature of 6000 K; the other 48% is visible light and this was in Glasstone 1957 wrongly assumed to travel without any absorption at all, leading to a massive exaggeration of the *long range* thermal effects from high yield weapons, and criticism from Dr Carl F. Miller who worked for the U.S. Naval Radiological Defense Laboratory at later nuclear tests to measure fallout on ships with washdown safeguards that were sailing under the expanding mushroom clouds:

‘Reliance on the ***Effects of Nuclear Weapons*** has its shortcomings... I was twenty miles from a detonation ... near ten megatons. The thermal flash did not produce the second-degree burn on the back of my neck, nor indeed any discomfort at all.’ - C. F. Miller, February 1966 *Scientist and Citizen*. (This journal was titled *Nuclear Information* August 1964 when it became *Scientist and Citizen;* it has since been renamed *Environment magazine*.)

In an attempt to resolve the confusion in July 1963, Ruth W. Shnider of the U.S. Naval Radiological Defense Laboratory, California, wrote the 43-page Secret - Restricted Data report, *Compilation and Empirical Analysis of Thermal Exposure Data from Nuclear Surface Bursts*, USNRDL-TR-658:

'A tabulation is presented of all available radiant-exposure data from nuclear surface bursts. The data are separated into surface exposures and airborne (measured in aircraft) exposures, and pertinent information, such as instrumentation and cloud cover, are included when available. The empirical analysis presents one set of Radiant Exposure versus Range curves for surface exposures, and another set for airborne exposures. Both sets are normalized to 1 kt, and distinguish between Nevada Test Site atmosphere (excellent thermal transmission [average visibility 50 miles due to the low water vapour content of the desert air]) and Pacific Proving Ground atmosphere (average-to-low thermal transmission [average visibility 10 miles due to the high humidity and hence high water vapour content in the mid-Pacific such as Bikini and Eniwetok Atolls]). It is recommended that these curves be employed for prediction of radiant exposures from nuclear surface detonations, rather than other methods in current literature.'



Surface burst radiant exposures normalized to 1 KT versus range

Above: Shnider's curves, taken from **this declassified handbook**.

Nuclear test data from the Nevada test site comes from various times of year and times of day (typically pre-dawn), and the visibility, as well as the temperature and humidity (which together determine the water vapour content in grams per cubic metre), varied considerably. However, an average 50 miles (very clear) visibility existed in general for the Nevada sky, while the average humidity was only about 40%, corresponding to 4 grams per cubic metre of water content at a typical pre-dawn temperature of 10 C. Bikini and Eniwetok Atolls near the equator suffered much less variability in temperature (which is almost always close to 27 C) and humidity (always close to 80%), so they have a usual visibility of 10 miles and a water vapour content of about 21 grams of water vapour per cubic metre.

The Pacific test data (10 miles visibility and 21 grams/cubic meter of water vapour) and the Nevada test data (50 miles visibility and 4 grams/cubic metre of water vapour) therefore represent two useful extremes in thermal radiation transmission: the former applicable for coastal cities and the latter applicable to the drier interior regions of continents like deserts.

The thermal transmission implied by the nuclear test data thermal measurements in the graph above is approximately just $T = \exp(-R/V) = e^{-R/V}$. Although the **Confidental U.S. Department of Defense November 1957 *Capabilities of Atomic Weapons* TM 23-200 Figure 3-5B on page 3-15 gave *air burst* thermal transmission curves that correspond to $T = \exp[-(R/V)^{1/2}]$, and are fairly accurate for distances near the visibility range, i.e. V = R, and were later used in Glasstone 1962/64 for both air and surface bursts, Figure 3-5B gave extremely inaccurate *surface burst* transmission curves because it wrongly assumed on page 3-2 that a surface burst had an average radiating temperature of only 3000 K (compared to 6000 K for an air burst).** Because 3000 K blackbody radiation is almost entirely easily-absorbed infrared radiation, **Figure 3-5B in TM 23-200 for *surface bursts* underestimated thermal transmission greatly,** since it corresponds to $T = \exp[-2(R/V)^{1/2}]$ for surface bursts as compared to $T = \exp[-(R/V)^{1/2}]$ for air bursts. By 1962 it was known from an analysis of nuclear test data that **Figure 3-5B** exaggerated transmission for *surface bursts,* so only the **TM 23-200 curves** for 6000 K blackbody thermal radiation from *air bursts* were presented in Glasstone's *Effects of Nuclear Weapons* 1962/64, and this air burst thermal transmission data was there used for *both* air and surface bursts. The explanation for why the empirical data supports simply T = exp(-R/V) rather than a faster or slower fall at long distances is that there are two competing factors which work in opposite directions at long distances:

(a) the greater the distance, the *more penetrating* the remaining radiation is (because the less penetrating frequencies in the radiation spectrum have *already been absorbed by the intervening air*), which tends to *increase* relative transmission at great distances

and

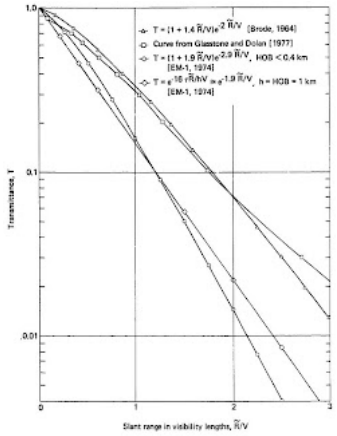
(b) the greater the distance, the greater the build-up of scattered radiation with degraded (lower energy), which gets absorbed more rapidly, tending to *decrease* relative transmission at great distances.

Hence, the filtered-spectrum effect, (a), *increases* the penetrating power of distant thermal radiation, but the build-up of scattered radiation with degraded energy, (b), decreases transmission. Thus, the filtering and scattering transmission effects *offset each other* so that the total transmission remain a simple exponential attenuation law, T = exp(-R/V).

An example of an error in thermal transmission data which completely ignores this phenomenon is **M. G. Gibbons *Transmissivity of the Atmosphere for Thermal Radiation from Nuclear Weapons,* U.S. Naval Radiological Defense Laboratory, report USNRDL-TR-1060, August 1966**, which is a study of transmission based on just a single wavelength of light, 0.65 microns wavelength for free air bursts and 0.55 microns wavelength for surface bursts and tower bursts where the fireball touches the ground. This analysis of transmission of monochromatic (single frequency) light transmission is wrong for nuclear weapons thermal radiation because it ignores the filtering effect [(a) above] of a wide spectrum source, so the only effect differing from exponential attenuation was the build-up of scattered radiation. However, Gibbons claims (providing no evidence or comparison to support his statement, presumably due to classification) that his transmission equation can be made to fit nuclear test data by using suitably selected values for the thermal yield fraction: namely 21% for surface bursts and 33% for air bursts. Gibbons' report **is used by Dolan in the *Thermal Radiation Phenomena* chapter of the 1972-81 versions of DNA-EM-1 *Capabilities of Nuclear Weapons*,** and it is also **cited as the source for thermal transmission graphical data given by Glasstone and Dolan, 1977.**

However, none of these references seem to actually give Gibbons data: Gibbons gives the formula for surface bursts by the equation $T = e^{-2R/V}(1 + 1.4R/V)$ where $e^{-2R/V}$ is for absorption and $(1 + 1.4R/V)$ represents the build-up of scattered radiation. This formula is also given in Brode's 1964 report. Dolan's 1972 EM-1 gives a highly altered version of this: $T = e^{-2.9R/V}(1 + 1.9R/V)$. Notice that both of the numerical factors have been increased by a third or so. **Dolan in 1972 indirectly explains this change in the footnote on page 3-8 of EM-1: the definition of "clear" atmospheric visibility given by Gibbons 12 miles while the revised definition of "clear" atmospheric visibility given by Dolan in EM-1 is 16 miles, one-third greater**. Simply to allow for 33% increase in the numerical definition of the standard average "clear" visibility range, **Dolan in 1972 revised Gibbons' formula $T = e^{-2R/V}(1 + 1.4R/V)$ by increasing the numerical coefficients to incorporate the redefinition of "visibility", giving the new formula: $T = e^{-2.9R/V}(1 + 1.9R/V)$.**

Glasstone and Dolan's ***The Effects of Nuclear Weapons,* 1977, reverts specifies Gibbons 1966 range of 12 miles for "clear" visibility, rather than Dolan's 1972 EM-1 value of 16 miles**. The transmission data given in Glasstone and Dolan 1977 is closer to Gibbons' 1966 original formula than to Dolan's 1972 EM-1 formula:



Above: thermal transmission data for nuclear explosions from **Dr Harold L. Brode and Richard D. Small, *Fire Damage and Strategic Targeting*, Pacific-Sierra Research Corporation, Los Angeles, California, Defense Nuclear Agency report DNA-TR-84-272 (1 June 1984), accession number ADA159280** which is partly discussed near the end of the post **http://glasstone.blogspot.com/2006/08/nuclear-weapons-1st-edition-1956-by.html**.

Professor Charles J. Bridgman in his book *Introduction to the Physics of Nuclear Weapons Effects,* Defense Threat Reduction Agency, 2001, pages 252-4, presents data for thermal transmission from **James M. Leonard's 1985 Air Force Institute of Technology MSc thesis, *Nuclear Thermal Transmittance in the Atmosphere Using LOWTRAN-6 Computer Code,* Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering, report AFIT/GNE/ENP/85M-13, also AD-A154 669/6**, which is a theoretical computer calculation of transmission using the known properties of air to absorb different components of the thermal spectrum. For a distance equal to the visibility range (i.e., for V = R), a surface burst and a target on the ground, Bridgman's curves based on Leonard's report all show only 7% transmission. The Pacific nuclear test data of indicate a transmission of 37% for this situation of V = R.

It turns out that this large difference is due mainly to the vertical height of several kilometres for the fireballs in the megaton range Pacific tests, which allowed much of the thermal radiation transmission path to a distant target to be through air of lower water vapour concentration than the sea level air, but also partly to the channelling of thermal radiation between the reflective ocean and the base of the cloud cover in the sky above the fireball in some tests. These effects of source altitude (e.g. vertical fireball height for a high yield surface burst) and channelling between a reflective ground or ocean surface and the base of a layer of cloud cover, are revealed by the graphs in Figures 39-44 published in the revision to DNA-EM-1 made in report **DNA-TR-84-388**, which we will discuss in detail next.

DNA-EM-1 thermal transmission formulae were updated in the 1980s as a result of a study by John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, available as **ADA176959**, November 1984: 'This report covers a review of the present procedures employed by the Army in calculating thermal transmissivity. As result of the analysis it was determined that the present approach does not accurately predict the transmissivity. The report discusses a comparison between the present methodology and that employed in the revised DNA EM-1 handbook. A procedure is recommended which will correct existing deficiencies.'

This 136-page long report compares **George F. Riley's report, *Empirical Determination of Scattered Light Transport Through the Lower Atmosphere,* U.S. Air Force Cambridge Research Laboratory, AFCRL-68-0256, AD0673999, May 1965** and the **U.K. Atomic Weapons Research Establishment report AWRE-O28/75 (1975), *Thermal transmissivities in North-West Europe,*** with a rigorous theoretical thermal radiation emission and transmission analysis method developed by Kaman Sciences Corporation as an update to Dolan's DNA-EM-1 *Capabilities of Nuclear Weapons.* It summarizes all of the new revisions (including thermal partitions, thermal output curves as a function of yield, height of burst, and interaction of the fireball with the surface, as well as thermal transmission through the atmosphere) made to the updated thermal radiation phenomena chapter of Dolan's DNA-EM-1, although its main focus is on the prediction of thermal transmission from tactical nuclear explosions by the U.S. Army to order to defend Northwest Europe (specifically giving data for Germany and Britain) in the event of a Russian invasion, like the invasion of Afghanistan in 1979.

For Britain, it gives a mean atmospheric H_2O content of 3.467 g/m^3 for the cold, dry fall-winter seasons (falling exponentially with increasing altitude, so that at 5 km height the concentration is 9.2 times lower), and 13.87 g/m^3 for the warmer and hence more humid spring-summer seasons (falling with increasing altitude by a factor of 14 at a height of 5 km). The all-year mean sea level water content of the atmosphere in the U.K. is therefore about 8.7 g/m^3. The CO_2 content of the atmosphere is assumed to be 0.0314% irrespective of altitude. Kaman Sciences Corporation (KSC) developed the TRAX computer code with 18 wavelength bands from 0.25-3.8 microns to accurately evaluate atmospheric transmission with infrared absorption by H_2O, CO_2 and CH_4, ultraviolet absorption by O_2 and O_3, and absorption and scattering by atmospheric dusts and aerosols. [For some background research on this, see: **Ralph G. Eldridge and John C. Johnson, "Distribution of Irradiance in Haze and Fog," *Journal of the Optical Society of America,* vol. 52, pp. 787-791 (1962)**; **Matthew G. Gibbons, Frank I. Laughridge, John R. Nichols, and Nicholas A. Krause, "Transmission and Scattering Properties of a Nevada Desert Atmosphere under Cloudy Conditions," *Journal of the Optical Society of America,* vol. 52, 38-39 (1962)**; and **A. K. Ghosh, "Effect of Scattering by Haze on the Spectral Distribution of Light and Its Colour Coordinates", *Proceedings of the Indian***

***National Science Academy,* vol. 39A, pp. 348-63 (1973).**]

It also includes a proper treatment of the reflection of scattered and direct radiations by various types of ground surface and by a cloud layer at various altitudes. It begins by updating the theoretical models used to calculate fireball phenomenology and the emission of nuclear weapons thermal radiation.

Discussion of detailed thermal revisions presented in John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388 (1984)

One of the most important things this report presents is the disclosure that the time to the final peak radiating power was underestimated by the 1960s and 1970s computer simulations of nuclear fireballs, because although those computer codes included fireball opacity due to air ionization, they failed to include the extra opacity due to the presence of the bomb debris which soon mixes with the ionized air in the fireball, slowing down the rate that thermal radiation is emitted from the surface of the fireball, and protracting the duration of the thermal pulse while reducing the effective radiating temperature and the thermal power. (Similarly, the soil or other surface material incorporated within the fireball in a surface burst increases the opacity, slowing thermal emission, reducing the radiating power and increasing the time to final thermal maximum, as the report states on page 45: "The surface burst has a much smaller second [final] thermal power maximum and a somewhat longer time to second [final] maximum [than an air burst near sea level].")

Page 31:

"The basic data used in the free air burst model are based upon a set of four detailed theoretical radiation-hydrodynamic code calculations run with the RHGEN code at yields of 4, 14, 100, and 6600 kt. The first three correspond to three U.S. nuclear atmospheric bursts which have been measured and analyzed in great detail. The RHGEN code contains the latest air opacity data, a realistic [bomb] debris mixing model and an improved technique for shock front location which is necesssary to provide good definition of the early time pulse characteristics. The [bomb] debris mixing model was found to be necessary to provide good comparisons with measured second maxima times and powers [the earlier version of the fireball thermal emission theory, which omitted the mixing of debris with the ionized air in the fireball, did not fit nuclear test data well, as shown in Dolan's 1972 DNA-EM-1 comparison curves].

"... The increased opacity due to the [bomb] debris contribution seems to slow the radial heat flow near the time of minimum, increases the pressure in the fireball, causing a continued expansion with a resulting delay in the time of second maximum. The increased opacity causes an increase in the effective fireball radius, a decrease in the effective temperature, and a lower power.

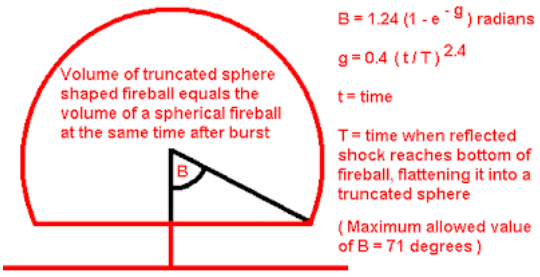
"... The time of breakaway is about one-third that of minimum so that a very small amount of energy is released prior to this time [thus the final pulse is the most important for thermal emission calculations]."

Page 33:

"The surface burst model is based to a large extent on analysis of nuclear test results because of the difficulty in representing the experimental results entirely from theoretical results ... For times through minimum the fireball development is the same as that for a free air burst but with a different effective yield. The parameters needed to obtain the spectral power at the later times were determined from experimental data. ...

"If the fireball contacts the surface prior to shock formation, the low altitude air burst is [then] transformed into a surface burst. The spectral power computed in the code always refers to that radiated from a sphere. For the surface burst an effective yield factor of 1.96 is used ... [Diagrams show the fireball from a low air burst expanding spherically until it intersects the ground, after which it reflects off the grouns, becoming effectively a hemisphere as in a surface burst, when the fireball radius exceeds about twice the altitude of burst.]"

On pages 35-7, a model is given for the interaction of the air burst with the surface in the event that the contact of occurs *after* the shock wave has formed: "negligible energy is transmitted to the surface". The shock wave simply bounces off the ground and flattens the base of the fireball, so that the fireball changes shape into a truncated sphere (for nuclear test data on this effect, see **Eric M. Jones and Jeffrey D. Colvin, *Fireball Shape as a Height-of-Burst Diagnostic,* Los Alamos report LA-7833-MS, 1979**):



John R. Keith and Anthony F. Portare, An Analysis of Army Thermal Transmissivity Calculations, Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388 (1984)

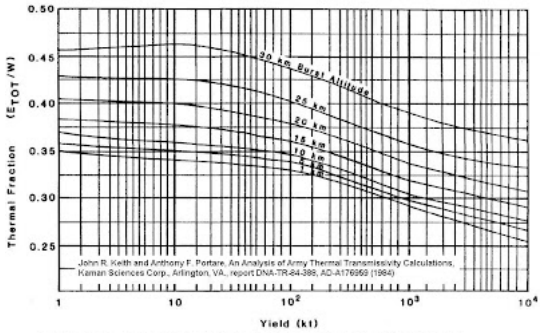


Figure 12. Thermal Yield Fraction as a Function of Burst Altitude and Yield (Yield Contours)
(Source: Hillendahl, 1980; EM-1 Date: February 1982)

Above: Fig. 12 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). According to page 39 of the report, these are the air burst thermal yields radiated up to a time of 10 times the time of the final thermal maximum ($10t_{2nd\ max.}$) as a function of weapon yield and burst altitude: "A general downward trend is noted with increasing yield." This reduction of thermal yield fraction with increasing total weapon yield is the opposite of Harold L. Brode's theoretical emission equation in his 1968 *Annual Review of Nuclear Science* article "Review of Nuclear Weapons Effects".

Brode's incorrect conclusion (in simple radiative cooling models that ignore convective cooling and the engulfment of cold air) that the thermal yield fraction increases with increasing total yield, seemed to be justified by the simple fact that the concentration of nitrogen dioxide in the shock front that shields thermal emission from the hot fireball is dependent on overpressure.

This suggests that the distance of any given amount of nitrogen dioxide shielding should scale as the cube-root of the total yield, whereas the fireball radius at final thermal maximum scales as the two-fifths power of the total yield.

Consequently, as the total yield increases, a there should be a reduction in the shielding by the nitrogen dioxide, which as the total yield increases, extends to an ever smaller fraction of the fireball radius at second maximum. The fireball radius at second thermal maximum increases relative to the nitrogen dioxide shielding layer radius as the total yield increases, thus increasing the thermal yield fraction emitted up to that time as a function of total yield, because of the reduced shielding by nitrogen dioxide at higher yields.

However, this argument is only applicable during the period that nitrogen dioxide shock wave shielding of fireball core emission is important, i.e. only up to the final thermal maximum power, by which time about 20-30% of the thermal radiation is emitted. Since 70-80% of the thermal radiation is emitted after the time of the final thermal maximum power, the nitrogen dioxide shielding effect is not important in the late stages. Brode's 1960s calculations of thermal radiation emission from the fireball *omitted* the effect of fireball cooling by engulfing cold air (in an air burst) and soil (in a surface burst) from the environment. Due to the inertia of air, these convection cooling effects take time to come into play and so are relatively more important in the case of megaton yields (which emit significant thermal radiation over a long period of many seconds) than kiloton yields, where most of the thermal radiation is radiated within a second, before efficient convection cooling starts. Hence, for higher yield nuclear weapons, convection cooling by the entrainment of cold air and (in the case of a surface burst) soil, quickly cools the fireball after the time of thermal maximum and reduces the fraction of the total yield emitted as thermal radiation in an air burst. The $10t_{2nd\ max.}$ thermal yield fraction for a sea-level air density free air burst falls from 35.0% at 1 kt to 34.1% at 10 kt, 33.0% at 100 kt, 29.1% at 1 Mt and to 25.4% at 10 Mt (source: DNA-TR-84-388, AD-A176959, 1984, Table 6, page 42).

In a surface burst, the thermal yield trend as a function of total yield is the opposite to that in a free air burst, because the crater ejecta throw-out shields thermal radiation emission from the fireball more effectively at low yields than at high yields. The radius for any given degree of thermal radiation shielding by crater ejecta scales as the cube-root of yield at sub-kiloton total yields and typically as the quarter-power of total yield for the megaton yield range; thus it is always scaling as a weaker function of total yield than the fireball radius at final thermal maximum, which scales as the two-fifths power of yield. Hence, more of the fireball thermal radiation gets shielded by crater ejecta throw-out in low yield surface bursts than in high yield surface bursts. This makes the thermal yield fraction in a surface burst increase from 4.5% at 1 kt to 6.6% at 10 kt, 13% at 100 kt, 16% at 1 Mt, and 17% at 10 Mt (source: DNA-TR-84-388, AD-A176959, 1984, Table 6, page 42).

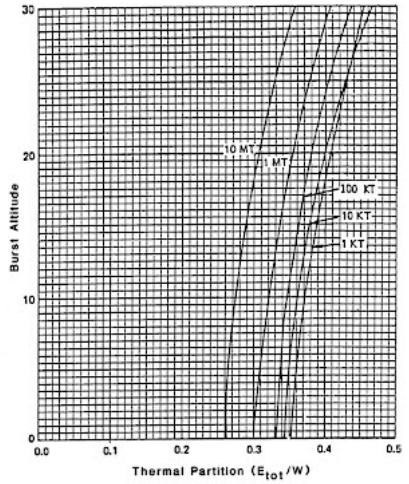


Figure 13. Thermal Yield Fraction as a Function of Burst Altitude and Yield (Altitude Contours)
(Source: Hillendahl, 1980: EM-1 Date: February 1982)

Above: Fig. 13 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). According to page 39 of the report, these are the air burst thermal yields radiated up to a time of 10 times the time of the final thermal maximum ($10t_{2nd\ max.}$) as a function of weapon yield and burst altitude: "A general downward trend is noted with increasing yield."

Table 6. Thermal Partition for Near-Surface Bursts.

John R. Keith and Anthony F. Portare, An Analysis of Army Thermal Transmissivity Calculations, Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984)

	Surface Burst	Non-Surface Burst	Transition
Yield (KT)	Partition (Fraction)	Partition (Fraction)	Height (Meters)
1	0.045	0.350	4
10	0.066	0.341	8.6
100	0.13	0.330	18.5
1000	0.16	0.291	40
10000	0.17	0.254	86

Above: Table 6 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). According to page 39 of the report, these are the thermal yields radiated up to a time of 10 times the time of the final thermal maximum ($10t_{2nd\ max.}$). Notice that, as we have explained physically, the sea-level *air burst* thermal yield fraction *decreases* with increasing total yield because more and more of the cooling is done by convection mixing processes rather than by radiation in the longer thermal pulse of higher yields, while in a *surface burst* the thermal yield fraction *increases* with increasing total yield, because the crater ejecta throw-out radii which absorb much thermal radiation in a surface burst scale less rapidly (i.e., as the cube or fourth root) with total yield than does the fireball radius at final thermal peak power (i.e., the two-fifths power of yield).

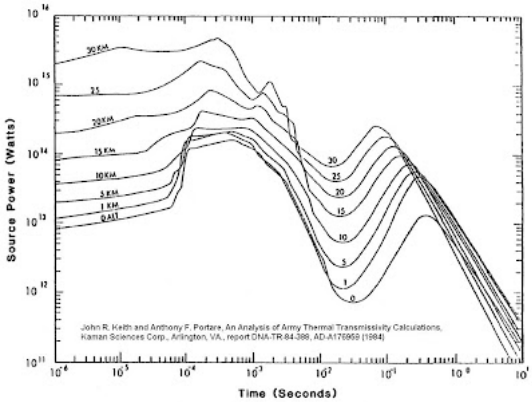


Figure 14. Effect of Altitude on Total Thermal Power, 100-Kiloton Burst.

Above: Fig. 14 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). This diagram shows the effect of burst altitude from sea level to 30 km upon the thermal pulse curve shape for a 100 kt air burst. The report notes that a surface burst thermal power curve is not identical to a sea level air burst, but on account of the extra opacity of the fireball due to the earth incorporated from the crater process, the surface burst thermal curve has a much smaller final thermal maximum radiating power. The surface burst fireball also takes a slightly longer time to reach the final peak thermal emission, than an equivalent yield sea level air density air burst.

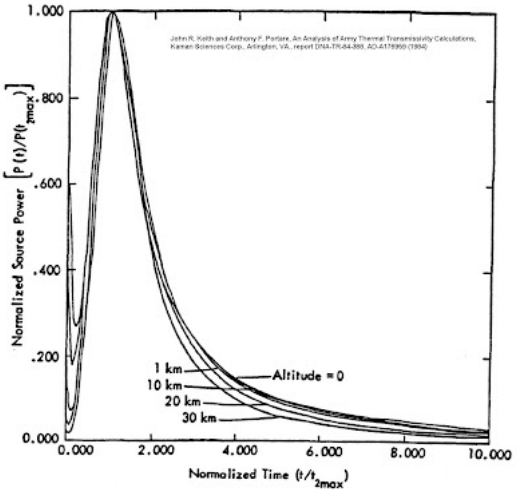


Figure 15. Effect of Altitude on Thermal Power Pulse Shape, 100 Kilotons.

Above: Fig. 15 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). This diagram is a linear version of the logarithmic plots in Fig. 14, showing how the shape of the standard thermal pulse curve depends on burst altitude for air bursts of 100 kt total yield.

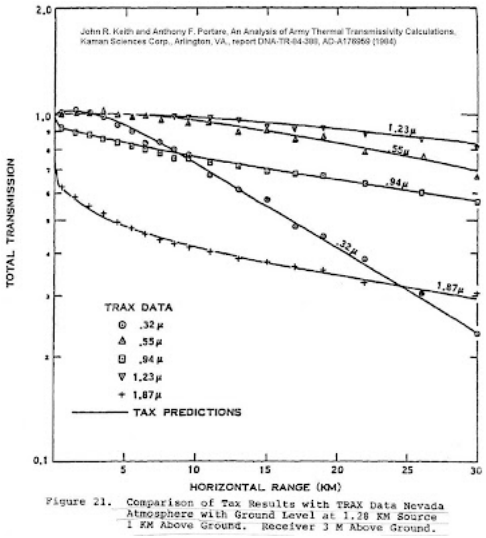


Figure 21. Comparison of Tax Results with TRAX Data Nevada Atmosphere with Ground Level at 1.28 KM Source 1 KM Above Ground. Receiver 3 M Above Ground.

Above: Fig. 21 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). This diagram shows how the different wavelengths in the thermal radiation spectrum, from 0.32 micron ultraviolet to 1.87 micron infrared, are transmitted through a standard Nevada desert atmosphere for an air burst 1 km above ground (or a megaton range surface burst fireball with a radius of over 2 km, so that the mean height of the radiating surface is 1 km above ground) with ground level taken to 1.28 km above sea level. The data come from Kaman Science Corporation's TRAX Monte Carlo simulation code for atmospheric transmission. Notice that the 0.32 micron curve for ultraviolet shows rapid attenuation due to absorption by natural ozone in the atmosphere, and the 1.87 micron infrared curve shows absorption by water vapour and carbon dioxide; but the shape of the transmission curves for ultraviolet and infrared are totally different (each departs from a straight line exponential attenuation law by curving in a different direction from a straight line, so that the average would be close to a straight line and thus a simple exponential attenuation law). Because the transmission fraction is a logarithmic plot while distance is linear plot, a straight-line transmission on this graph represents exponential attenuation and a curve represents a departure from exponential attenuation. The data for the wavelengths between the extremes, i.e. 0.55, 0.94, and 1.23 microns, all show much less attenuation as they are closer to (or within) the visible radiation band. The 0.55-micron curve shows a transmission of 70% to a horizontal range of 30 km. If this is treated as an exponential absorption with the typical Nevada desert visibility range of 80 km, then the Nevada nuclear test data thermal radiation transmission, $T = e^{-R/V} = e^{-30/80} = 0.69$, is similar to the 0.55-micron wavelength transmission predictions. However, this simplified approach (used in the 1960s by Gibbons) would not be justified because it would properly take account of the effect of atmospheric water vapour of air near sea level on the infrared radiation transmission.

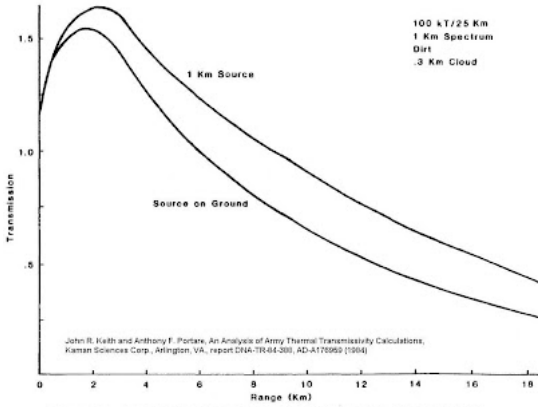


Figure 39. Effect of Source Altitude on Transmission Predictions.

Above: Fig. 39 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). Transmission for a surface burst and a 1 km altitude air burst (or a high yield surface burst where the mean height of the hemispherical fireball radiating surface is 1 km high) for sandy soil ground, 300 m base altitude cloud cover, and 25 km atmospheric visibility (1.5 g/m^3 of sea level water vapour concentration). This report proves that the effect of the fireball radiating temperature on changing the source spectra of the thermal radiation as a function of weapon yield and for ground interaction is negligible in comparison to the effect of the height of the fireball. The thermal transmission as a function of distance is similar for different yields if the effective fireball height above the ground is the same. It is also similar for a surface burst and a sea level air burst (although obviously the thermal yield will be different in each case) if the mean height of the fireball is the same. However, varying the height of the centre of the radiating surface of the fireball causes a large change in the thermal transmission curve, mainly as a result of the variation in the water vapour content of the air as a function of height. The cooler air at higher altitudes contains less water vapour and therefore allows more transmission of infrared radiation than sea level air.

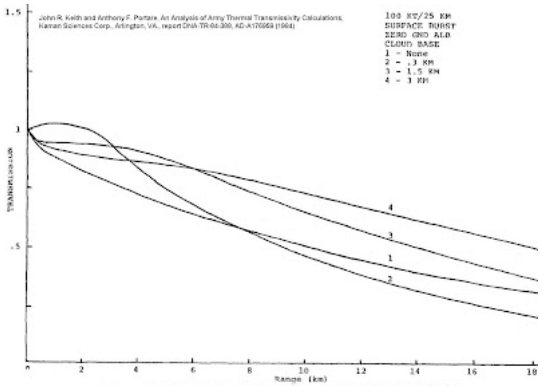


Figure 40. Effects of Cloud Ceiling Altitudes on the Transmission for Zero Ground Albedo.

Above: Fig. 40 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). Thermal transmission from a 100 kt surface burst with the fireball at ground level for a hypothetical dark, zero albedo ground, i.e. a totally radiation absorbing, non-reflective ground which does not reflect any of the thermal radiation, for no cloud cover (curve 1) and cloud cover with its base at altitudes of 300 m (curve 2), 1,500 m (curve 3) and 3,000 m (curve 4), with in each case 25 km atmospheric visibility (1.5 g/m^3 of sea level water vapour concentration). Curve 1 therefore presents the case where the transmission is purely a function of the air characteristics, without any ground or cloud reflection effects.

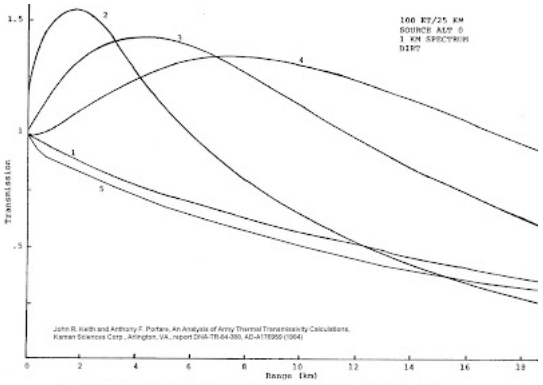


Figure 41. Effect of Cloud Ceiling Altitude on the Transmission for Dirt Ground Surface.

Above: Fig. 41 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). Thermal transmission from a 100 kt surface

burst with the fireball at ground level for a sandy soil, for no cloud cover (curve 1) and cloud cover with its base at altitudes of 300 m (curve 2), 1,500 m (curve 3) and 3,000 m (curve 4), with in each case 25 km atmospheric visibility (1.5 g/m^3 of sea level water vapour concentration). Curve 1 therefore presents the case where the transmission is purely a function of the air characteristics and ground reflection, with no cloud reflection effects. We have added curve 5 (which is curve 1 from Fig. 40 already given, for a non-reflecting ground and no cloud cover) to show the small effect of the ground reflection on transmission. It is clear that when both ground reflection and cloud reflection occur, the surfaces act like a waveguide for thermal radiation energy, whose transmission is enhanced by “channelling” of thermal energy.

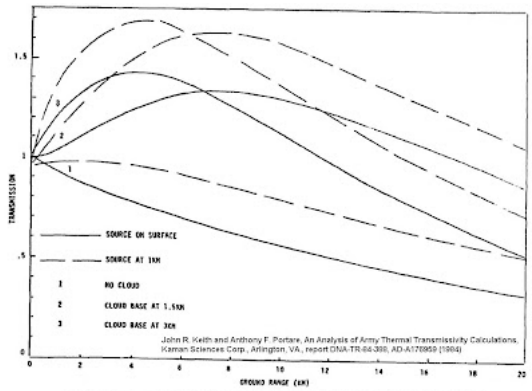


Figure 43. Effect of Burst Altitude on Transmission with Albedo Surfaces.

Above: Fig. 43 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). Thermal transmission for a sandy soil, for no cloud cover (curve 1) and cloud cover with its base at altitudes of 1,500 m (curves 2), 1,500 m (curves 3) and 3,000 m (curves 3), with in each case 25 km atmospheric visibility (1.5 g/m^3 of sea level water vapour concentration). High level clouds above the nuclear explosion can enhance thermal transmission, by reflecting back to the ground some of the thermal radiation that would otherwise be lost to space. But when a nuclear explosion occurs in or above a cloud layer, or above a smoke screen, the opposite effect occurs and the thermal radiation is shielded and attenuated to a considerable extent prior to reaching a target. During Pacific nuclear tests of air and high altitude bursts in 1958 and 1962, cloud cover over ground zero was either required as a condition for firing, or alternatively was provided artificially by smoke screen generators in order to prevent any risk of injury to the dark coloured terns. Similarly, for the very high altitude tests in 1962 where the fireballs would be above the horizon as viewed from the Hawaiian islands 1,300 km always, firing was only authorized when there was low-level local cloud cover over the Hawaiian islands to protect the public from any risk of retinal injury. Nevada tests in 1955 over smoke screens demonstrated the value of smoke clouds in attenuating thermal radiation from nuclear weapons. The 110 kt 1954 *CASTLE-KOON* test at Bikini Atoll was detonated in a rainstorm with very low visibility, and thermal radiation effects were undetectable at the measuring stations.

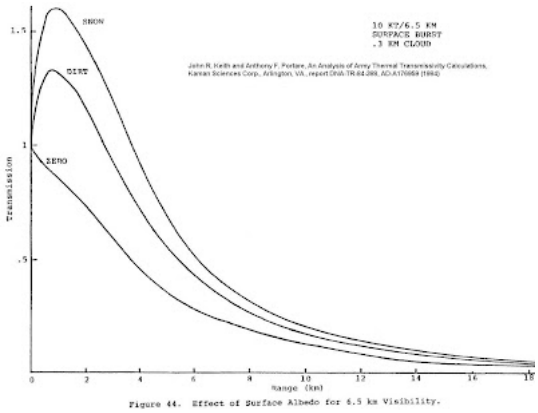
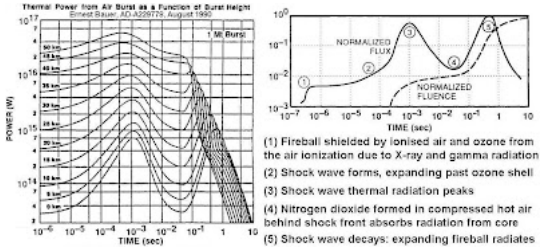


Figure 44. Effect of Surface Albedo for 6.5 km Visibility.

Above: Fig. 44 from John R. Keith and Anthony F. Portare, *An Analysis of Army Thermal Transmissivity Calculations,* Kaman Sciences Corp., Arlington, VA., report DNA-TR-84-388, AD-A176959 (1984). Thermal transmission in 6.5 km atmospheric visibility (10 g/m^3 of sea level water vapour concentration) for a 10 kt surface burst with 300 m base cloud cover and three different ground surface reflections: zero reflection, dirt (sandy soil), and snow. Comparisons of these curves to those of the previous figure prove that the ground reflection characteristics are much less important in determining thermal radiation transmission than the atmospheric visibility, the fireball altitude, and the cloud cover situation. The curve for dirt (sandy soil) with 6.5 km visibility due to 10 g/m^3 of sea level water vapour concentration in the air and cloud cover with its base at 300 m represents the mean transmission to be expected for thermal radiation in the U.K. and other areas of Northwest Europe, as shown by statistical data in DNA-TR-84-388, AD-A176959 (1984).



Above: **Ernest Bauer's August 1990 Institute for Defense Analyses report, *Physics of High-Temperature Air. Part. 2. Applications,* ADA229778,** contains a useful section summarising a little of the available nuclear testing data on the mass of fallout as a function of burst altitude for surface bursts, free air bursts, and tower burst nuclear weapons tests, as well as the family of computed curves above showing the transition from a single thermal pulse for a 1 Mt air burst at 50 km altitude to a double-pulse for a 1 Mt sea level air burst. The main reason for the transition is the weakening of the shock wave due to the lower air density at higher altitudes: the lower air density at high altitudes simply allows the X-rays (which comprise 75% of the primary energy emission from a typical 1 ton mass, 1 megaton yield detonation) to travel much larger distances before being absorbed by the air.

This means that same amount of energy is spread over a larger volume of air in a high altitude burst, so the energy density (energy per unit volume) in the fireball is lower than it is for the tiny initial X-ray fireball at sea level, and this lower energy density produces a smaller temperature rise, and thus a weaker blast wave. This weaker blast wave at high altitudes is unable to compress air to a high enough density to form the concentrations of nitrogen dioxide that shield thermal radiation after shock formation in a sea level detonation. The nitrogen dioxide formed in the shock wave from compressed hot air absorbs the thermal radiation from the fireball core in a sea level detonation, causing the minimum and thus the two pulses, but nitrogen dioxide is not formed in a high altitude burst because the shock wave is not strong enough to produce it, hence the thermal minimum gradually disappears as the burst height is increased, merging the two pulses together into a single pulse for a 1 Mt detonation at 50 km altitude.

For eye retinal burns data from nuclear weapon test accidents and experiments, see **AD742837** and for theoretical estimates see **AD0668549**.

Chapter 4: X-Ray Radiation Phenomena

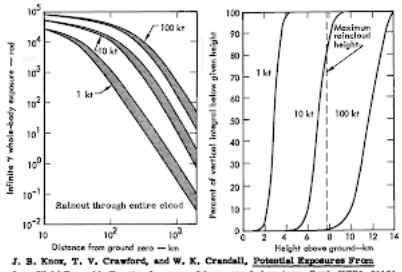
***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 4. X-Ray Radiation Phenomena.* 38 pages, July 1978, AD-A955388**.

Treatment of X-ray radiation output from nuclear weapons of different designs, from 'cold' (1 keV initial radiating temperature, high mass-to-yield ratio designs) to 'hot' (10 keV, low mass-to-yield ratio) X-ray weapons, from the perspective of the use of X-rays by ABM warheads to damage missiles in space by the recoil from ablation. Since recoil forces from ablation caused by X-rays from a fission primary bomb are used to compress and heat fusion materials in Teller-Ulam weapons, this chapter is best not discussed in detail. The enhanced neutron weapon is employed in ABM warheads to melt down the fissile material inside the warheads of incoming ICBMs by using neutrons. The weight of useful neutron shields for high-energy neutron exposure to ICBM warheads is prohibitive in terms of the numbers and sizes of warheads and decoys that ICBMs can carry.

Chapter 5: Nuclear Radiation Phenomena

***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 5. Nuclear Radiation Phenomena.* 152 pages, July 1978, AD-A955389, 4.6 MB PDF file**

This chapter provides initial nuclear radiation predictions in detail for eight different designs of weapons including the neutron bomb, the detailed neutron induced activity from an air burst over various types of soil, the radiation dose prediction for 1 kt, 10 kt and 100 kt yield underwater nuclear explosions of various yields for various wind and ocean water current conditions, and the accurate prediction of fallout patterns for various wind speeds - the more detailed and accurate basis for the far more simplified and approximate scaling system provided in Glasstone and Dolan, *Effects of Nuclear Weapons,* 1977. (After 1984, the 8 categories of nuclear weapon design used from 1972-84 for predicting initial nuclear radiation outputs, was extended to 13 categories; modern nuclear weapons have far less high explosive and tamper thicknesses and generally emit far more initial radiation than did the heavy Nagasaki bomb.) It also discusses detailed predictions of water surface burst fallout and rainout dose hazards from air bursts where part of the mushroom cloud encounters a rainstorm, which is particularly important in lower yield nuclear detonations below 60 kt, where the cloud height is not too high and so is more likely to mix with the rain-making parts of rainclouds or thunderstorms. The updated August 1981 page changes to this chapter provide detailed quantitative predictions of rainout doses.

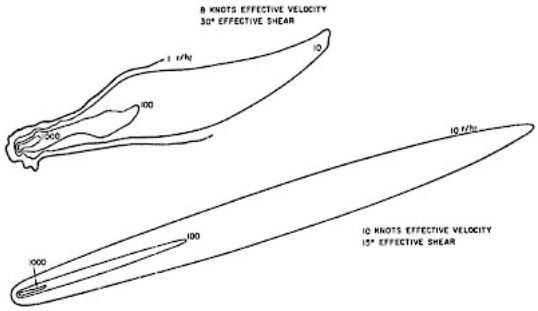


J. B. Knox, T. V. Crawford, and W. K. Crandall, Potential Exposures From Low-Yield Free-Air Bursts, Lawrence Livermore Laboratory, Rept. UCRL-51164 (1971).

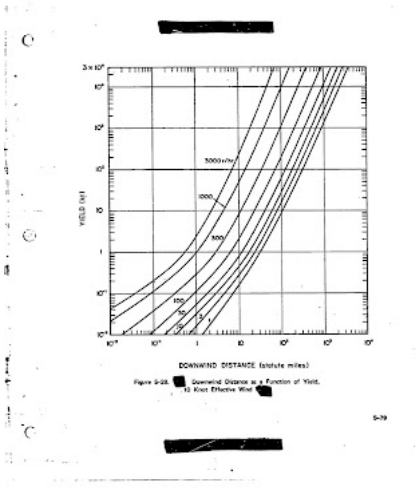
Yield (kt)	Fraction deposited (%)	Distance downwind (km)	Infinite whole-body external γ dose (rem)	External γ exposure rate at time of arrival (R/hr)
1	100	10	25,000	25,000
		100	400–1200	35–100
10	10	10	5000	7000
		100	1000–1500	150–200
100	1	10	800	1200
		100	300–350	45–55

W. K. Crandall, C. R. Molenkamp, A. L. Williams, M. M. Fulk, R. Lange, and J. B. Knox, An Investigation of Scavenging of Radioactivity from Nuclear Debris Clouds: Research in Progress, Lawrence Livermore Laboratory, Rept. UCRL-51328 (1973).

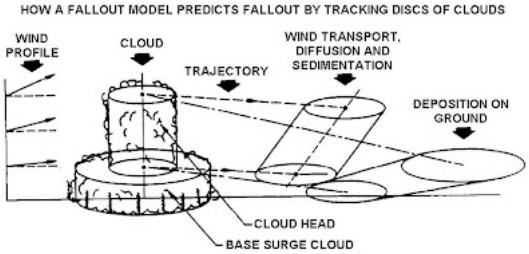
One of the great strengths of Dolan's revision of *Capabilities of Nuclear Weapons* was the move away from scaling American test data and trying to check the validity against independent British fallout data, to use instead a computer fallout prediction system called DELFIC (DEfense Land Fallout Interpretative Code) based on theoretical physics and chemistry, and compare those purely theoretical predictions (which calculates cloud rise based on the empirically-justified assumption that 45% of the detonation energy is waste heat left in the hot air behind the shock wave, which gets drawn into the fireball by the reversed winds, causing the mushroom cloud to rise buoyantly as soon as the fireball reaches pressure equilibrium with the surrounding atmosphere). DELFIC fundamentals are **summarized in the PDF report here**.



Above: Dolan's comparison of a DELFIC-derived idealized gamma dose rate fallout pattern with the observed fallout from the 1.65 kt Nevada 1962 surface burst *Small Boy*, in ***Capabilities of Nuclear Weapons* DNA-EM-1, 1972, page 5-69** (R/hr at 1 hour after detonation). The *Small Boy* test fallout situation had an effective wind velocity of 8 knots and an effective wind directional shear of 30 degrees between the ground and cloud top. The idealized prediction is for 10 knots and 15 degrees shear, and includes corrections for terrain shielding and instrument response. The *measured* 10 R/hr contour extended for 9 statute miles downwind from ground zero. The agreement between the **DELFIC-based** idealized prediction and data is good, taking account of the differences in windshear and wind speed.

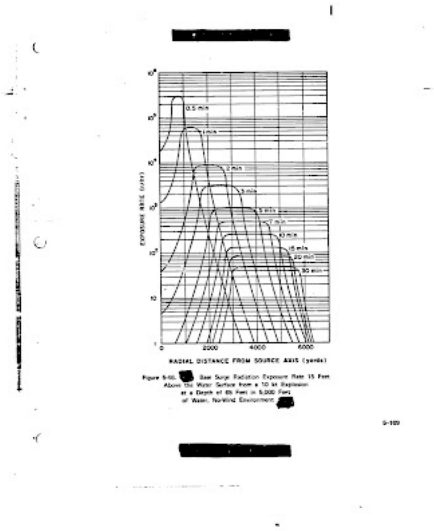


Above: 1 hour reference time (assuming fallout is deposited by then, which is not the case for large yields) gamma ideal plane fallout dose rates from **DELFIC calculations,** as predicted in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**. DELFIC calculations used a lognormal particle size-activity distribution (median radius 123 microns), based on ground-collected fallout from the *Teapot-Ess* shallow underground test.



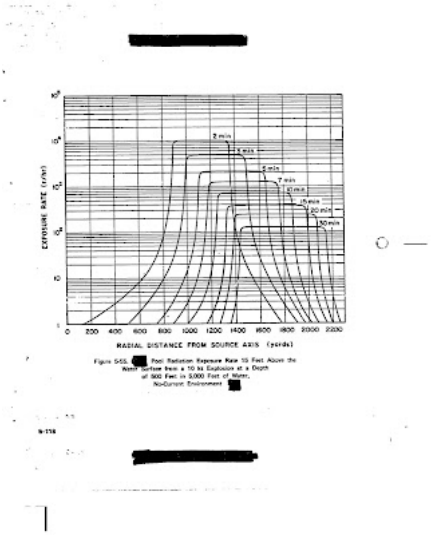
T. Harvey, et al., 'KDFOC3: A Nuclear Fallout Assessment Capability', Lawrence Livermore National Laboratory, report UCRL-TM-222788 (1992)

The **later March 1990 revision of the DNA-EM-1 *Nuclear Radiation Phenomena* chapter (AD-C045890) is based on DNAF-1, which provides curves for yields of 0.003 kt - 100 Mt and winds of 0.5-100 m/s, and gives a catalogue of 27 precalculated fallout patterns covering 9 different yields and 3 different wind speeds**. DNAF-1 is a simplified version of DELFIC, using a fixed fission product bomb deposit activity to gamma dose rate conversion factor of 6,973 (R/hr)/(kt/km^2) for ideal surfaces; substantially higher than the figure of 5,180, used in the WSEG-10 fallout model, but lower than the figure of 7,770 used in the SEER3 model. However, it should be noted that fallout analyst Dr R. Robert Rapp of the RAND Corporation in his December 1966 report RM-5164-PR, *An Error in the Prediction of Fallout Radiation,* argued for a figure of only 2,300 (R/hr)/(kt/km^2) from the 1.2 kt Nevada 1951 *Jangle-Sugar* surface burst data (see **A. Schiff, *Problems with Predicting Fallout Radiation Hazard in Tactical Battlefield Situations,* Lawrence Livermore National Laboratory report UCRL-51440, ADA385024, 1973, page 12**). The *Effects of Nuclear Weapons* 1957, 1962/64 and 1977 use values of about 3,200, 10,000, and 7,500, respectively. (**The effects of terrain roughness, instrument response (in a laboratory calibration a Co-60 source was expose simply the sensor part of the instrument, but in an all-round radiation field some gamma rays were shielded by the instrument battery unit; in addition the response to the mean 1.25 MeV gamma rays of Co-60 is different to the response to typical ~0.5 MeV fallout gamma rays), instrument shielding by the body of the person holding the radiation meter, and fallout composition variations (due to fractionation of fission products and neutron induced activity) are given for a large number of American and British nuclear tests in the report here. Generally the body of the person holding a radiac meter reduces the reading by 25% for gamma radiation from deposited fallout, while terrain irregularities absorb another 25% of the gamma dose that would be received over a smooth infinite contaminated surface**.) DELFIC fission product predicts that fractionation results in an average of 67% of the 1-hour local fallout activity being due to unfractionated (refractory) fission product decay chains (distributed through the volume of molten particles at early times), and predicts that 33% is from volatile decay chains distributed on the surfaces of particles after they have condensed. This leads the DELFIC decay rate calculations to indicate that the local fallout gamma dose rate is proportional to $t^{-1.26}$, which fits DELFIC output to within 10 percent between 15 minutes and 1,000 hours after burst, **which is now used for land surface bursts in the revised March 1990 DNA-EM-1 chapter *Nuclear Radiation Phenomena,* instead of the older $t^{-1.2}$ Way-Wigner decay rule used by Glasstone and Dolan**. The use of the $t^{-1.26}$ decay rate for gamma dose rates from land surface bursts in the revised chapter gives long-term dose predictions slightly smaller than predicted using $t^{-1.2}$. In fact, fractionation varies with particle size and therefore downwind distance (the smaller fallout particles far downwind are less depleted in volatile decay chains, see the reports **here**, **here**, **here**, **here**, **here**, **here** and **here**), which alters the decay rate slightly downwind, and neutron induced activities in fallout also affect the decay rate. The March 1990 revision **includes a better fallout prediction system for shallow underground bursts caused by earth-penetrator warheads which destroy hardened targets by ground shock and cratering action**: see the reports **here** and **here**.



Above: example of an **underwater burst base surge dose rate and expansion prediction** given in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation***

***Phenomena*, August 1981 revision**.



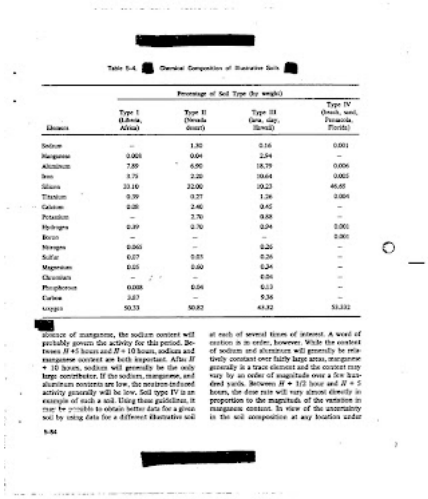
Above: example of **an underwater burst expanding water pool dose rate prediction** given in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**.

Philip J. Dolan's 1972 DNA-EM-1 *Capabilities of Nuclear Weapons* gives a far more complete treatment of all the underwater burst problems than unclassified sources, and older confidental manuals. The final sections of Chapter 2 on blast and shock phenomena (306 pages) includes water shock, base surge, water waves from surface and underwater bursts, and so on, while **chapter 5 on nuclear radiation phenomena** gives computer predictions of base surge and water 'pool' dose rates and accumulated doses for yields of 1, 10 and 100 kt for various depths underwater and proximities of the bomb to the ocean bottom (the 1958 *Umbrella* test was detonated on the seabed, so there is evidence to validate such a preduction). The base surge part of that computer model was developed by I. O. Huebsch of the U.S. Naval Radiological Defense laboratory; see his 106 pages long May 1963 report USNRDL-TR-653, *A Model for Computing Base-Surge Dose-Rate Histories for Underwater Nuclear Bursts* (Confidential-Formerly Restricted Data):

> 'A model for calculating transit-radiation dose rates and doses from the base surge of an underwater nuclear burst is described. Calculated values are compared with measurements made at *Hardtack Wahoo* and *Umbrella, Crossroads Baker,* and *Wigwam,* and with predicted values for two proposed underwater shots. The model is a geometrical-radiological representation of the base surge, whose characteristics depend on weapon yield, burst depth and surface wind speed. The model is estimated to be valid for 1-kt to 100-kt underwater bursts for minimum depths of 20 to 90 ft, respectively, and for times at least 30 seconds after burst. Dose rates and doses can be computed for either fixed or moving points in the radiation field. The comparisons show that the calculated values, in almost all cases, agree within +/- 50% of the measured values. (Abstract UNCLASSIFIED.)'

This base surge radiation model for underwater bursts was later supplemented with a code that predicts dosage from the expanding 'pool' of contaminated water (which is water that has been heated and contaminated with fission products by the pulsating bubble of the detonation as it rises, before erupting through the water). In nuclear tests, underwater radiation probes were able to distinguish this effect from the base surge radiation which was measured by probes above the water. The full computer code was finished in 1968 and is called **'Daedalus' (the 'cunning worker' of Greek mythology**), the underwater equivalent of the land surface burst fallout computer code DELFIC:

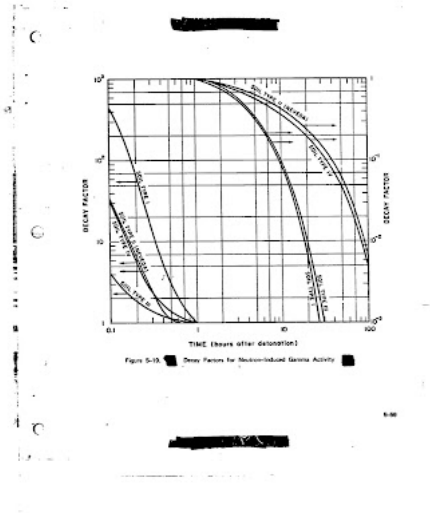
> Edward A. Schuert, et al., *DAEDALUS: A Gamma Exposure Rate Prediction Code for Underwater Nuclear Explosions,* U.S. Naval Radiological Defense Laboratory, report USNRDL-TR-68-137, July 1968, Secret-Formerly Restricted Data.



Above: typical composition of representative soil types for calculating neutron induced activity, given in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**.

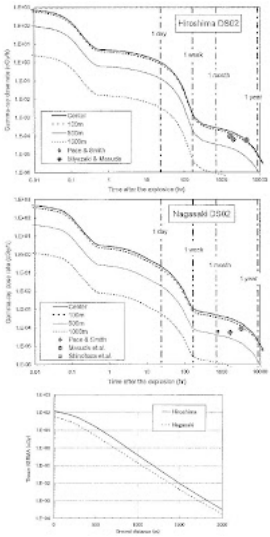
For air bursts that do not produce early fallout unless there is **rainout**, neutron induced activity is treated in detail in Dolan's manual which makes it clear that the gamma dose rate at 1 hour after burst above ground due to neutron induced activity can vary by a factor of 4,540, depending on the amounts of manganese and sodium in the soil. The minimum gamma hazard from neutron induced activity would occur clean Pensacola sand (99.982% pure silicate) which is 0.001% sodium, 0% manganese, and 46.65% silicon by mass. For such almost pure silicate sand, silicon-31 is the only significant gamma dose contributor, although it is trivial in other soils (because they contain higher manganese or soldium levels).

Because there is so little sodium-24 in this soil, Si-31 stands out initially (at 1 hour after burst, 52% of the gamma dose rate would be due to Si-31 with a 2.62 hr half life, and 48% to Na-24 with a 15.0 hr half life). The worst neutron induced activity danger, 4,540 times more intense, would come from Hawaiian lava clay soil, which is 2.94% manganese by mass, resulting in a massive amount of Mn-56 (2.58 hr half life), although no other significant gamma dose contributors. The hazards from all other soils and also from sea water (containing sodium chloride) fall between these two extreme examples, and is mainly due to sodium-24 and manganese-56.



Above: decay rates of the different soil neutron induced activities, given in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**.

The gamma dose rate variations due to the type of soil far outweigh possible variations due to the design of the nuclear weapon used. Hence a reasonable prediction is possible provided that the target is known. The peak neutron induced activity generally occurs at a depth of 6-7 cm so there is considerable self-shielding by the soil which makes the hazard far less than you would naively expect if assuming the activity is in the top surface layer of soil.



Above: neutron induced activity dose rates, decay rates, and doses for Hiroshima and Nagasaki air bursts where fallout was negligible at ground zero ("DS02" indicates 2002 dosimetry system, the latest data). Notice that although the gun-type assembly Hiroshima bomb had a smaller total yield (16 kt), it leaked far more neutrons than the implosion type 21 kt Nagasaki bomb, hence creating more neutron-induced activity in the ground below! This was because the light hydrogen nuclei (protons) predominating in the exploded TNT molecules (surrounding the core of the Nagasaki bomb) slowed down neutrons very efficiently, unlike the case of the steel Hiroshima bomb. In an head-on elastic collision, by the principles of conservation of momentum and energy, a neutron scattered by a proton (hydrogen nucleus) can **lose *all* of its energy (like a head on billiard ball collision!),** whereas a neutron elastically scattered by a heavy nucleus like iron only loses a trivial amount of energy (although in practice, elastic collisions are rare and *inelastic* collisions occur, where the heavy nucleus absorbs more of the energy and then emits that excess energy as a gamma ray). This is why the heavier iron atoms in the steel nose forging of the Hiroshima bomb scattered neutrons without absorbing much neutron energy, whereas the thick TNT layer around the core of the Nagasaki bomb reduced the escaping neutron fluence markedly. *Bomb design details are thus vitally important for accurate neutron induced activity calculations.*

Chapter 6: Transient-Radiation Effects on Electronics (TREE) Phenomena

***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 6. Transient-Radiation Effects on Electronics (TREE) Phenomena.* 16 pages, July 1978, AD-A955390**.

Concerned with close-in intense initial nuclear radiation effects on electronics in missiles subjected to high altitude nuclear explosions from ABM warheads, etc. In November 1990, this material was used to create the new Chapter 22, *Damage to Space Systems*.

Chapter 7: Electromagnetic Pulse (EMP) Phenomena

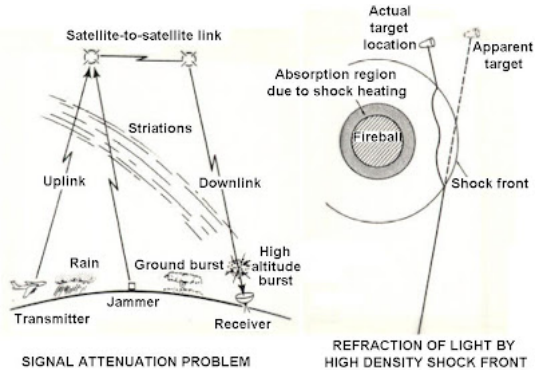
***Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 7. Electromagnetic Pulse (EMP) Phenomena.* 40 pages, July 1978, AD-A955391, 1.3 MB PDF file.**

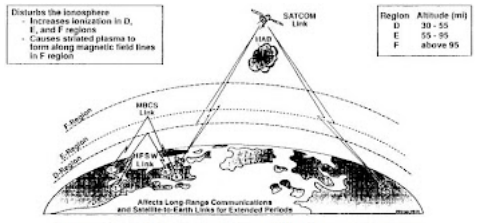
This vital chapter has some graphs deleted for high altitude bursts **which are now available from another document** but provides complete, quantitative surface burst EMP source region data that is lacking from Glasstone and Dolan, 1977. **For example, the July 1978 page changes to this chapter includes graphs (Figures 7-25 to 7-35) showing all of the calculated EMP peak field strengths, including transverse and radial electric field, azimuth magnetic field and air condutivity versus time, for 100 kt and 1 Mt surface bursts compared to the peak air overpressure at the corresponding distances, plus the waveforms for four locations and the frequency spectra derived from the waveforms using Fourier analysis.** The graph showing the radial Compton current in a surface burst has been deleted from the chapter, but it can be seen from another report openly available on surface burst EMP physics: see Fig 3-2 on page 34 of the report by **Conrad L. Longmire and James L. Gilbert, *Theory of EMP Coupling in the Source Region*, Defense Nuclear Agency, report DNA 5687F, DTIC document reference ADA108751**. Also Fig 3-3 on page 37 gives air conductivity, although this data is only partially deleted from DNA-EM-1 Chapter 7, since although one graph of air conductivity versus time at 500 m distance is deleted, another set of curves are included giving air conductivity versus time for four separate distances corresponding to various peak air blast overpressures which include 500 m for the highest intensity. The chapter also gives the data available on prompt gamma ray outputs for different yields of nuclear weapon, showing that the fraction of bomb yield radiated in prompt gamma rays can vary from 0.5% for small inefficient designs to 0.1% for efficient typical megaton yield warheads. **In addition, it shows that the peak E-field at the deposition region radius in a surface burst varies as a weak function of yield, from 1,300 v/m for 1 kt and 1,670 v/m for 10 Mt. The deposition region radius is 5.8 km for 100 kt and 7.2 km for 1 Mt. This deposition region radius is defined by Glasstone and Dolan as the range where the peak air conductivity attained due to ionization is 10^{-7} mho/m (S/m in SI units). The radiated peak electric field outside the deposition region (inside that region the EMP is far more complicated, due to the effect of the air's conductivity on the EMP radiation) at distance *R* from ground zero in a surface burst is $E = E_0(R_0/R)$ volts/metre, where E_0 is the peak electric field at the deposition radius (about 1,650 v/m in a 1 Mt surface burst) and R_0 is the deposition region radius (7.2 km for a 1 Mt surface burst). Hence at 7.2 km from a 1 Mt surface burst, the vertically polarized (horizontally propagating) radiated EMP has a peak electric field strength of 1,650 v/m, and at double that distance the field is half as strong.**

Chapter 8: Phenomena Affecting Electromagnetic Propagation

Capabilities of Nuclear Weapons. Part 1. Phenomenology. Change 1. Chapter 8. Phenomena Affecting Electromagnetic Propagation. **94 pages, July 1978, AD-A955392, 3.6 MB PDF file.** This chapter is **also available here.**

Essential data on fireball rise, expansion and settling back for high altitude bursts, predictions of debris transfer across the magnetic equator to conjugate regions, and the calculation of ionization patch-caused attenuation of radio and radar signals in decibels from these bursts for radio transmissions that require ionospheric reflection or penetration of the ionosphere to reach satellites (uplink), and also the problem of receiving communications from satellites where the transmitter power is limited and can't be increased to overcome attenuation (satellite downlink). **Professor David Jenn gives some extracts from the revised version of this chapter here.** 'Scintillation' is the fading and waveform distortion effect caused by multipath propagation through the striated fireball plasma which has been produced by the interaction of the expanding ionized fireball with the earth's magnetic field.

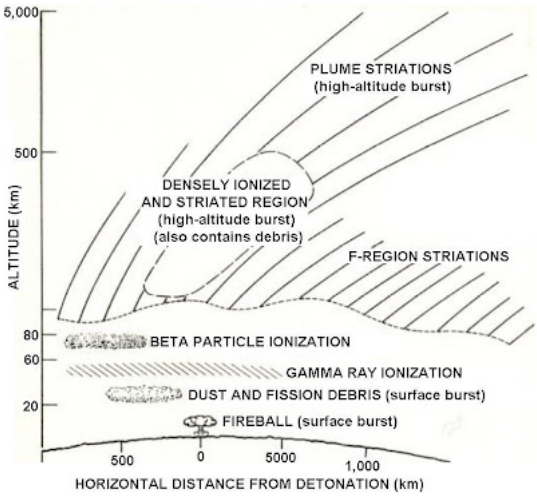




Summary of High-Altitude Nuclear Effects on Military Communication Systems

Band	Mode	Type of Effect	Level of Effect	Duration
VLF 3 kHz–30 kHz	SW	Absorption Phase changes	15 dB > ±2σ	30 min 5 min
LF 30 kHz–300 kHz	SW	Absorption Phase changes	30 dB ~ ±2σ	1 hr 5 min
MF 300 kHz–3 MHz	SW	Absorption	50 dB	4 hr
HF 3 MHz–30 MHz	SW	Absorption	100 dB	8 hr
VHF 30 MHz–300 MHz	MBCS	Absorption Noise	60 dB 10 dB	2 hr days
UHF 300 MHz–3 GHz	TROPOSAT	Noise Absorption Scintillation	6 dB 10 dB 30 dB	30 min 10 min 4 hr
SHF 3 GHz–30 GHz	SAT	Absorption Scintillation	3 dB 10 dB	5 min 2 hr
EHF 30 GHz–300 GHz	SAT	Scintillation	6 dB	30 min

DNA EMP Engineering Handbook for Ground-Based Facilities, Vol. 2 - Design and Engineering, Booz-Allen and Hamilton, Inc., DNA-H-86-60-V2, November 1986.



'For detonations below about 80 km and weapon yields greater than 100 kt, absorption through the fireball is expected to exceed 25 decibels for about 50 seconds at 10 gigahertz and for longer than 100 seconds at 1 gigahertz.' – DNA-EM-1, 1978, c. 8, p. 19.

PDF download of Philip J. Dolan (Editor), DNA-EM-1 *Capabilities of Nuclear Weapons, Part 2* preliminary pages and contents pages, Change 2, August 1981 (50 pages, 1.7 MB)

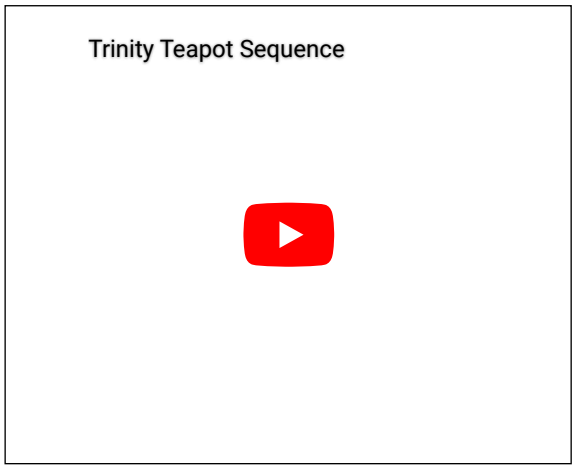
Chapter 9: Introduction to Damage Criteria

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 9. Introduction to Damage Criteria.* 187 pages, July 1978, AD-A955393**

Extensive tables, graphs and nuclear test data for correlating the phenomenology of the explosion with damage results; much essential background data such as the EMP energy needed to damage different kinds of electronic component.

Chapter 10: Personnel Casualties

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 10. Personnel Casualties.* 38 pages, July 1978, AD-A955394**



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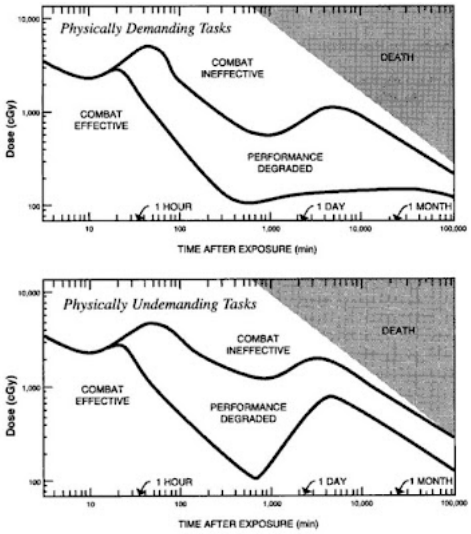
> Collapse of a brick house is expected to result in approximately 25% mortality, 20% serious injury and 10% light injury to the occupants. Reinforced concrete structures, though much more resistant to blast forces, will produce almost 100% mortality on collapse ... based on data from British World War II experience ... for cases where the population expects bombing and most personnel have selected the safest places in the buildings.’ – Philip J. Dolan, editor, *Capabilities of Nuclear Weapons,* U.S. Department of Defence, DNA-EM-1, 1978, c. 10, p. 5, Secret – Restricted Data.

Similar to Glasstone and Dolan 1977, but also includes a set of very detailed graphs showing the time-dependent incapacitation response of humans to extremely high initial radiation doses from enhanced neutron weapons, based on human irradiation accidents and animal experiments. Useful extracts from revised versions of EM-1 are given on pages 1-26 and 1-27 (new data on acute radiation effects versus dose, giving the mid-line LD50 as 385 rem) of the **White House April 2005 *National Planning Scenarios* civil defence planning manual here**, see also the document on **treatment for radiation casualties (here)**, and the ***NATO Handbook on the Medical Aspects of NBC Defensive Operations,* AMedP-6(B), U.S. Army Field Manual FM 8-9, February 1996,** which gives the following illustration on neutron bomb radiation effects from this chapter of DNA-EM-1 *Capabilities of Nuclear Weapons:*



Above: **'These figures have been developed from subhuman primate studies at the Armed Forces Radiobiology Research Institute (for times less than 60 minutes, postexposure) and from an assessment of how radiation sickness signs and symptoms will affect the performance of combat tasks (for times greater than 60 minutes, postexposure). ... The prediction associated with those identified as being "combat effective" is that they will be suffering radiation sickness signs and symptoms of such a nature that they will be able to maintain their performance of at least 75 percent of their preexposure performance level. Those predicted as being "performance degraded" could be operating at a performance level between 25 and 75 percent of their preexposure performance. Those predicted as being "combat ineffective" should be considered as being capable of performing their tasks at 25 percent (at best) of their preexposure performance level. Of course, these predictions are based on combatants suffering only one stressor, that being ionizing radiation exposures. The prediction of performance capacity of those having received ionizing radiation exposures will now have to be considered together with how other stressors (conventional injury, endemic disease, continuous duty (sleeplessness), time in combat, fatigue, etc.) might affect the total performance capability of the force.'**

See also the report by **Siegmund J. Baum, et al., *Nuclear Weapon Effect Research at PSR (Pacific-Sierra Research Corporation) - 1983: Symptomatology of Acute Radiation Effects in Humans after Exposure to Doses of 75 to 4500 Rads (cGy) Free-in-Air,* report ADA166280, August 1984**, and the ***Medical NBC Battlebook,* USACHPPM Tech Guide 244, May 2000.** Page 388 of David E. Hogan's *Disaster Medicine* (Lippincott Williams and Wilkins, 2nd ed., 2007) shows that 0 of 53 Chernobyl personnel exposed in 1986 to whole body gamma doses of 200-400 cGy died, 7 out of 23 exposed to 420-630 cGy died at 2-7 weeks post exposure, and 17 out of 20 exposed to doses of 500-1,600 cGy died at 4-50 days post exposure. This purely radiation data naturally indicates a much higher LD50 than the synergism results of combined thermal and nuclear radiation casualty data from Hiroshima and Nagasaki. (Thermal burns lower the nuclear radiation LD50 if the wounds tend to become infected, since radiation reduces the white blood cell count for a few weeks following exposure, preventing the body from coping with infections.)

Using the DNA-EM-1 manual, ***USAF Intelligence Targetting Guide, Air Force Pamphlet 14-210 Intelligence, 1998, Attachment 7 Collateral Damage*** states that *negligible collateral damage* to personnel is defined as 2/3rds of the thermal exposure required to produce 1st degree burns to bare skin (moderate sunburn type injury), 5 R of nuclear radiation, or 3 psi peak overpressure; *moderate collateral damage* to personnel is 1st degree burns (moderate sunburn) to bare skin, 20 R of nuclear radiation or 5 psi peak overpressure, and emergency collateral damage is 2/3rds of the thermal exposure for 2nd degree bare skin burns (severe sunburn, i.e., blistering), 100 R of nuclear radiation, or 10 psi peak overpressure:

'When nuclear weapons are employed at a considerable distance from friendly troops, safety is a matter of concern from the following viewpoints:

'Areas of fallout contamination from surface bursts may preclude or interfere with friendly force use of, or passage through, these areas.

'A reasonable margin of safety must be provided for military and civilian populations of friendly and neutral countries in accordance with the area commander's weapons restraint policy.

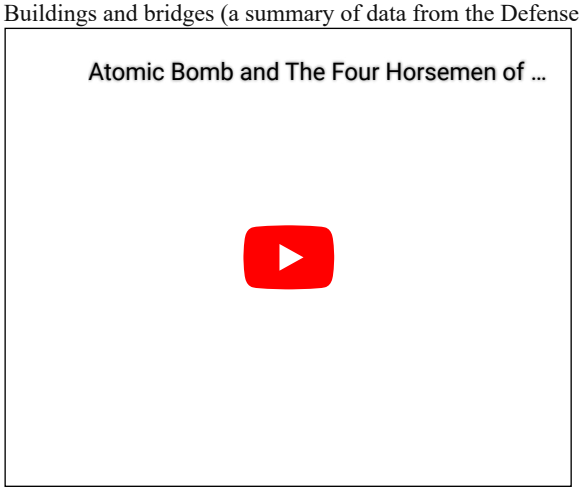
'Temporary dazzle during daylight conditions, loss of night visual adaptation, or retinal burns may handicap friendly forces if they are not warned to protect their eyes at the time of detonation. ... detailed target analysis collateral damage avoidance tables for each weapon system and yield can be obtained in FM 101-31-2/ AFP 200-31, Volume II, *Nuclear Weapons Employment Effects Data*.'

Chapter 11: Damage to Structures

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 11. Damage to Structures.* 50 Pages, July 1978, AD-A955385.**

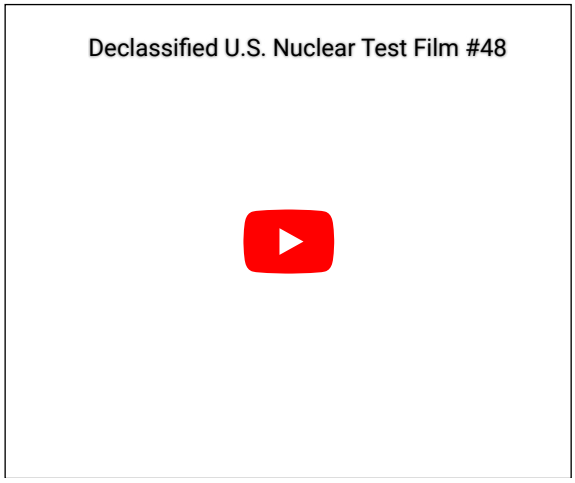
Above: This railroad bridge segment at 1,800 feet from the 37 kt *PRISCILLA* Nevada test in 1957 survived a peak overpressure of 450 psi but had severe distorting to its internal structure.

Buildings and bridges (a summary of data from the Defense Intelligence Agency *Physical Vulnerability Handbook*).



Chapter 12: Mechanical Damage Distances for Surface Ships and Submarines Subjected to Nuclear Explosions

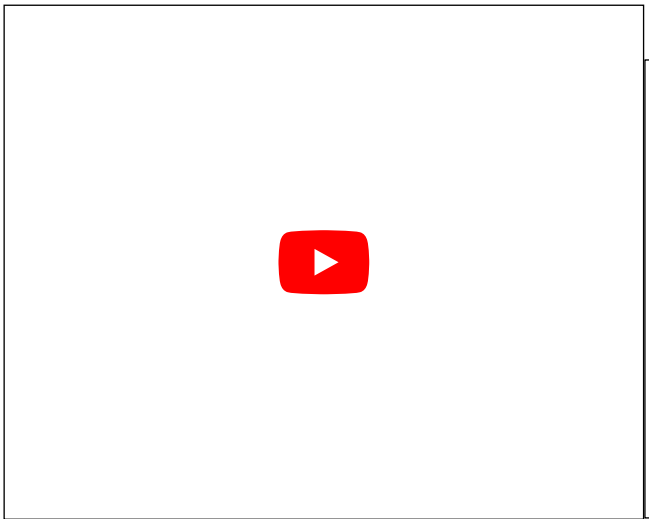
***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 12. Mechanical Damage Distances for Surface Ships and Submarines Subjected to Nuclear Explosions.* 147 pages, July 1978, AD-A955396.**

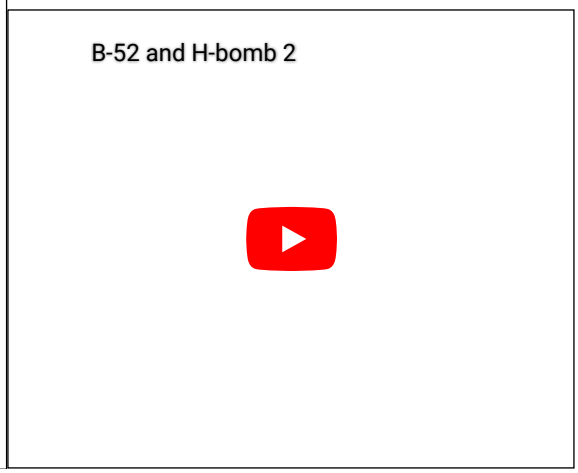


Above: the multimedia supplement to this chapter is this U.S. Navy film, *Nuclear Effects at Sea* which states that for destroyer-type ships, a peak air blast overpressure of 3 psi (20 kPa) produces injury to personnel due to debris and bodily displacement, 6 psi (40 kPa) causes light damage to the superstructure equipment such as radar dishes, 10 psi (70 kPa) causes moderate damage, while 14 psi (100 kPa) causes severe damage (defined as hull rupture, flooding and sinking).

Chapter 13: Damage to Aircraft

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 13. Damage to Aircraft.* 81 pages, July 1978, ADA955397, 4.8 MB PDF file.**





In June 1992 this chapter on aircraft damage was rewritten by J. R. Drake, et al., to include the effects of nuclear cloud dust intake and resulting jet aircraft engine performance (*Capabilities of Nuclear Weapons,*, DNA-EM-1, Chapter 20, *Damage to Aircraft,* RDA-TR-2-2261-2201-001, June 1992. There is also a separate *Handbook for Analysis of Nuclear Weapons Effects on Aircraft,* DNA 2084-1 Volume 1 and DNA 2084-2 Volume II.)

Chapter 14: Damage to Military Field Equipment

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 14. Damage to Military Field Equipment.* 46 pages, July 1978, AD-A955398.**

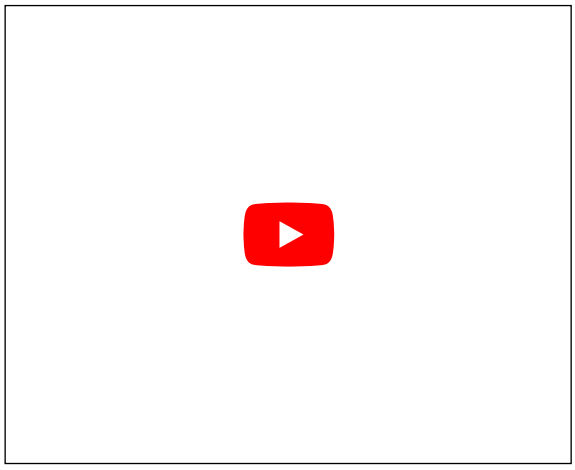
Page 1 states: 'One of the primary uses of nuclear weapons would be for the destruction of military field equipment.'

Above: tank (460 m from ground zero) and machine gun emplacement (1,550 m from ground zero) surviving the 31 kt *CHARLIE* nuclear air drop from a B-50 bomber, detonating at 1,050 m altitude at Nevada on 22 April 1952 (the first nuclear explosion to be broadcast live on TV; the vacuum tube electronics survived the EMP with just a click and brief interference due to temporary 'radioflash').

Above: damage to U.S. Army truck 450 yards from the 31 kt yield, 3,447 ft altitude air burst *Operation TUMBLER-SNAPPER,* shot *CHARLIE* nuclear test in Nevada on April 22, 1952.

For extensive data on the effects of blast on vehicles like jeeps and tanks in the blast precursor zone from low air bursts (where the wind drag is increased by the sandstorm effect of dust produced by the thermal flash "popcorning" desert sand, which loads the air and massively increases the dynamic pressure impulse at the expense of the peak overpressure), see **E. J. Bryant, N. H. Ethridge, and M. R. Johnson, *Response of Drag Type Equipment Targets in the Precursor Zone,* Operation Teapot, Project 3.1, weapon test report WT-1123, AD339948, 1959 (originally secret), online here.**

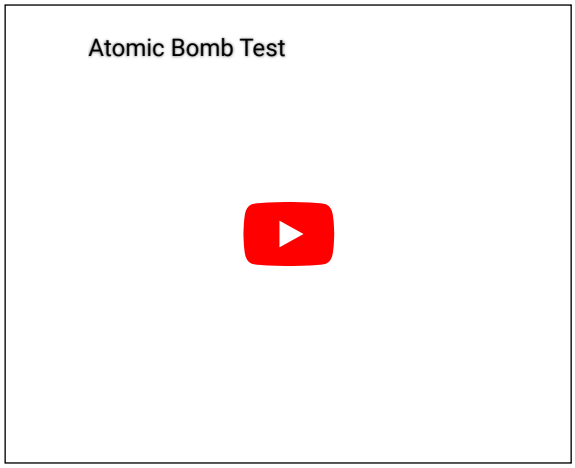
For extensive data on the effects of blast on field fortifications see **Allan R. Fowler and Daniel R. Muller, *Field Fortifications, Operation Upshot-Knothole, Project 3.9,* weapon test report WT-728, AD482991, 1954 (originally secret).**



This chapter uses and cites in its bibliography both American and British atmospheric nuclear test data. There are a relatively large number of useful reports on British tests on military field equipment in Maralinga, since those tests - although far fewer in number than the American tests at Nevada - were utilised for many experiments. In particular, British policy at nuclear tests was to leave military vehicles exposed to tests with their engines running, which helped to evaluate the risks of ignition due to blast damage (due to carburetor damage or fuel line rupture, etc.) rather than just thermal ignition. See also the blast damage tables compiled in the ***Medical NBC Battlebook,* USACHPPM Tech Guide 244, May 2000.**

Chapter 15: Damage to Forest Stands

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 15. Damage to Forest Stands.* 64 pages, July 1978, AD-A955399.**



This chapter is extremely important and detailed, showing detailed test results for the blowdown and thermal ignition of different types of forests as a function of blast pressure, thermal exposure, tree density, humidity, and elevation angle of the burst. Thermal ignition in forests depends on holes in the leaf canopy and on the amount of dry leaf litter on the ground: green leaves were found to shield thermal radiation by giving off clouds of black smoke during exposure at nuclear tests. The smoke shielded the ground from thermal radiation, so ignition is not nearly as easy as you might naively expect. This is why forest stands did not burn in nuclear tests (although Lynn Eden, author of the incorrect *Whole World on Fire* anti-civil defence book will, I expect, probably resort to political, pseudoscientific claims that the test trees survived fire by 'heroic' countermeasures such as magic, instead of *the failure of a brief pulse of heat to ignite fires!).* There is no information about any of this in Glasstone and Dolan 1977.

Operation BLOWDOWN: an Australian-British-American 0.05 kt test on 43 m high tower in a rainforest at Iron Range, Northern Queensland, on 18 July 1963 to assess the dynamic pressures required for tree blowdown, and the difficulty in moving through the blowdown area.

Above: Operation BLOWDOWN, an Australian-British-American 0.05 kt test on a 43 m high tower in a rainforest at Iron Range, Northern Queensland, on 18 July 1963 to assess the dynamic pressures required for tree blowdown, and the difficulty in moving through the blowdown area.

'The foliage making up the crowns [upper branches and leaves] of the trees, while it has a high probability of being exposed to the full free-field radiation environment from air bursts ... may, however, materially reduce the exposure of the forest floor by generating quantities of smoke and steam, as well as by direct shading.' - *Capabilities of Nuclear Weapons,* - Chapter 15, Damage to Forest Stands, paragraph 15-9.

*Ignition of rural, wildland, and forest fires by nuclear weapons**
H = % relative humidity (determines the moisture content of dead leaves), W = weapon yield (kt)

Area type	*Conditions required for a propagating fire*	*Ignition energy (cal/cm²)* For 1 kt	*Intense burning time for a fixed location***	*Typical total duration of fire spread***
Grassland	>0.5 ton/acre of grass.	$3.0[1+(0.0042H_m)]$	2 minutes	30 minutes
Wildland	>75% of ground covered with bushes (12 tons/acre). >2 tons/acre of dead leaves.	$1.8[1+(0.0069H_m)]$	8-80 minutes	16-72 hours
Forest	>2 tons/acre of dead leaves on forest floor. *See also equation for forest floor shielding by leaf canopy.*	$1.8[1+(0.0069H_m)]$ *(thin leaves)* $3.7[1+(0.015H_m)]$ *(conifer needles)*	3 hours	7 days

*Data derived from: P.J. Dolan, editor, *Capabilities of Nuclear Weapons*, U.S. Defense Nuclear Agency, 1978, Figure 15-39, Table 15-10, and Table 15-13.
**Typical American fire durations; the total fire duration depends on how long the fire can proliferate. The burning grass fire zone is only 1-2 metres thick at any given time as it propagates, but the smoke from the smouldering burned ground makes it appear deeper. Mature forest fires, like house fires, involve thick wood and burn for 2-3 hours at any location, with a much deeper fire zone.

'Fuels seldom burn vigorously, regardless of the wind conditions, when fuel moisture content exceeds about 16 percent. This corresponds to an equilibrium moisture content for a condition of 80 percent relative humidity. Rainfall of only a fraction of an inch will render most fuels temporarily nonflammable and may extinguish fires in thin fuels ... Surface fuels in the interior of timber stands are exposed to reduced wind velocities; generally, these fuels retain their moisture as a result of shielding from the wind and shading from

sunlight by the canopy.' - *Capabilities of Nuclear Weapons,* 1978 revision, Chapter 15, *Damage to Forest Stands*, page 15-60.

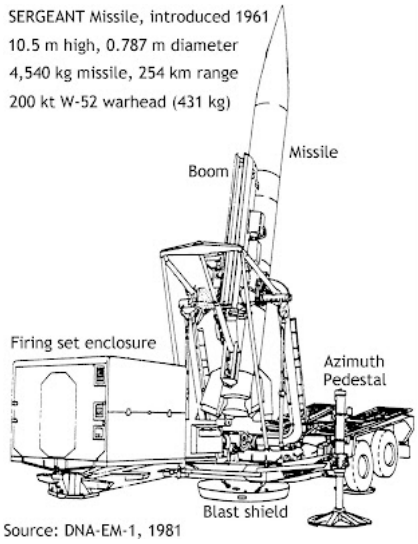
This chapter on forest damage was later partitioned to treat separately blast blowdown (chapter 18, *Airblast Damage to Forests,* edited by Applied Research Associates of Raleigh, North Carolina, in 1993) and thermal ignition of fires (chapter 16, *Fires from Nuclear Weapons,* was edited by Pacific-Sierra Corporation, California, in 1992; and chapter 17, *Fire Damage to Forests,* deals specifically with forest fires).

See also the reports linked **here** and **here**.

Chapter 16: Damage to Missiles

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 16. Damage to Missiles.* 121 pages, July 1978, AD-A955400.**

Explains how thermal radiation ablation can degrade thin missile metal skins before blast arrival, and how thermal ablation or blast waves can cause large g-forces to the missiles. Generally missiles can withstand head-on blast and heat very well since they are designed to take atmospheric drag forces and re-entry ablation in their stride, but a side-on exposure is more serious. There is also the issue of how hard missiles are while in storage on the ground in silos or on mobile platforms. Missiles in hardened, reinforced concrete silos can withstand vast peak air overpressures, 1,000-3,000 psi (or more with a suitable silo lining), but they are still vulnerable to excessive ground shock and cratering action. *Damage to Missiles* was later moved to Chapter 21 of EM-1, and in 1996 was updated to include terrorist/rogue nation missiles carrying warheads that include chemical or biological weapons.



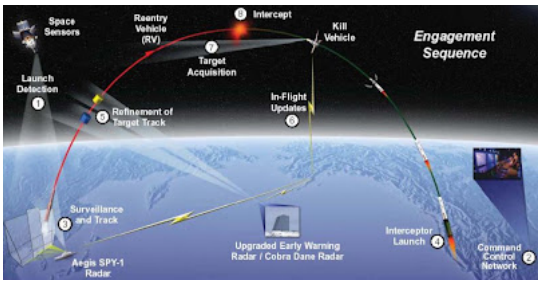
Above: illustration in DNA-EM-1 (1978) for analyzing the vulnerability of a major threat from proliferation: cheap and portable thermonuclear battlefield SRBM weapons. Above 30-km, X-rays and other radiation are the most potent means to destroy a missile in flight. Below 30-km altitude, missiles are vulnerable to blast, while their plutonium is still vulnerable to meltdown due to neutron radiation. 130-kPa peak overpressure from a 1-kt detonation or 83-kPa from 300-kt would destroy a missile. The heat flash needed to burn through a metal missile skin would only occur well within the fireball, but lesser heating softens the metal and makes it more vulnerable to subsequent blast. Shooting down a missile is easiest while it is in its initial 'boost phase', immediately after launch. ICBM and SLBM weapons take about 3 minutes of boost phase to reach an altitude of 200 km. The individual warheads then separate from the missile 'bus'. Attempts to confuse radar using metal balloons (as decoy warheads), and pieces of wire chaff to reflect back false signals, can actually be counter-productive, as they simply create a bigger overall radar signal. A sufficiently powerful ABM warhead detonated in space can affect a very wide area, encompassing both the decoys and the real warheads! The use of specially designed **95% clean** ABM weapons can avert a destructive ground-level EMP and fallout risks.

Chapter 17: Radio Frequency Signal Degradation Relevant to Communications and Radar Systems

***Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Chapter 17. Radio Frequency Signal Degradation Relevant to Communications and Radar Systems.* 32 pages, July 1978, report reference: AD-A955401**.

Professor David Jenn gives some extracts from the revised version of this chapter **here.**

Above: as a multimedia supplement to the *Capabilities of Nuclear Weapons,* this excellent originally secret U.S. Defense Nuclear Agency film, *High-Altitude Nuclear Weapons Effects: Part Two, Systems Interference* (16 minutes), discusses the interference to radio and radar signals by high altitude nuclear detonations.



Above: **the planned U.S. ABM system's missile detector radars and communications satellites must overcome signal attenuation due to atmospheric ionization by a detonation**. See also: **Warren S. Knapp, *Summary of Communication and Navigation Systems Degradation in a Nuclear Environment,* Defense Nuclear Agency Handbook DNA 4890H, 1979, report AD-A196802 (linked here).**

Appendices A thru F

Capabilities of Nuclear Weapons. Part 2. Damage Criteria. Change 1. Appendices A thru F. 112 pages, July 1978, AD-A955402.

Dolan's derivation of the Rankine-Hugoniot equations of shock waves and also brief but very detailed and useful summary-abstracts from all the secret reports used in the compilation of *Capabilities of Nuclear Weapons,* reports like DASA-1200 (*Nuclear Weapons Blast Phenomenology*) and the Lockheed Missiles and Space Company extensive series of reports *Theoretical Models for Nuclear Fireballs*, giving the results of computer simulations for nuclear fireballs. These appendices also provide tabular data on the overpressures and dynamic pressures required to cause differing degrees of damage the structure classes listed in Chapter 11, such as all the different types of buildings and bridges known, as a function of yield (pressures to cause damage vary according to the duration of the blast wave, which is yield-dependent particularly for big buildings and/or for wind drag/dynamic pressure sensitive targets).

The early history of the Capabilities of Nuclear Weapons

Above: Dr. Gerald Woodrow Johnson as Test Director of *OPERATION PLUMBBOB,* 1957. Johnson (born 1917), graduated from Washington State College in 1937, received the MSc degree from the same college in 1939, and was awarded a PhD in physics from the University of California, Berkeley, in 1947. He was active in the testing of nuclear weapons.

'After teaching physics at Washington State University for two years, Johnson began working in solid state and neutron physics at Brookhaven National Laboratory in 1949. In 1951 he headed the Analysis Branch, Nuclear Weapons Effects, in the Armed Forces Special Weapons Project. Johnson joined the Lawrence Radiation Laboratory in 1953 and was later named associate director for testing, responsible for nuclear testing in Nevada and the Pacific. In 1957, he became the laboratory's first director of the Plowshare Program, an effort to develop civil, industrial, and scientific uses of nuclear explosives. From 1961 to 1963 Johnson worked in the Kennedy Administration as chairman of the military liaison committee to the Atomic Energy Commission and also as special assistant to the Secretary of Defense for atomic energy. In this position, Johnson was responsible for the safety of nuclear weapons and the introduction of permissive action links into the U.S. and NATO stockpiles. From 1963 to 1966 he was associate director of the Lawrence Radiation Laboratory...'

Until Dolan's 1972 edition of *Capabilities of Nuclear Weapons,* it had been a single volume based on test data deemed too sensitive to be allowed widespread general release. **A 162 pages long typescript draft had been issued in 1945**, but the first version to supplement Glasstone's 1950 unclassified handbook, *Capabilities of Atomic Weapons,* TM 23-200, was edited by Dr Gerald W. Johnson (Chief of the Analysis Branch, U.S. Armed Forces Special Weapons Project) and had been issued in July 1951 and revised in October 1952 as a secret supplement to Glasstone's 456 pages-long openly published *Effects* book. It was stated to be: 'a special supplement prepared for the Armed Forces Special Weapons Project by the Los Alamos Scientific Laboratory'. The total number of copies of *Capabilities of Atomic Weapons* printed for use by the U.S. Department of Defense (including the U.S. Armed Forces Special Weapons Project), in each edition was 1,079.

It was initially classified 'Secret - Security Information', which was redefined 'Secret - Restricted Data' after the Atomic Energy Act of 1954. Before the *Mike* thermonuclear weapon test of November 1952, 100 copies of a separate *Super Effects Handbook* (AFSWP 351-B, second revision in December 1953, Secret - Restricted Data) was issued to top ranking military commanders who had to decide how to deploy megaton yield bombs, but in June 1955 that handbook was incorporated into an updated 530 pages long edition of the *Capabilities of Atomic Weapons,* and on **30 November 1957 this manual was revised and degraded from 'Secret - Restricted Data' to 'Confidential - Restricted Data'. This confidential manual was given to Britain in exchange for British nuclear test effects data, and was used for British civil defence planning by the Home Office's Scientific Advisory Branch, headed by Dr R. H. Purcell (the Home Office Chief Scientific Advisor).**

TM 23-200, *Capabilities of Atomic Weapons,* is a single volume consisting of 441 pages in 12 sections divided into 2 parts (it has only about a quarter as many pages as Dolan's 1651 pages long 2-volume 1972 revision DNA-EM-1):

Contents of *Capabilities of Atomic Weapons,* U.S. Armed Forces Special Weapons Project, Washington, D.C., technical manual TM 23-200, November 1957, Confidential (declassified in 1997)

Preliminary pages (22 pages consisting of title pages, distribution list, contents pages, page locator for physical phenomena figures and tables, and foreword)

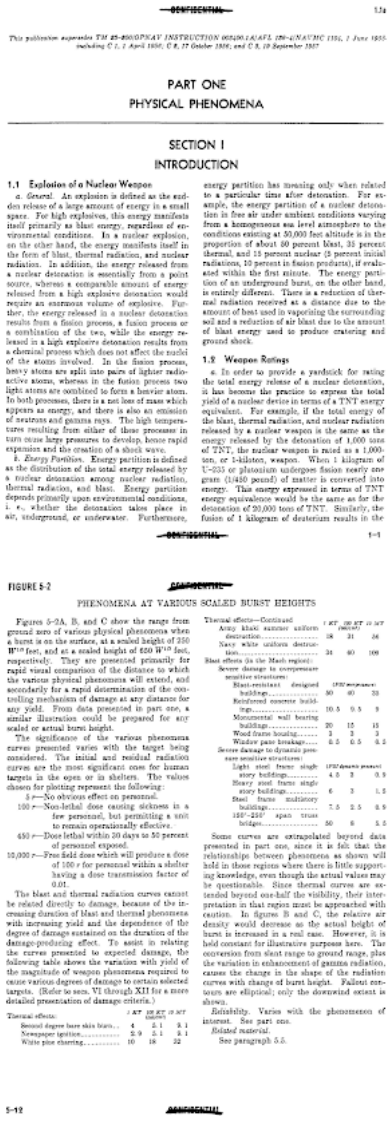
Part 1: Physical Phenomena

Section 1: Introduction (13 pages)
Section 2: Blast and Shock Phenomena (95 pages)
Section 3: Thermal Radiation Phenomena (19 pages)
Section 4: Nuclear Radiation Phenomena (87 pages)

Part 2: Damage Criteria

Section 5: Introduction (21 pages)
Section 6: Personnel Casualties (20 pages)
Section 7: Damage to Structures (54 pages)
Section 8: Damage to Naval Equipment (15 pages)
Section 9: Damage to Aircraft (11 pages)

Page 4 of this bibliography cites the report: J. F. Canu and P. J. Dolan, *Prediction of Neutron-Induced Activity in Soils,* AFSWP-518, June 1957, Secret – Restricted Data.



CONFIDENTIAL 1.1a

This publication supersedes TM 23-200/OPNAV INSTRUCTION 03520.1A/AFL 136-4/NAVMC 1191, 1 June 1955, including C 1, 1 April 1956; C 2, 17 October 1956; and C 3, 10 September 1957

PART ONE
PHYSICAL PHENOMENA

SECTION 1
INTRODUCTION

1.1 Explosion of a Nuclear Weapon

a. General. An explosion is defined as the sudden release of a large amount of energy in a small space. For high explosives, this energy manifests itself primarily as blast energy, regardless of environmental conditions. In a nuclear explosion, on the other hand, the energy manifests itself in the form of blast, thermal radiation, and nuclear radiation. In addition, the energy released from a nuclear detonation is essentially from a point source, whereas a comparable amount of energy released from a high explosive detonation would require an enormous volume of explosive. Further, the energy released in a nuclear detonation results from a fission process, a fusion process or a combination of the two, while the energy released in a high explosive detonation results from a chemical process which does not affect the nuclei of the atoms involved. In the fission process, heavy atoms are split into pairs of lighter radioactive atoms, whereas in the fusion process two light atoms are combined to form a heavier atom. In both processes, there is a net loss of mass which appears as energy, and there is also an emission of neutrons and gamma rays. The high temperatures resulting from either of these processes in turn cause large pressures to develop, hence rapid expansion and the creation of a shock wave.

b. Energy Partition. Energy partition is defined as the distribution of the total energy released by a nuclear detonation among nuclear radiation, thermal radiation, and blast. Energy partition depends primarily upon environmental conditions, i. e., whether the detonation takes place in air, underground, or underwater. Furthermore, energy partition has meaning only when related to a particular time after detonation. For example, the energy partition of a nuclear detonation in free air under ambient conditions varying from a homogeneous sea level atmosphere to the conditions existing at 50,000 feet altitude is in the proportion of about 50 percent blast, 35 percent thermal, and 15 percent nuclear (5 percent initial radiations, 10 percent in fusion products), if evaluated within the first minute. The energy partition of an underground burst, on the other hand, is entirely different. There is a reduction of thermal radiation received at a distance due to the amount of heat used in vaporizing the surrounding soil and a reduction of air blast due to the amount of blast energy used to produce cratering and ground shock.

1.2 Weapon Ratings

a. In order to provide a yardstick for rating the total energy release of a nuclear detonation, it has become the practice to express the total yield of a nuclear device in terms of a TNT energy equivalent. For example, if the total energy of the blast, thermal radiation, and nuclear radiation released by a nuclear weapon is the same as the energy released by the detonation of 1,000 tons of TNT, the nuclear weapon is rated as a 1,000-ton, or 1-kiloton, weapon. When 1 kilogram of U-235 or plutonium undergoes fission nearly one gram (1/450 pound) of matter is converted into energy. This energy expressed in terms of TNT energy equivalence would be the same as for the detonation of 20,000 tons of TNT. Similarly, the fusion of 1 kilogram of deuterium results in the

CONFIDENTIAL 1-1

FIGURE 5-2

CONFIDENTIAL

PHENOMENA AT VARIOUS SCALED BURST HEIGHTS

Figures 5-2A, B, and C show the range from ground zero of various physical phenomena when a burst is on the surface, at a scaled height of 250 $W^{1/3}$ feet, and at a scaled height of 620 $W^{1/3}$ feet, respectively. They are presented primarily for rapid visual comparison of the distance to which the various physical phenomena will extend, and secondarily for a rapid determination of the controlling mechanism of damage at any distance for any yield. From data presented in part one, a similar illustration could be prepared for any scaled or actual burst height.

The significance of the various phenomena curves presented varies with the target being considered. The initial and residual radiation curves are the most significant ones for human targets in the open or in shelters. The values chosen for plotting represent the following:

5 r—No obvious effect on personnel.
100 r—Non-lethal dose causing sickness in a few personnel, but permitting a unit to remain operationally effective.
450 r—Dose lethal within 30 days to 50 percent of personnel exposed.
10,000 r—Free field dose which will produce a dose of 100 r for personnel within a shelter having a dose transmission factor of 0.01.

The blast and thermal radiation curves cannot be related directly to damage, because of the increasing duration of blast and thermal phenomena with increasing yield and the dependence of the degree of damage sustained on the duration of the damage-producing effect. To assist in relating the curves presented to expected damage, the following table shows the variation with yield of the magnitude of weapon phenomena required to cause various degrees of damage to certain selected targets. (Refer to secs. VI through XII for a more detailed presentation of damage criteria.)

Thermal effects:	1 KT	100 KT (MEGS)	10 MT (MEGS)
Second degree burn skin burn	4	2.1	3.1
Newspaper ignition	2.9	2.1	3.1
White pine charring	10	18	32
Army khaki summer uniform destruction	18	31	56
Navy white uniform destruction	34	60	100
Blast effects (in the Mach region):			
Severe damage to overpressure sensitive structures:			
Blast-resistant designed buildings	80	60	30
Reinforced concrete building	10.5	9.5	9
Monumental wall bearing buildings	20	15	15
Wood frame housing	3	3	3
Window pane breakage	0.5	0.5	0.5
Severe damage to dynamic pressure sensitive structures:			
Light steel frame single story buildings	4.5	3	3.5
Heavy steel frame single story buildings	6	3	1.5
Steel frame multistory buildings	7.5	2.5	3.5
150'–250' span truss bridge	50	6	5.5

Some curves are extrapolated beyond data presented in part one, since it is felt that the relationships between phenomena as shown will hold in those regions where there is little supporting knowledge, even though the actual values may be questionable. Since thermal curves are extended beyond one-half the visibility, their interpretation in that region must be approached with caution. In figures B and C, the relative air density would decrease as the actual height of burst is increased in a real case. However, it is held constant for illustrative purposes here. The conversion from slant range to ground range, plus the variation in enhancement of gamma radiation, causes the change in the shape of the radiation curves with change of burst height. Fallout contours are elliptical; only the downwind extent is shown.

Reliability. Varies with the phenomenon of interest. See part one.

Related material.
See paragraph 5.5.

5-12 CONFIDENTIAL

It has a Foreword on page xxii by Edward N. Parker (Rear Admiral, USN), Chief, Armed Forces Special Weapons Project, stating:

'The purpose of this manual is to provide the military Services with a compendium of the phenomena manifested by the detonation of nuclear weapons and the effects thereof in terms of damage to targets of military interest.

'This edition of Capabilities of Atomic Weapons represents the continuing effort by the Armed Forces Special Weapons Project to make available the progressively improved data resulting from field testing, scaled tests, laboratory and theoretical analyses.

'... Every effort has been made to include the best available data which will assist the using Services in meeting their particular operational requirements. As additional or better data becomes available it will be incorporated herein.'

Concerning the early history of EMP as a damaging effect of nuclear weapons, a very brief and but pertinent discussion of EMP effects from low altitude and surface bursts occurs in the November 1957 edition of the Confidential (classified) U.S. Department of Defense, Armed Forces Special Weapons Project manual TM 23-200, *Capabilities of Atomic Weapons,* section 12, *Miscellaneous Radiation Damage Criteria,* page 12-2, paragraph 12.2c:

'*Electromagnetic Radiation.* A large electrical signal is produced by a nuclear weapon detonation. The signal consists of a rather sharp transient signal with a strong frequency component in the neighborhood of 15 kilocycles. Field strengths greater than 1 volt per metre have been detected from megaton yield weapons at a distance of about 2,000 miles. Electronic equipment which responds to rapid, short

duration transients can be expected to be actuated by pickup of this electrical noise.'

Capabilities of Atomic Weapons was renamed *Capabilities of Nuclear Weapons* in 1964:

'In November 1964, DASA (Defence Atomic Support Agency) consolidated nuclear effects knowledge in the classified publication, *Capabilities of Nuclear Weapons.* A revised edition was published in 1968. These publications preceded the two-volume Effects Manual-1 (EM-1), first published in 1972. ... *Integrating Knowledge:* In 1972, DNA published a two-volume nuclear weapons effects manual called Effects Manual-1 (EM-1). Two years later, DNA issued a NATO-releasable [less classified] version of EM-1. These volumes provided critical planning information for unified and specified CINCs, civilian civil defense activities, and NATO officials.' - **pages 16 and 19 of the colourful booklet, *Defense Soecial Weapons Agency,* 50th Anniversary 1947-1997**. For a 466 page review published by the Defense Threat Reduction Agency in 2002, see **AD-A412977 (35.3 Mb).**

All civil defence planning is either directly or indirectly (via Glasstone and Dolan *Effects of Nuclear Weapons* 1977) based on Dolan's *Capabilities of Nuclear Weapons.* The latest official American civil defence manual, for example, cites directly the secret 1988 revision of *'DNA EM-1 (Effects Manual 1), Capabilities of Nuclear Weapons, Chapter 10, July 1, 1972';* **'NATIONAL PLANNING SCENARIOS: Created for Use in National, Federal, State, and Local Homeland Security Preparedness Activities, Version 21.2 DRAFT, February 2006'.** (The hyperlink for the last named article has been changed to earlier, April 2005, version hosted by the *Washington Post* newspaper after the later version was deleted from an internet site. There is little difference.)

Above: Cresson Kearny explains how to shield against fallout by making a 'core shelter' inside a building: put cardboard boxes on top of, and around, a strong table that you can shelter under: then put two large waterproof plastic waste bags inside one another in each box, and simply fill them up with water. This saves you messing around with dirt for shielding. Just 5 inches of water halves the intensity of 1 MeV gamma radiation penetrating it. Actually, dirty bombs with U-238 jackets produce a great deal of softer gamma rays from Np-239 (which has a half life of 56 hours and thus contributes a peak percentage to fallout radiation at a time of 1.73 X 56 = 4 days after burst) and U/Np-240, as well as U-237 which has a longer half life and contributes substantially during the two week sheltering period. So protection is even more efficient than Kearny quotes, due to the lower-energy of fallout from dirty hydrogen bombs with neutron capture in U-238. American experiments on fallout shielding by buildings used cobalt-60 gamma rays, which have a mean energy of 1.25 MeV (**see page 120, 'Transmission Factors' in the PDF file of the U.S. Army Field Manual 3-3-1, *Nuclear Contamination Avoidance,* linked here**) whereas dirty (high fission yield) thermonuclear weapons which contaminate large areas all expose U-238 to neutrons which always results in large amounts of non-fission neutron captures in U-238, **creating large amounts of very low-energy gamma emitting Np-239, U-240, and U-237.** The time that any neutron induced species contributes a peak percentage of the radiation from fallout is equal to 1.73 times its half-life (the 1.73 factor is simply the ratio 1.2/ln2, where 1.2 is the decay exponent of time for the overall mixture of nuclides in fallout, while ln2 is the factor which converts the average life of a particular nuclide into its half-life, which is always a factor 1.44 smaller than its average life). Thus, for Np-239 which has a half life of 56 hours and emits gamma rays of mean energy just 0.14 MeV, the peak percentage contribution it gives to fallout radiation occurs 4 days after detonation. U-237, which emits gamma rays of mean energy just 0.10 MeV, has a half-life of 6.8 days, so contributes a peak percentage to fallout radiation 12 days after detonation.

Fractionation of fission products (the loss of slowly-condensing gaseous fission product decay chains from fast-falling large particles of fallout which exit the fireball before the slowly condensing nuclides have solidified, and are thus depleted in many fission product species) also affects the spectrum of gamma ray energy in a predictable way, softening the spectrum to lower mean energies in the close-in (depleted) fallout. **Dr Terry Triffet first made this effect public in the 22-26 June 1959 U.S. Congressional Hearings on *The Biological and Environmental Effects of Nuclear War,* pages 61-111**. Triffet in that testimony, **with more details in in his declassified weapon test report WT-1317, 1961** (see also **Dr Carl F. Miller's 1961 report USNRDL-466 for detailed *REDWING* fallout station distances from ground zero, nuclide measured fractionation ratios and neutron induced activity data**), showed that at 1 week after burst, the mean gamma ray energy of fractionated fallout 8 statute miles downwind on Bikini Lagoon barge YFNB29 due to 5.01 Mt burst 87% fission *REDWING-TEWA* in 1956 was **just 0.25 MeV** (4.5 grams per square foot of fallout was deposited there, giving a peak dose rate on the barge of 40 R/hr at 2.7 hours after burst), while at 60 statute miles on ship LST611 downwind it was **0.35 MeV** (due to less depletion of high energy fission products at greater distances, a fractionation effect) where only 0.06 gram/square foot of fallout was deposited giving a peak dose rate of 0.25 R/hr at 14 hours after burst. On page 205 of those June 1959 hearings, Triffet explained:

'I thought this might be an appropriate place to comment on the variation of the average energy. It is clear when you think of shielding, because the effectiveness of shielding depends directly on the average energy radiation from the deposited material. As I mentioned, Dr Cook at our [U.S. Naval Radiological Defense] laboratory has done quite a bit of work on this. ... if induced products are important in the bomb [dirty bombs with U-238 jackets], there are a lot of radiations emanating from these, but the energy is low so it operates to reduce the average energy in this period and shielding is immensely more effective.'

Fractionation of fission products in the condensing fireball has two mechanisms:

(1) the lower the boiling point temperature of a fission product element, the longer a fallout particle must remain in the cooling fireball in order to have that element deposited upon it. If the fallout particle is large and falls out of the fireball before a given fission product element itself condenses, the fallout will be lacking (depleted in) that particular fission fragment. Large particles of the heated soil condense into solids and fall out of the fireball without before slower condensing (still gaseous) fission products are condensed upon them.

(2) fission products are formed in a series of beta radioactive decays called a 'decay chain'. Where the initial nuclide in the chain is a permanent gas like xenon or krypton, it cannot condense on to a solid particle of soil until it has first decayed into a solid fission product elements (the emission of a beta particle increases the atomic number one unit, changing the element). Therefore, in this case, fractionation is controlled by radioactive decay (which is independent of weapon yield or fireball cooling time), not just by the comparison of the time taken for a particle to fall out of the hot fireball and the time taken for the fireball to coll below the solidification temperature of fission products.

The large particles of fallout near ground zero is therefore missing many nuclides, which include iodine-131, cesium-137 and strontium-89.

Even for the small particles of fallout which do get contaminated, the cooling phenomenon produces an effect on the distribution of radioactivity within the fallout particle, which affects solubility and thus biological uptake of the fission products. Some fission products have boiling points lower than the melting point of soil, so they are relatively 'volatile' and condense only upon the outside of already-solidified fallout particles, producing relatively soluble fallout radioactivity. The fission products with high boiling points are relatively 'refractory' and condense at early times onto molten soil particles, so they can diffuse into the internal volume of the particle before it solidifies, forming fallout with relatively insoluble radioactivity for those fission products.

These fractionation and solubility mechanisms were first observed and measured in the 1951 *GREENHOUSE* test series at Eniwetok Atoll, and are documented in nuclear weapon test report WT-4, *Fallout Phenomenology*. Further studies were done at later tests, particularly *REDWING* and *HARDTACK*.

Above: **Home-Made Self-Calibrating Kearny fallout meter (see Kearny's Oak Ridge National Laboratory book *Nuclear War Survival Skills* for instructions on building it**, PDF version **linked here**; the self-calibrating radiation measurement accuracy data can be found in the **original report ORNL-5040 linked here**) being tested with a dental X-ray machine. *The charged foil plates discharge and visibly fall together as soon as the X-ray machine is turned on. This is just a simple electroscope dosimeter, using the same principle as the pocket quartz fibre dosimeter, although it is in some respects better since you can clearly see the effects of radiation on discharging the plates*.

You make it by taking two pieces of aluminium foil and folding them repeatedly until you have two 8-ply (8-layer) pieces of square shape and 2 inch long sides (this ensures the calibration). You hang each square in contact with the other by electrically non-conducting threads or thin non-conducting fishing line (any thin thread which has not been given anti-static treatment will do!) inside a can or jar. To get it to work you do need to have dry air inside the can (in high humidity air, you can't charge it since the water molecules almost immediately discharge the comb before it can even charge up the foil plates, so you need to put the whole thing inside a "dry bucket" with a transparent cover, adding some heated hydroscopic gypsum from plaster or re-heated **silica gel** to the bottom of the can, which comes in little paper packets in the packaging of all kinds of items these days, preventing moisture damage).

The top of the can is just covered by kitchen clear plastic wrap, with a little millimetre-calibrated scale on it to measure the distance between the aluminium plates when charged. A piece of wire like a straightened paperclip poked through the plastic wrap is used to charge the foil leaves; you simply bring a hair-charged plastic comb (or some other source of static electricity like a plastic ruler rubbed in a rolled up newspaper) to the charging wire, and the plates are charged. Because similar electric charges repel, the plates then move apart from one another! As air is ionized by radiation, charged air ions move between the plates, discharging them. The speed with which the plates are discharged therefore tells you the radiation level. Simple!

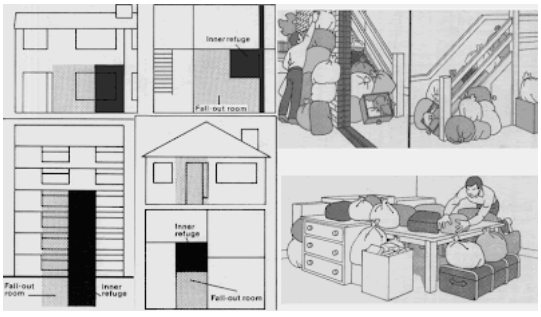
In reality, of course, **hazardous fallout has always proved to be extremely visible,** once the **political pseudoscientific fallout quackery, hype and spin (claiming that natural cancer deaths are due to radiation exposure, and other lunacy) is rejected**. A land surface burst (water surface bursts produce even more!) as proved by all the American tests ALWAYS creates roughly 200 tons of sand like fallout contaminant per kiloton of total yield, so if the 1-hour exposure rate conversion factor is taken to be typically 2000 (R/hr)/(kt/sq. mile) then the 2000 R/hr at 1 hour after bursts corresponds to 200 tons of fallout mass per square mile or 77 grams per square metre. Try sprinkling 77 grams of sand or flour per square metre. **It's visible. Even when the particles themselves (like tiny flour**

grains) are too small to be seen, the bulk of material is visible. Similarly, atoms aren't visible to the eye, but if you have enough atoms, the bulk of material becomes visible! That's the whole reason why we can see matter in bulk, despite the individual fundamental particles of matter being individually too small to see! Rainout from air bursts is visible as rain, and runs down the drain or soaks deep into the ground (which attenuates the radiation) in the same way as rain. Ocean surface burst fallout arrives as tiny non-depositing wind-carried dry salt crystals if the humidity is very low, or as wet salt-slurry droplets in a high humidity atmosphere; the depositing droplets are visible. Anti-civil defense propaganda covers up the nuclear test data on fallout particle deposits and covers up the difference between radiation and fallout to make people confused about the danger and make it seem mysterious and fearful. **Actually, you can wash fallout away, you can brush dry fallout away, it can be swept up and buried under the soil while it decays. There are numerous ways to successfully decontaminate and shield the danger. (On military ships, turning on the fire sprinklers on decks during fallout deposition was found to decontaminate the ships clean while fallout landed; it went straight down the drains, and the dose rate from surrounding contaminated water was 535 times lower than on land due to the mixing and sinking of fallout in the water, which shields most of the radiation! A favourite trick is to use large sheets of plastic to collect fallout. Once fallout has deposited, you roll them up and bury them, so that the fallout is shielded underground, meaning that you don't need to take shelter!**

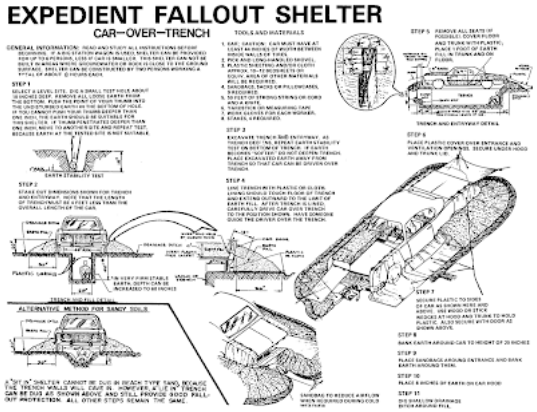
'A number of factors make large-scale decontamination useful in urban areas. **Much of the area between buildings is paved and, thus, readily cleaned using motorized flushers and sweepers, which are usually available. If, in addition, the roofs are decontaminated by high-pressure hosing, it may be possible to make entire buildings habitable fairly soon, even if the fallout has been very heavy**.' – Dr Frederick P. Cowan and Charles B. Meinhold, *Decontamination,* Chapter 10, pp. 225-40 in Dr Eugene P. Wigner (editor), *Survival and the Bomb,* Indiana University Press, Bloomington, 1969.

For dry road sweeper decontamination data see **D. E. Clark, Jr., and W. C. Cobbin, *Removal of Simulated Fallout from Pavements by Conventional Street Flushers,* report USNRDL-TR-797, 1964.** For a typical U.S. Naval Radiological Defense Laboratory report on the **decontamination of streets by high pressure hosing, click here (USNRDL-TR-1049, 1965).**

Small areas of fallout contamination, such as indoor ingressed fallout contamination, are always in practice found to make totally and utterly negligible contributions to gamma ray doses by comparison to the gamma hazard from the wide areas of fallout outdoors, because most of the gamma dose rate comes from large distances horizontally across a vast uniformly contaminated plane, and that coming vertically upwards from the small amount of fallout under your feet or nearby is trivial by comparison, so the ingress of fallout into damaged buildings makes no significant difference to gamma doses!



Above: **'The three factors which count in gaining protection are the distance from the radioactive dust, the weight of material in between, and the time for which one remains protected while the radioactivity decays. A slit trench with overhead cover of two or three feet of earth** would give **very good protection against fall-out, as well as protection against blast**, but the occupants would have to remain in the trench for forty-eight hours or more while the radioactivity surrounding them decayed. ... A prepared refuge room inside a house could be made to give good protection against fall-out (although not so good as a covered slit trench) and it would also be much less uncomfortable for a period of two days or more. A cellar or basement would be by far the best place for a refuge room; next best would be the room with the fewest outside walls and the smallest windows. The windows would need to be blocked with solid material, to the thickness of the surrounding walls at least. It would help if the walls themselves were thickened, not necessarily to their full height, with sandbags, boxes filled with earth, or heavy furniture. The occupants of the refuge roof would have to remain in it until told that it was safe to come out - perhaps for a period of days - and the room would have to be prepared and equipped accordingly.' - British Home Office civil defence booklet, *The Hydrogen Bomb* (Her Majesty's Stationery Office, London, 1957, 32 pages.)



Above: The **car-over-trench expedient fallout shelter** from **G. A. Cristy and C. H. Kearny, *Expedient Shelter Handbook,* Oak Ridge National Laboratory, August 1974, report AD0787483, 318 pages**. In place of a car, doors, felled logs, or planks of wood heaped with soil can be used instead, depending on the resources to hand. Kearny showed in a later Oak Ridge National Laboratory book, ***Nuclear War Survival Skills,*** 2nd ed., 1987, **how to build improvised efficient, self-calibrating radiation dosimeter (a comb-charged jam-jar electroscope, calibrated accurately by the size of the aluminium foil leaves which carry the charge; the charges keeps the leaves separated against gravity until air is ionized by radiation, when the leaves lose charge and fall together, the amount of declease in separation distance in millimetres being accurately correlated with radiation dose as proved by laboratory tests!) that can be quickly made by anyone with kitchen odds and ends in an emergency**, a **hand-powered simple string-pulled hinged panel air cooling pump for such shelters in hot weather**, and **how to obtain food** and **water** in a nuclear war.

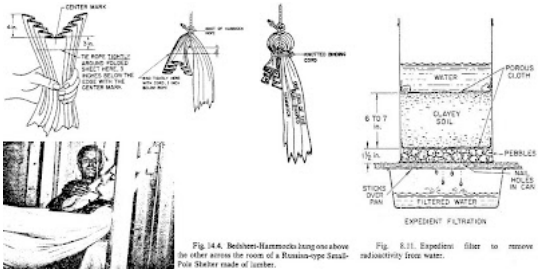


Fig. 14.4. Bedsheet-Hammocks hung one above the other across the room of a Russian-type Semi-Pole Shelter made of lumber.

Fig. 8.11. Expedient filter to remove radioactivity from water.

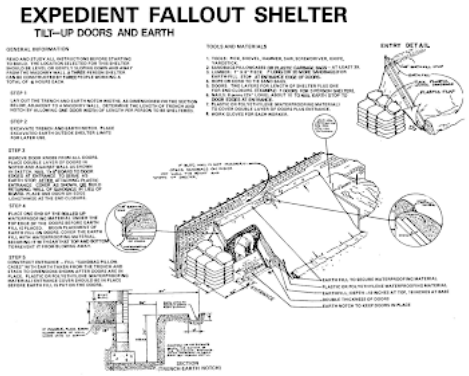
The most important for emergency use (where rapid protection is desirable) are the 'car over trench shelter' (dig a trench the right size to drive your car over, putting the excavated earth to the sides for added shielding, then drive your car over it), "tilt up doors and earth" shelter (if your house is badly damaged, build a fallout shelter against any surviving wall of the house by putting doors against it and piling earth on top in accordance to the plans), and the "above ground door-covered shelter" (basically a trench with excavated earth piles at the sides, doors placed on top, then a layer of earth piled on top of the doors).

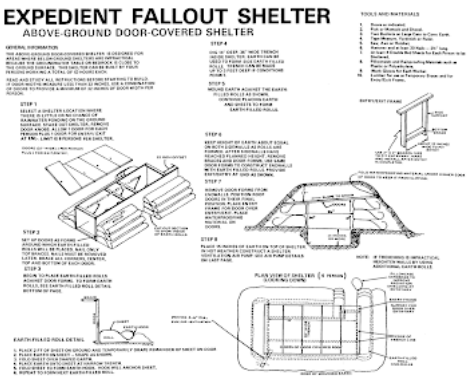
DOSE TRANSMISSION FACTORS FOR VARIOUS STRUCTURES

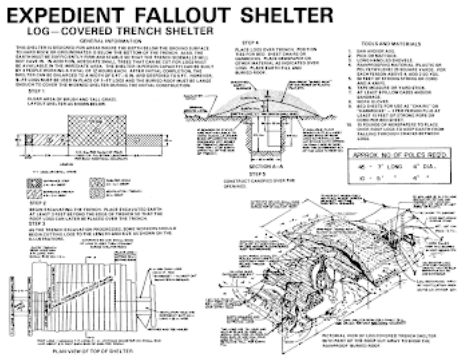
Structure	Initial Gamma Rays	Neutrons	Early fallout Gamma Rays
Three feet underground	0.002–0.004	0.002–0.01	0.0002
Frame House	0.8–1.0	0.3–0.8	0.3–0.6
Basement	0.1–0.6	0.1–0.8	0.05–0.1
Multistory building (apartment type):			
Upper stories	0.8–0.9	0.9–1.0	0.01
Lower stories	0.3–0.6	0.3–0.8	0.1
Concrete blockhouse shelter:			
9-in. walls	0.1–0.2	0.3–0.5	0.007–0.09
12-in. walls	0.05–0.1	0.2–0.4	0.001–0.03
24-in. walls	0.007–0.02	0.1–0.2	0.0001–0.002
Shelter, partly above grade:			
With 2 ft earth cover	0.03–0.07	0.02–0.08	0.005–0.02
With 3 ft earth cover	0.007–0.02	0.01–0.05	0.001–0.005

Effects of Nuclear Weapons, 3rd ed., 1977, pp. 349 and 441.

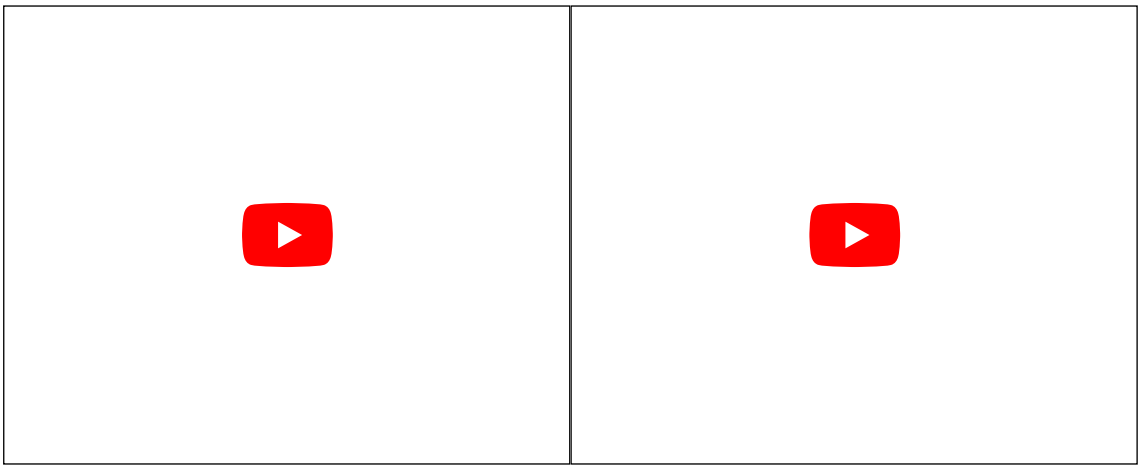

EXPEDIENT FALLOUT SHELTER
CAR—OVER—TRENCH


EXPEDIENT FALLOUT SHELTER
TILT—UP DOORS AND EARTH


EXPEDIENT FALLOUT SHELTER
ABOVE-GROUND DOOR-COVERED SHELTER



All these shelters can be constructed very quickly under emergency conditions (in a time of some hours, e.g., comparable to the time taken for fallout to arrive in the major danger area downwind from a large nuclear explosion). **For the known energy of gamma rays from fallout including neutron induced activities with low energy gamma ray emission (Np-239, U-237, etc.),** a thickness of 1 foot or 30 centimetres of packed earth (density 1.6 grams per cubic centimetre) shields 95% of fallout gamma radiation, giving an additional protective factor of about 20. A thickness of 2 feet or 60 centimetres of packed earth provides a protective factor of about 400. Caravans have a protective factor of 1.4-1.8, single storey modern bungalows have a protection factor of 5-6, while brick bungalows have a protective factor of 8-9. British brick multi-storey buildings have protection factors of 10-20, while British brick house basements have protective factors of 90-150. These figures can easily be increased by at least a factor of 2-3 by making a protected 'inner core' or 'refuge' within the building at a central point, giving additional shielding:



In 1964, Britain conducted experiments with Co-60 sources to validate the 'core' ***Protect and Survive*** **shelter plan (above videos): A. D. Perryman,** ***Experimental Determination of Protective Factors in a Semi-Detached House With or Without Core Shelters*****, U.K. Home Office report CD/SA117. Using Co-60, the dry fallout protective factor was 21 on the ground floor of a brick house, increasing to 39 in a core shelter, made using furniture piled near an inner wall. For real fallout with less than the 1.25 MeV mean gamma ray energy of Co-60, the protection would be far greater**. See also the **75-pages long American report on these 'Protect and Survive' core shelter experiments in Britain by Joseph D. Velletri, Nancy-Ruth York and John F. Batter,** ***Protection Factors of Emergency Shelters in a British Residence,*** **Technical Operations Research, Burlington, Massachusetts, report AD439332, 1963.**

John Newman examined effects of fallout blown into a buildings, due to blast-broken windows, in ***Health Physics,*** **vol. 13 (1967), p. 991: 'In a particular example of a seven-storey building, the internal contamination on each floor is estimated to be 2.5% of that on the roof. This contamination, if spread uniformly over the floor, reduces the protection factor on the fifth floor from 28 to 18 and in the unexposed, uncontaminated basement from 420 to 200.'**

But measured volcanic ash ingress, measured as the ratio of mass per unit area indoors to that on the roof, was under 0.6% even with the windows open and an 11-22 km/hour wind speed (U.S. Naval Radiological Defense Laboratory report **USNRDL-TR-953**, 1965). The main gamma hazard is from a very big surrounding area, not from trivial fallout nearby!

Dr Saad Z. Mikhail's paper, *Beta-Radiation Doses from Fallout Particles Deposited on the Skin* (Environmental Science Associates, Foster City, California, report **AD0888503**, 1971) quantified the beta contact hazard for fallout particles while they are descending in the open:

'A fission density of 10^{15} fissions per cubic centimeter of fallout material was assumed. Comparison of computed doses with the most recent experimental data relative to skin response to beta-energy deposition leads to the conclusion that even for fallout arrival times as early as 16.7 minutes post-detonation, no skin ulceration is expected from single particles 500 micron or less in diameter. Absorbed gamma doses calculated for one particle size (100 microns) show a beta-to-gamma ratio of about 15. Dose ratio for larger particle sizes will be smaller. Doses from arrays of fallout particles of different size distributions were computed, also, for several fallout mass deposition densities; time intervals required to accumulate doses sufficient to initiate skin lesions were calculated. These times depend strongly on the assumed fallout-particle-size distribution. Deposition densities in excess of 100 mg per square foot of the skin will cause beta burns if fallout arrival time is less than about three hours, unless the particles are relatively coarse (mean particle diameter more than

250 microns).'

Seven-year-old Rongelap girl contaminated with fallout: beta ray hair loss at 28 days and complete regrowth some 6 months later.

Blistering and depigmentation on upper surface of bare feet by beta rays from fallout sticking to moist, thin skin, at 28 days after burst (left) and recovery 6 months later (right). Rongelap people were only burned on bare skin exposed from H+4 to H+50 hours.

Keeping the highly visible particles off the skin by wearing clothing, or removing them quickly by brushing or washing after contamination, eliminates the beta burn hazard, **as demonstrated by the examples of Marshallese Islanders who washed after fallout contamination:**

U.S. Congressional Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, *The Nature of Radioactive Fallout and Its Effects on Man,* 27 May - 3 June 1957, pages 173-216 where Dr Gordon M. Dunning testified that fallout beta burns only occur where fallout is in direct contact with the skin and dose not occur to people wearing clothing which covers the skin, or people who wash the fallout off the skin instead of leaving it there for two days:

'In the case of the Marshallese who were in the fallout from the detonation at the Pacific on March 1, 1954, most of the more heavily exposed showed some degree of skin damage, as well as about half of them showing some degree of epilation [hair loss] due to beta doses. However, none of these effects were present except in those areas where the radioactive material was in contact with the skin, i.e., the scalp, neck, bend of the elbow, between and topside of the toes. No skin damage was observed where there was a covering of even a single layer of cotton clothing. ... The Marshallese were semiclothed, had moist skin, and most of them were out-of-doors during the time of fallout. Some bathed during the two-day exposure period before evacuation, but others did not; therefore, they were optimal conditions for possible beta damage. The group suffering greatest exposure [Rongelap Islanders, 175 R gamma dose from 4 hours to 2 days after burst, plus 2,000 R beta dose to sweaty areas of bare skin which retained a similar contamination density to the ground deposit density] showed 20 percent (13 individuals) with deep lesions; 70 percent (45 individuals) superficial lesions; and 10 percent (6 individuals) no lesions. Likewise, 55 percent (35 individuals) showed some degree of epilation followed by a regrowth of hair.'

Station 20, "Castle Bravo" shot cab at end of 2,000 ft. causeway westward of Namu island, Bikini atoll, January 1954. The 7,500 ft., 12-pipe diagnostic array stretches into the background. Semicircular arc of reflecting mirror covers (Stations 1350-01 through 1350-12) stands to right of shot cab. Mirrors reflected early bomb explosion light to "smash" cameras a few miles away. (LANL D-55-8)

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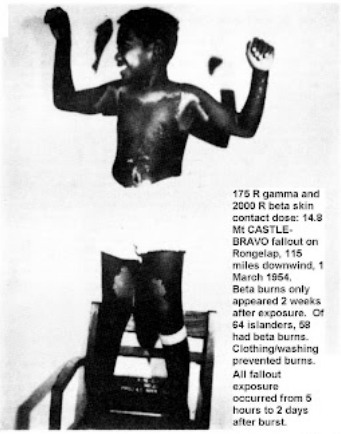
FIGURE 1



175 R gamma and 2000 R beta skin contact dose: 14.8 Mt CASTLE-BRAVO fallout on Rongelap, 115 miles downwind, 1 March 1954. Beta burns only appeared 2 weeks after exposure. Of 64 islanders, 58 had beta burns. Clothing/washing prevented burns. All fallout exposure occurred from 5 hours to 2 days after burst.

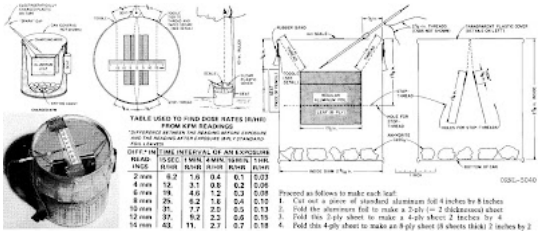
FIGURE 1.—Extensive lesions, 46 days after exposure, on a young boy who wore little clothing at the time of exposure. Note particularly the lesions on the neck, in the armpits and at the beltline—areas where the fallout material tended especially to collect.

Above: the top photo shows that the *CASTLE-BRAVO* device was detonated in the midst of a the coral reef on the Northern extremity of Bikini Atoll, upon an artificial island made from coral sand dredged up from Bikini Lagoon, to the West of Namu Island (to which the bomb island was joined by a 2,900 ft long causeway, allowing radiation to be piped through vacuum tubes to detectors 7,500 ft from the bomb which could survive the EMP, blast, ground shock and cratering action unlike nearby instruments which would be destroyed). Therefore it was a land surface burst, although the fireball and cratering action extended over shallow water above the nearby reef and deeper water in the ocean to the North and the lagoon to the South. Most of the fallout was incinerated coral, reduced by the fireball heat from calcium carbonate to calcium oxide. This, and the calcium hydroxide which forms when calcium oxide encounters moisture, is an irritant. The irritating effects of the fallout disappeared when it was washed off after 64 highly contaminated Rongelap people 115 miles downwind were evacuated 2 days after detonation. The fallout had arrived at 5 hours. The evacuation was delayed because of an unnecessary panic when the more nearby Enyu Island firing party were hit with fallout (they had a heavily protected bunker to survive in, but it caused alarm and they were nevertheless evacuated by helicopter once the fallout had stopped descending). While this drama unfolded, the test commander's attention was diverted from the danger further downwind. The second photo taken 46 days after detonation shows beta burns to a young boy who was contaminated heavily by the fallout, which was visible and looked like snowflakes on Rongelap **(this photo is from the 22-26 June 1959 U.S. Congressional Hearings on the *Biological and Environmental Effects of Nuclear War*).** He has beta burns and depigmentation to the bare areas of skin which retained fallout, principally the sweaty areas. The third photo shows hair loss in a young girl due to beta exposure to the scalp from fallout retained in coconut oil-dressed hair, and the full recovery 6 months later.

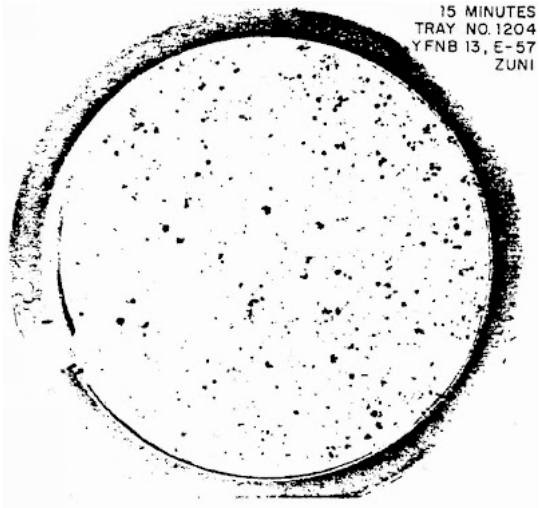
On pages 944-948 of the 1957 U.S. Congressional Hearings on the *Nature of Radioactive Fallout and Its Effects on Man,* Dr Eugene P. Cronkite testified:

'The fallout material consisted predominantly of flakes of calcium oxide resulting from the incineration of the coral [reef near Namu Island at Bikini Atoll]. Upon the flakes of calcium oxide fission products were deposited. At Rongelap Atoll the material was visible and described as snowlike. ... To arrive at some physical estimate of the skin dose, an attempt must be made to add up the contributions of the penetrating gamma, the less penetrating gamma, the beta bath to which the individuals were exposed from the relatively uniform deposition of fission products in the environment, and the point contact source of fallout material deposited on the skin. By all means, the largest component of skin irradiation resulted from the spotty local deposits of fallout material on deposited surfaces of the body. To put it in reverse, the individuals who remained inside had no skin burn. It was only on those on whom the material was directly deposited on the skin that received burns. ... Itching and burning of the skin occurred in 28 percent of the people on Rongelap, 20 percent of the group on Ailinginae, and 5 percent of the Americans [weather station staff exposed to fallout on Rongerik Atoll]. There were no symptoms referable to the skin in the individuals on Utirik. In addition to the itching of the skin there was burning of the eyes and lacrimation in people on Rongelap and Ailinginae. It is probable that these initial skin symptoms were due to irradiation since all individuals who experienced the initial symptoms later developed unquestioned radiation-induced skin lesions that will be described later in detail. It is possible, however, that the intensely alkaline nature of the calcium oxide [produced when the coral i.e. calcium carbonate was heated in the fireball] when dissolved in perspiration might have contributed to the initial symptoms. ...

'Burns were caused by direct contact of the radioactive material with the skin. The perspiration as common in the tropics, the delay in decontamination and the difficulties in decontamination certainly favored the development of the skin burns. Those individuals who remained indoors or under trees during the fallout developed less severe skin burns. The children who went wading in the ocean developed fewer lesions of the feet and most of the Americans who were more aware of the dangers of the fallout, took shelter in aluminum buildings and bathed and changed clothes. Consequently they developed only very mild beta burns. Lastly, a single layer of cotton material offered almost complete protection, as was demonstrated by the fact that skin burns developed almost entirely on the exposed parts of the body.'

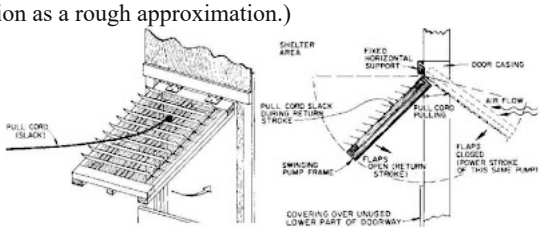


Above: **the Kearny Fallout Meter, first described in Oak Ridge National Laboratory report ORNL-5040**. In actual fact, **scientifically validated, statistically significant, non-lying, non-noise injury from fallout (i.e., excluding the statistical "noise" from the completely non-radiation *natural* cancer rates in a properly matched non-exposed control group)** has only ever occurred where the deposit of fallout has been **clearly visible, as airborne ash, rainout or "snowflakes", and as a deposit. Therefore, you don't need a radiation meter to detect fallout, you can feel and see it. A radiation meter indicates how much nuclear radiation is being *given off by the clearly visible dangerous fallout*.**



Above: visible appearance of a typical deposit of dangerous fallout; this is a secret photo from WT-1317 of a fallout tray automatically exposed for just 15 minutes at 1 hour after detonation of the 3.53 megaton, 15% fission surface burst ***Redwing-Zuni*** at Bikini in 1956. The fallout illustrated occurred on barge YFNB 13, located 20 km North-North-West of ground zero (downwind). The circular tray's inner diameter is 8.1 cm. This 15 minute sample is only 22% of the total deposit of 21.9 g/m^2 which occurred at that location. The barge's radiation meter recorded a peak gamma intensity of 6 R/hr at 1.25 hours after the explosion.

Because fallout sinks in the ocean (which shields the fallout quite effectively, giving only a small dose rate) and the barge deck is much smaller than a land area, the barge radiation meters record only about 25% of those on land which are contaminated to the same extent. So on land the peak gamma ray intensity for this fallout would have been 4 x 6 = 24 R/hr at 1.25 hours. Correcting from 15% fission yield to 100% fission yield would increase this to 160 R/hr. The infinite time fallout dose is 5 times the peak intensity times the time of that intensity as measured from the time of explosion. Hence the infinite dose outdoors on land for pure fission would be 5 x 160 x 1.25 = 1000 R which is lethal. Any house would provide enough protection to save your life, however. (The dose law of 5 times intensity times arrival time is based on the $t^{-1.2}$ decay law. Obviously it is well known that the fallout intensity drops below that law within 200 days, and a better law is 4 times intensity times arrival time. On the other hand, some radiation is received before the peak dose rate occurs, so it is sensible to use the factor of 5 multiplication as a rough approximation.)



Above: Kearny air pump, a simple but highly efficient string-pulled swinging panel with slats to ensure a one-way air flow that sucks fresh air through a shelter to prevent stagnation and heat exhaustion in hot weather.

Robert Ehrlich (Physics Department, George Mason University, Virginia) and Jane Orient, MD, 'The Case for Civil Defense in Nuclear War Education', *Physics and Society,* vol. 19, no. 2, April 1990, pp. 3-5:

'A majority of educators teaching courses on nuclear war and peace profess to believe in the importance of presenting both sides of controversial issues. Yet the pro side of the civil defense issue is seldom presented without the ridicule often used by its detractors. In fact, many nuclear war courses do not include *any* significant amount of material on civil defense. This may be because most educators feel very strongly that nuclear war is unsurvivable, or perhaps that thoughts of nuclear war survivability are an obstacle to peace. This article argues that civil defense advocates should be allowed to make their own case, so students can decide for themselves whether or not the idea deserves to be ridiculed. ...

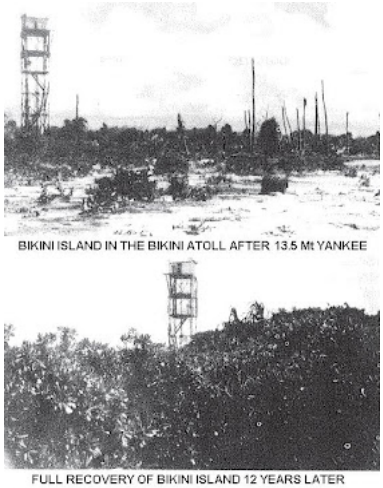
'For many Americans the thought of experiencing the kind of unpleasant hand-to-mouth existence prevalent in 90 percent of the Third World today, a realistic prospect for survivors, is simply unimaginable. It is more comforting to imagine one's instantaneous annihilation in a nuclear war. In reality, of course, far more people would suffer slow, painful deaths, especially those who died from radiation sickness – deaths that could be prevented by taking precautions, some of a relatively simple nature.

'For example, fallout radiation (present on dust particles) can be simply washed off food without the food being contaminated afterwards, and contaminated water can easily be decontaminated by simply filtering it through an earthen filter. Another simple protective measure unknown to many civil defense skeptics who think in terms of special purpose fallout shelters is the simple expedient of survivors staying in their own home basements for a week or two following a nuclear war. ...

'Civil defense critics often portray the situation otherwise by speaking of the vast land area that can be "contaminated" by a single nuclear explosion. ... everyone on earth is contaminated right now [with natural uranium, radon, carbon-14, and best yet the naturally radioactive potassium-40, which has "scary" 1,248,000,000 years half-life that makes the 24,000 years half-life of plutonium-239 look trivial and safe] ...

'In discussing the dangers of fallout from nuclear weapons, people often mention the islands in the Pacific that remain "contaminated" as a result of U.S. nuclear testing ... The Northern Marshall Islands Radiological Survey conducted in 1978 showed that on most of the islands the annual dose due to fallout was about 0.006 rems from all exposure pathways, including food, or about 4 percent of the average annual external background dose in the U.S. On **Bikini Island**, one of the most heavily contaminated areas, the maximum dose to those

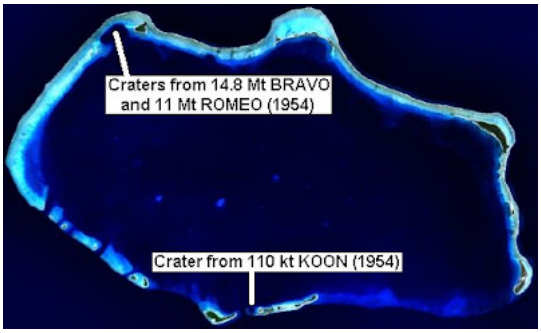
eating locally contaminated food was less than 2 rems. [**Note that in the 1990s, KCl added to the coral soil of Bikini Atoll (scene of 76.8 Mt of tests) reduced the Cs-137 in coconuts by 95% from 3,700 Bq/kg to 185 Bq/kg**.] ...



BIKINI ISLAND IN THE BIKINI ATOLL AFTER 13.5 Mt YANKEE

FULL RECOVERY OF BIKINI ISLAND 12 YEARS LATER

SOURCE: 'DCPA Attack Environment Manual, Chapter 8, What the Planner Needs to Know About the Post-Shelter Environment', CPG 2-1A8, June 1973, Panel 22.



'The primary human hazard of a depleted ozone layer would be an increase in skin cancers due to ultraviolet radiation. Calculations by the National Academy of Sciences estimate the rate of increase following a nuclear war to be about 10 percent for Northern Hemisphere survivors – roughly one tenth the increase in danger faced by someone who today chose to move from Minnesota to sunny Texas! ...

'As S. L. Thompson and S. H. Schneider note: "On scientific grounds the global apocalyptic conclusions of the initial nuclear winter hypothesis can now be relegated to a vanishingly low level of probability.' ("Nuclear Winter Reapraised," *Foreign Affairs,* vol. 64, 1986, pp. 981-1005). ...

'Disinterest in civil defense is not a global phenomenon. The Soviet Union, for example, spends over 20 times as much as the U.S. does on civil defense every year. Despite assertions about the unsurvivability of nuclear war made by Mikhail Gorbachev in his 1987 book, thre is no sign of slackening in Soviet civil defense efforts. ...

'At the same time that many deride civil defense as being incapable of coping with an all-out attack by the Soviet Union, there is a growing perception that better U.S.-Soviet relations make such an attack less likely, perhaps even the least likely, of potential nuclear threats. If that is the case, civil defense deserves reconsideration even by Doomsday theorists. The proliferation of nuclear weapons (and worse, long-range delivery systems) to Third World nations, or even to terrorist groups, poses a growing though clearly non-apocalyptic threat. Civil defense could also make a considerable difference in coping with the aftermath of the accidental launch of a few weapons.'

Nancy Deale Greene's article, 'Civil Defense and the Strategic Balance', in the *Journal of Civil Defense,* Vol. 15, No. 4, August 1982, pp. 6-9, stated:

> 'The Soviets spend the U.S. equivalent of about $2 billion annually on civil defense [this figure comes from the CIA report *Soviet Civil Defense,* July 1978, which worked out the cost of the immense Soviet civil defense program in terms of American wages if it were implemented in America, and found it would cost $2,000 million]. This compares to about $128 million annually by the United States ... Only about 5,000 people in the United States work in civil defense, including agency employees, compared with 100,000 permanent civil defense workers in the U.S.S.R., and an *additional 20 million part-time trained civil defense workers.* ... Every school child in the U.S.S.R. learns about civil defense; a five-year course is required at higher education levels. ... *A people without weapons are defenseless, but weapons without a people are purposeless.* ... (Only about 2 percent of the United States is targetted, but about 60 percent of the population lives in the 2 percent.) ...
>
> 'Unfortunately, most Americans believe the oft-repeated myth that nuclear weapons are a thousand times more destructive than the Hiroshima bomb because they may be a thousand times more powerful [the area damaged is not directly proportional to the energy/power of the explosion, but scales up more slowly, particularly for city-type devastation where the fact of conservation of energy tells us that - contrary to the claim in *The Effects of Nuclear Weapons* - the blast wave *irreversibly* loses at least 1% of its energy, which gets degraded to waste warmth of the rubble, each time it blows up a house along any given radial line outward from ground zero; thus after a few hundred houses in any given radial line have been totalled, the resulting

exponential energy loss in the blast wave means that the ideal-terrain blast overpressure predictions are falsely way too high, **as Lord Penney, et al., observed from a detailed analysis of accurate damage blast indicators for both Hiroshima and Nagasaki in their 1970 paper**]. But a foxhole ... and 12 to 18 inches of dirt over one's head, can provide good protection. ... most citizens do not know that closing the drapes could be a life-saving act fifteen miles from ground zero [against the light and thermal flash and the **blast window fragments, which are not propelled very forcefully by the weak blast winds at that distance, and so can be caught and stopped by curtains**]. ... Marxist-Leninist theory supports "the *initiation* of war as a deliberate act of policy ... if the Soviet Union is virtually certain of winning and the gains clearly outweigh the cost." (Michael McGuire: *International Security,* Vol. 3, No. 4, Spring, 1979.) ... One expects to live a long life, but most carry life insurance. The life insurance policy of the United States is in its people, not in its weapons.'

In 1950, the first editions of Glasstone's two most widely reprinted and cited works, *Sourcebook on Atomic Energy* and *The Effects of Atomic Weapons,* were both published while he was working at Los Alamos Scientific Laboratory as consultant to the U.S. Atomic Energy Commission. His job was to teach courses in these subjects, and prepare study materials. The main problem with ***The Effects of Nuclear Weapons*** and also its secret companion *Capabilities of Nuclear Weapons* is the numbered logical arrangement of information into chapters by effects, which occurred in 1950, not by types of burst. This gives all readers the entirely mistaken belief that all nuclear explosions are very similar in qualitative nature, with merely some quantitative differences in the different effects. However, the effects are so entirely different for different types of burst, say compare an **under water burst** to a **detonation in outer space**, that this is really misleading. This confusion gives most people the impression that the same general effects are associated with all detonations, which is totally false. However, *the books were a major advance* and the **1957**-64 editions contained a chapter on civil defence (dropped from the **1977 edition** which was published during President Carter's administration which also considerately delayed the neutron bomb deployment, at the request of Moscow as we shall see).

'During World War II many large cities in England, Germany, and Japan were subjected to terrific attacks by high-explosive and incendiary bombs. Yet, when proper steps had been taken for the protection of the civilian population and for the restoration of services after the bombing, there was little, if any, evidence of panic. It is the purpose of this book to state the facts concerning the atomic bomb, and to make an objective, scientific analysis of these facts. It is hoped that as a result, although it may not be feasible completely to allay fear, it will at least be possible to avoid panic.'

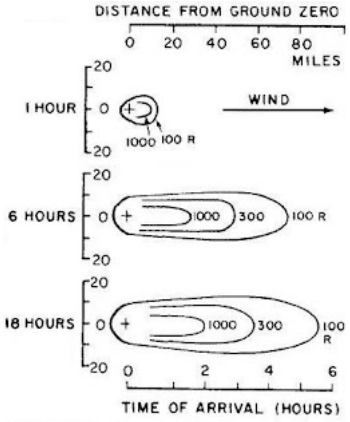
– **Dr George Gamow (the big bang cosmologist and nuclear weapons expert)**, Dr Samuel Glasstone (Executive Editor), and **Professor Joseph O. Hirschfelder**, ***The Effects of Atomic Weapons,* (S. Glasstone, Executive Editor), U.S. Department of Defense, September 1950, chapter 1, p. 1, paragraph 1.3.**

'The penalty of a loss of confidence is illustrated by the depression of 1929. The physical plant of our society did not shrink, the skills of the people did not grow less, yet production fell by more than 40 per cent and millions were unemployed.'

- Dr Henry A. Kissinger, *Nuclear Weapons and Foreign Policy,* Harper & Brothers, New York, 1957, pp. 65-6. (Or, as T. S. Eliot wrote, 'This is the world ends: not with a bang but with a whimper'.)

'The consequences of a multiweapon nuclear attack would certainly be grave ... Nevertheless, recovery should be possible if plans exist and are carried out to restore social order and to mitigate the economic disruption.'

- Philip J. Dolan, Stanford Research Institute, Appendix A of the **U.S. National Council on Radiological protection (NCRP) symposium *The Control of Exposure to the Public of Ionising Radiation in the Event of Accident or Attack,* 1981.**

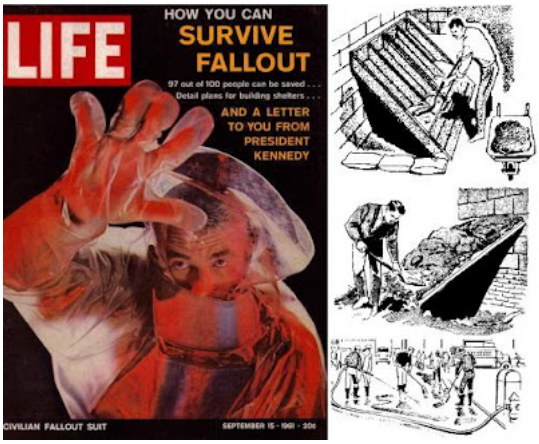


2 Mt 50% fission yield land surface burst: 15 mph wind. Glasstone and Dolan 1977

No terrain shielding or building shielding is included. On land people can escape lethal fallout by just walking crosswind!

Philip J. Dolan noted there that 20% of the U.S. urban population and 19% of the rural population have access to protection factors from fallout of over 1,000 in subways and basements, while 75% of the urban population and 43% of the rural population have access to a protection factor of 100 or more. In that report, assuming an attack on U.S. military, industrial and civilian targets with 1,444 weapons with a total yield of 6,559 megatons with 50% fission yield, of which 5,051 total yield megatons were surface bursts, including 113 ground bursts of 20-Mt yield each, Dolan found that 92 million people lived in areas where the 1-hour reference gamma dose rate would be 300-3,000 R/hr, and that they would receive an outdoor exposure of 360-5,400 R over 4 days. This implies that the effective fallout arrival time for those people ranges from 3.9-9.2 hours, thus ***most people would have many hours to prepare and take cover against wind carried fallout***. Surveying the actual risk of such a nuclear war, Dolan cited an army calculation that estimated 3% per decade, while averaged public opinion polls forecast a risk of about 10% per decade. In response to such concerns, between 1955-64 America invested $53 million in buying 3,117,201 self-reading 0-200 R gamma electroscope dosimeters, 515,032 dosimeter chargers, 567,457 ion chambers for 0-500 R/hr to be used during fallout sheltering, and 452,558 Geiger counters for 0-50 mR/hr, to aid the decontamination of water, food, and clothing at later times.

Herman Kahn of the RAND Corporation in the **22-26 June 1959 U.S. Congressional Hearings on the *Biological and Environmental effects of Nuclear War* pp. 913-5** recommended spending $100 million on buying 2 million dose rate fallout survey meters and 10 million quartz fibre dosimeters with charging units. He also recommended on p. 915 that $50 million be spent on 'identifying, counting and labeling the various structures that either provide valuable levels of fallout protection as they now stand or that can easily be modified to do so. [Another $100 million] would be spent for such supplies as radios, minimal toilet equipment ... and possibly even minimal food supplies ... or materials for improving the protection of the shelter.' Kahn justified the expense on p. 913: 'It costs from $50 to $100 million to develop an engine for a military airplane. It costs $100 to £200 million to develop an interceptor aircraft and $500 million to $1 billion to develop an intercontinental bomber. The ICBM development program cost between $1 and $2 billion. The Department of Defense spends $5 billion every year on research and development. We are saying that a complete nonmilitary defense program is at least as complicated as an interceptor aircraft.' On 15 September 1961, just after the construction of the Berlin Wall, President John F. Kennedy adopted some of Kahn's 1959 civil defense expedient shelter recommendations and had the following letter published in that issue of *LIFE* magazine, which made civil defense the cover story, called *How You Can Survive Fallout:*



The White House
September 7, 1961

My Fellow Americans:

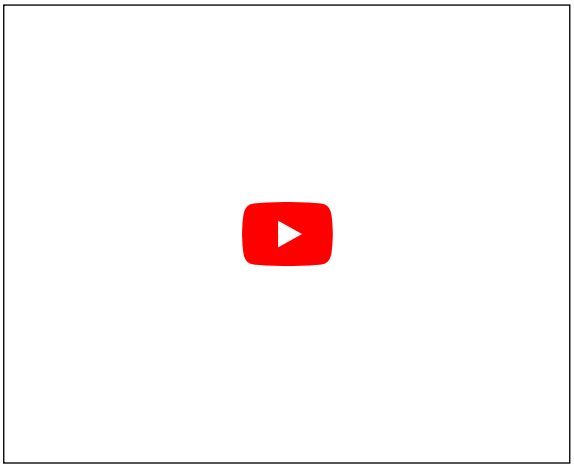
Nuclear weapons and the possibility of nuclear war are facts of life we cannot ignore today. I do not believe that war can solve any of the problems facing the world today. But the decision is not ours alone.

The government is moving to improve the protection afforded you in your communities through civil defense. We have begun, and will be continuing throughout the next year and a half, a survey of all public buildings with fallout shelter potential, and the marking of those with adequate shelter for 50 persons or more. We are providing fallout shelter in new and in some existing federal buildings. We are stocking these shelters with one week's food and medical supplies and two weeks' water supply for the shelter occupants. In addition, I have recommended to the Congress the establishment of food reserves in centers around the country where they might be needed following an attack. Finally, we are developing improved warning systems which will make it possible to sound attack warning on buzzers right in your homes and places of business.

More comprehensive measures than these lie ahead, but they cannot be brought to completion in the immediate future. In the meantime there is much that you can do to protect yourself - and in doing so strengthen your nation.

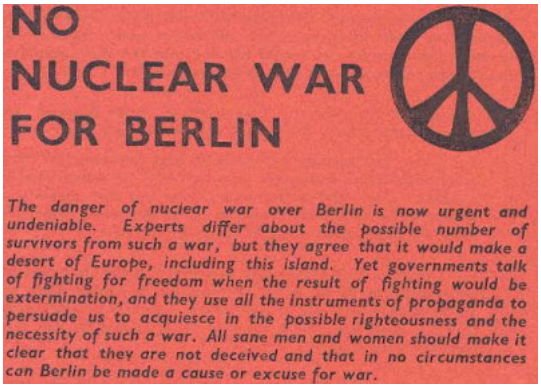
I urge you to read and consider seriously the contents in this issue of LIFE. The security of our country and the peace of the world are the objectives of our policy. But in these dangerous days when both these objectives are threatened we must prepare for all eventualities. The ability to survive coupled with the will to do so therefore are essential to our country.

John F. Kennedy

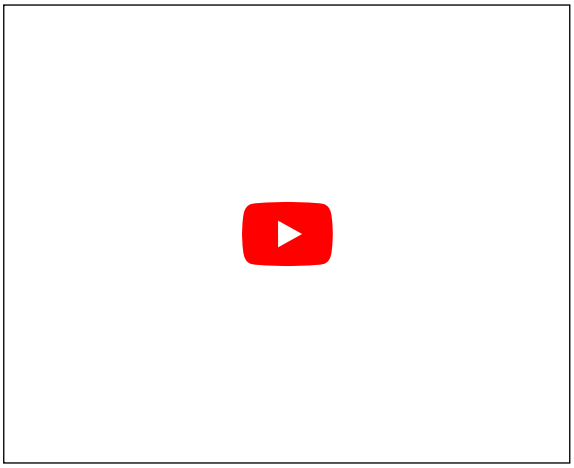


Above: Kennedy speaking in Berlin on 26 June 1963 in reference to the Berlin Wall put up in 1961 by the communists to prevent people escaping to freedom from the Eastern dictatorship (those who tried to climb the wall were shot by border guards acting on Soviet Premier Krushchev's orders and left there to bleed to death):

> Two thousand years ago, the proudest boast was: 'civis Romanus sum.' Today – in the world of freedom – the proudest boast is: 'Ich bin ein Berliner.' I appreciate my interpreter translating my German! There are many people in the world who really don't understand, or say they don't, what is the great issue between the free world and the Communist world. *Let them come to Berlin!* There are some who say that communism is the wave of the future. *Let them come to Berlin!* And there are some who say – in Europe and elsewhere – we can work with the Communists. *Let them come to Berlin!* And there are even a few who say that it is true that communism is an evil system, but it permits us to make economic progress. *Lass' sie nach Berlin kommen!* Let them come to Berlin! Freedom has many difficulties and democracy is not perfect. But we have never had to put a wall up to keep our people in – to prevent them from leaving us! ... You live in a defended island of freedom, but your life is part of the main. So let me ask you, as I close, to lift your eyes beyond the dangers of today, to the hopes of tomorrow; beyond the freedom merely of this city of Berlin – or your country of Germany – to the advance of freedom everywhere, beyond the wall to the day of peace with justice, beyond yourselves and ourselves to all mankind. Freedom is indivisible, and when one man is enslaved, all are not free. When all are free, then we look – can look forward to that day when this city will be joined as one and this country, and this great Continent of Europe, in a peaceful and hopeful globe. When that day finally comes, as it will, the people of West Berlin can take sober satisfaction in the fact that they were in the front lines for almost two decades. All free men – wherever they may live – are citizens of Berlin. And, therefore, as a free man, I take pride in the words: 'Ich bin ein Berliner.'

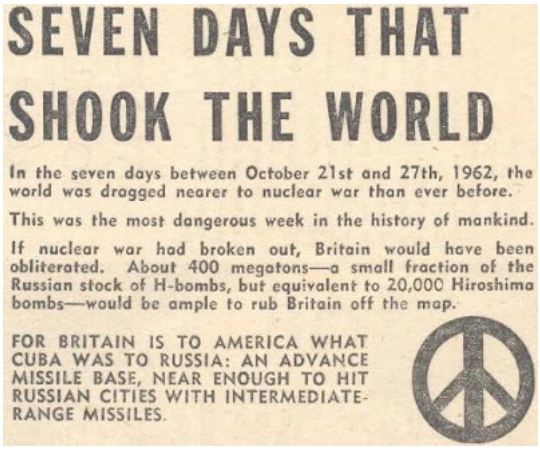


Above: President Kennedy's policy of civil defense and strength against the Communist threat was viciously opposed by CND, which exaggerated the effects of nuclear weapons to play down the effectiveness of civil defense (CND also ignored entirely the threat to survival from aggressive Communist dictatorships!). It's on the face of it totally bizarre that pacifism took off in Britain in the 1930s, insisting that Hitler be allowed to do whatever he wanted without a preventative war when such a war would have been successful (Germany was initially disarmed after defeat in World War I). But the combination of (initially) pacifism plus (later, when Hitler had an airforce and a massive army) gross exaggeration of the effects of conventional aerial bombardment warfare and poison gas threats against civilian targets, led to endless appeasement while the threat grew ever more serious. Kennedy himself witnessed this while in Britain at the outbreak of the war, and wrote an excellent book about the perils of appeasement which is still worth reading today, *Why England Slept.* This is one reason he stood up to Soviet tyranny.



Above: Kennedy's TV broadcast at 7 pm on Monday 22 October 1962, warning the Soviet Union's Premier Khrushchev of nuclear war if a nuclear missile was launched against the West, even by an accident:

> It shall be the policy of this nation to regard any nuclear missile launched from Cuba against any nation in the Western hemisphere as an attack by the Soviet Union on the United States, requiring a full retalitory response upon the Soviet Union.



SEVEN DAYS THAT SHOOK THE WORLD

In the seven days between October 21st and 27th, 1962, the world was dragged nearer to nuclear war than ever before.

This was the most dangerous week in the history of mankind.

If nuclear war had broken out, Britain would have been obliterated. About 400 megatons—a small fraction of the Russian stock of H-bombs, but equivalent to 20,000 Hiroshima bombs—would be ample to rub Britain off the map.

FOR BRITAIN IS TO AMERICA WHAT CUBA WAS TO RUSSIA: AN ADVANCE MISSILE BASE, NEAR ENOUGH TO HIT RUSSIAN CITIES WITH INTERMEDIATE-RANGE MISSILES.

Above: CND propaganda exaggerating the effects of nuclear weapons and ignoring even the most elementary concept of equivalent megatonnage, i.e. the relative inefficiency of large explosions due to the waste of energy as we will explain below. (In addition, they ignore the fact that nuclear weapons effects are easily defended against. Contrary to all films of nuclear explosions, the blast does not accompany the visible flash but is delayed like thunder after lightning, giving people the opportunity to take cover. Similarly, fallout is delayed, again giving people the chance to get under cover or out of the downwind hotspot area.)

Above: President Kennedy's Secretary of Defense Robert S. McNamara on risk of nuclear war during the Berlin wall crisis of August 1961 when the Soviet Union aggressively built a wall to keep its citizens from escaping from East Berlin, and deliberately murdered people who tried to climb over it and at the Cuban missiles crisis of 1962 when Kennedy threatened to retaliate in full against the Soviet Union if even a single nuclear missile was launched from Cuba against any Western nation. McNamara emphasises the role of pure *luck* in preventing a nuclear war during such crises (e.g., if the nuclear missiles on Cuba had been launched against Washington, D.C., by accident or in panic or by nefarious decisions of terrorist states or dictatorships, there would have been an all-out nuclear war). *This reliance on luck is why it is so important to have civil defense and understand the capabilities of nuclear weapons while they continue to exist today!*

If we don't extend our nuclear deterrent against terrorist, we must instead risk the banal appeasement of Hitler-like dictatorial terrorist nations and groups *until* they have so much military power that the danger to civilization is overwhelming so that there is public support for action (which will occur when it is too late for effective action), and then we will be forced to fight against invasions or wanton acts of terrorist like 9/11. President Kennedy explained the dictatorial challenge to freedom as follows in his 1963 State of the Union Message:

> In Vietnam we are determining whether or not the free world can help a nation defend itself against the subversion and guerrilla warfare which make up the 'war of national liberation' tactics. I think it is fair to say that we have largely stopped the Communist thrust all around the world in conventional and nuclear arms. We are now confronted by a new kind of threat, and we have to a degree invented a new kind of response to meet it. All of the underdeveloped nations of the world are watching the event. If South Vietnam falls, their will to resist this kind of aggression will be weakened and the whole fabric of free-world strength and determination damaged thereby.

Exactly as Kennedy there predicted, by the time that America withdrew in failure from Vietnam in 1975, the Soviet Union's power was at its peak, and as a result it set about a series of invasions and sponsored communist revolutions worldwide, culminating in setting up a dictatorship in Afghanistan. In their unbiased and widely-praised factual compendium, *Nuclear War File* (Ebury Press, London, 1983, pp. 26-7), Christopher Chant and Ian Hogg explained Soviet superiority in terms of equivalent megatonnage (the diffraction type overpressure-damaged ground area being proportional to the two-thirds power of individual bomb yields):

'... while the U.S.A. and U.S.S.R. enjoy an approximate parity in ICBM and SLBM warheads (about 7,500 each) ... [using equivalent megatonnage] we must come to another conclusion, namely that the U.S.S.R. has an advantage of the U.S.A. of about 2.65:1 in ICBMs and SLBMs, or of about 1.6:1 if aircraft-delivered warheads are included.'

Professor Richard E. Pipes had explained the reason for this superiority in his article, ‘Why the Soviet Union Thinks It Could Fight and Win a Nuclear War,’ Commentary, July 1977, p. 21:

‘The strategic doctrine adopted by the USSR over the past two decades calls for a policy diametrically opposite to that adopted in the United States by the predominant community of civilian strategists: not deterrence but victory, not sufficiency in weapons but superiority, not retaliation but offensive action.’

At the 14-25 February 1956 Soviet Communist Party 20th congress in Moscow, leader Khrushchev destroyed Stalin’s reputation, exposing his crimes. But in November 1956, the Soviet Union put down an uprising against communism in Hungary with brutal military force, tanks and bullets.

The hard-line communism which maintained the Soviet Union’s power in the 1960s was demonstrated when the Czechoslovakian communist party leader Alexander Dubcek in 1968 invented the heretical policy of ‘socialism with a human face.’ Dubcek reduced state suppression on freedom of speech in public and in newspaper reporting. On 29 April, the Soviet Union cut off food supplies to Czechoslovakia, followed by an invasion with 220,000 Soviet and Warsaw Pact soldiers and paratroops plus tanks on 20 August. Within 72 hours, Dubcek was jailed, and the opposition by the Czech people to the invasion merely increased the presence of Soviet troops to 650,000. The brief period of liberty was called the ‘Prague Spring’.

This is explained by J. R. Thackrah’s prologue to *Politics Made Simple* (Heinemann, London, 1987): ‘Stresses which lead to a weakening of political integration must be reduced by appropriate responses from the political authorities, otherwise the system will tend to divide or will collapse entirely.’

Back in 1949, Vannevar Bush had written in *Modern Arms and Free Men* (Simon and Schuster, New York, pp. 200-1):

‘The weakness of the Communist state resides in its rigidity, in the fact that it cannot tolerate heresy, and in the fact that it cannot allow its iron curtain to be fully penetrated. ... Dictatorship can tolerate no real independence of thought and expression. Its control depends entirely upon expressed adherence by all to a rigid formula, the party line. Its secret police must be ever alert to purge those who would depart from discipline and think their own thoughts, for departure would soon lead to a vast congeries of independent groups defying central authority, and the system would break.’

President Nixon had initiated 1970s ‘peace’ initiatives in a cynical public relations attempt to get his Watergate scandal out of the newspapers. In 1975, America signed the Helsinki Act, for the first time agreeing to the borders of the Soviet Union and its Warsaw Pact in Europe. This officially handed over those countries and people to Soviet control. After it was signed, the Chairman of the Soviet KGB (secret police), Yuri Andropov, stated in a letter to the Soviet Central Committee on 29 December 1975: ‘It is impossible at present to cease criminal prosecutions of those individuals who speak out against the Soviet system, since this would lead to an increase in especially dangerous state crimes and anti-social phenomena.’

On 12 July 1977, President Jimmy Carter announced his consideration of a plan to deploy the anti-tank neutron bomb to Europe to deter the 1,000,000 Soviet soldiers and 25,000 tanks amassed for an invasion. The co-ordinated Soviet response was for 28 communist parties to publish condemnations of the anti-tank neutron weapon. The Soviet ‘World Peace Council’ called an ‘international week of action’ in August 1977. The small yield and range of the neutron bomb (suiting only as a deterrent for massed tank invasions) was ignored, and the Soviet Union falsely portrayed it as a weapon which threatened people in general, not just the crews of 25,000 offensive Soviet tanks.

Within a year, Carter gave in to the false propaganda and demonstrations, and stopped deployment of the neutron bomb. Paul Mercer reports in his 465 pages long book *'Peace' of the Dead: The Truth Behind the Nuclear Disarmers* (Policy Research Publications, London, 1986), page 96:

'[Soviet news agency] TASS reported during the campaign [against deployment of Sam Cohen's neutron bomb, 25 July - 14 August 1977]

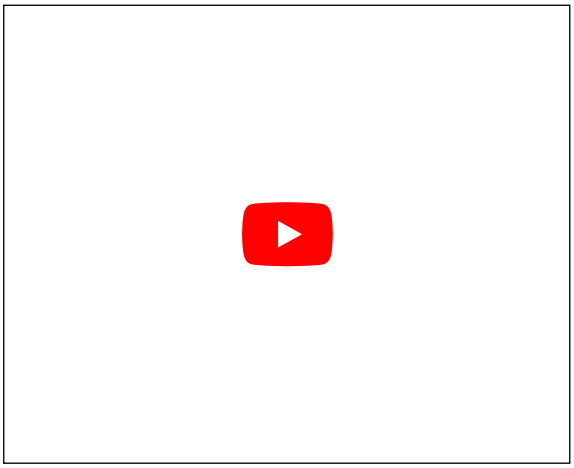
that: "Soviet Baptist leaders today condemned production of the neutron bomb as 'contrary to the teachings of Christ' and urged fellow Baptists in the United States to raise their voices in defense of peace." [Quoted in John Barrow, 'The KGB's Magical War for "Peace",' *Reader's Digest (US Edition),* October 1982, p. 226.] Jimmy Carter was, of course, a devoted Baptist, and this initiative had the effect of "peace" protesters in the United States taking the hint and disrupting services at his church, the First Baptist Church, in Washington, on three separate occasions.'

In 1979, the European threat from Soviet SS-20 missiles was countered by a NATO plan to deploy Cruise and Pershing missiles in Europe. Brezhnev responded with a paltry promise to remove a mere 20,000 soldiers and 1,000 tanks from East Germany as a peace gesture, and claimed that NATO would be guilty of escalating the arms race if it introduced Cruise and Pershing missiles. At first, Brezhnev received wide praise and support for his false 'peace talk,' but that finally evaporated when he ordered the invasion of Afghanistan in December 1979.

The Soviet Union's peace offensive installed dictatorships in Congo and Syria in 1968, South Yemen and Libya in 1969, Somalia in 1970, Guinea in 1971, Iraq in 1972, Zambia in 1973, Cambodia, Laos, and South Vietnam in 1975, Angola and Mozambique in 1976, Ethopia in 1978, and Afghanistan in 1979. By 1977, Western Europe was outnumbered by Soviet weapons poised for attack: the Soviets had a 4.6 times as many tanks and 4 times as much artillery as the west, with 4.8 million full-time military personnel compared to only 2.1 million on the American side. President Carter therefore proposed deploying Dr Samuel Cohen's neutron bomb to deter the Soviets from mounting a concentrated tank invasion of Western Europe. The Soviets had 584 major offensive submarines and ships, compared to 289 on the American side; and they had by 1978 some 3,909 strategic and intermediate offensive weapons, compared to only 2,125 on the American side. Moreover, the Soviet weapons were less accurate and therefore more threatening to sprawling civilian cities than to hardened military bases.

> 'I went to Czechoslovakia again in May 1983. As part of the Soviet Union's so-called "peace-offensive" the Czechoslovak authorities were holding a conference of peace organizations: The World Assembly for Peace and Life, Against Nuclear War. It was mostly a propaganda show against NATO's plans to install medium-range nuclear weapons in Europe. There was little evidence of new thinking about it.'

- BBC correspondent John Simpson, *Despatches from the Barricades: An Eye-Witness Account of the Revolutions that Shook the World 1989-90,* Hutchinson, London, 1990, p. 160.



Above: Ronald Reagan, the former actor and ex-lifeguard who had saved 77 lives, introduced the 'Peacekeeper' missile, a new civil defence propaganda assault and on 23 March 1983 a 'Star Wars' ABM research programme on 'Excalibur', Edward Teller's X-ray laser as well as chemical lasers. One thing that keeps getting forgotten in ABM discussions is that ABM is not new. In the 1960s, ABM was successfully tested over Kwajalein Atoll in the Pacific. It works. The American 'Sentinel' ABM system was briefly deployed in the 1970s to protect missile silos, but was simply too expensive to protect all American cities to a high degree of reliability and was also liable to produce EMP collateral damage owing to the high yield X-ray ablation mechanism Spartan missiles used for long-range intercepts above 35 km altitude. The full Sentinel system would have consisted of six Perimeter Acquisition Radar to cover the entire United States and detect and track enemy reentry vehicles when they rose over the horizon into view (at a range of 4,000 km, or 10 minutes warning time). Individual ABM launchers also had a shorter-range Missile Site Radar to target Spartan and Sprint missiles. The Spartan missiles with large warheads would be deployed to destroy the missiles by X-ray ablative recoil forces at altitudes above 35 km. If Spartan failed, then short-range Sprint missiles would be used for interception at altitudes below 35 km. Sprint used **clean** neutron bomb warheads to melt down the fissile material in enemy warheads (shielding such warheads would be prohibitive in terms of the number of warheads the missile could carry, just as decoys and chaff is a waste of time as a penetration aid; it just makes a bigger radar signal and bigger target to aim for). The whole advantage of civil defense (cheap) and ABM (expensive) countermeasures against attack is that they reduce the reliance on mutual deterrence, which is dependent on the goodwill of both sides (you would be foolish to rely entirely on the goodwill of a volatile dictatorship for peace and security).

Reagan's move towards lasers was to avert the collateral damage risks from blast and EMP of defensive nuclear detonations. An ordinary 1 kW carbon dioxide gas based laser, as used in industry, will burn through 1 mm thick steel plate at the rate of 8 cm per second. The thickness vaporized is proportional to the square root of the laser power. Lasers all work on the same quantum principle: the energy of a photon emitted by a quantum energy level transition is also the energy required to promote an electron to that energy level. By saturating a suitable, pure material with photons, the electrons will begin absorbing and emitting radiation of a specific wavelength (line spectra). The laser generally uses a rod with a reflector at one end and a partial reflector at the other, to allow many quantum transitions to build up radiation coherence before emission: coherent radiation builds up and stimulates the emission of similar radiation. Incoherent radiation is

pumped into the sides of the rod, and the coherent beam emerges from the partial reflector in a narrow beam dependent on the diameter of the rod. This is the Light Amplification by the Stimulated Emission of Radiation (LASER) principle.

Chemical lasers which fire at missiles within the atmosphere simply have to burn a hole in the missile skin, to allow the air drag force on the missile to crush it. This was proved in tests where the air drag force was simulated with hydraulic rams and a laser burned a hole in the missile skin. The orbital X-ray laser is for use outside the atmosphere, where X-rays can travel without attenuation. A nuclear explosion in Excalibur would release 80% of its energy as a blackbody spectrum of light-velocity 'hot' X-rays (mostly above 10 keV). These would pour into laser rods consisting of very low density (non-ablative) plastic foam like expanded polystyrine containing a small quantity of uranium-238 as the laser material. The inner electrons of ionized uranium-238 can be raised to energy levels as high as 10 keV, resulting in coherent X-ray emission. The rods would contain thick beryllium at one end as an X-ray mirror, and thin beryllium at the other end as a partial reflector (which emits the coherent X-ray beam after pumping of the uranium-238 atomic electrons in the rod). Based on the results of a Nevada underground test of Excalibur, a compact version would be too inefficient and for high efficiency very long laser rods would be required. X-ray laser rods 1 mm in diameter would need to be 1 km long to achieve the efficiency claimed by Edward Teller in 1983.

However, lower efficiencies are still practical for ABM purposes, and it is easy to design a system with coiled up expanded plastic laser rods like string, which could be stretched out inside long telescopic metal tubes (like those used for telescopic antennae). X-rays pumped into such metal tubes would enter the laser rods along the sides of the rods. Telescopes associated with each laser rod would focus them on nuclear missiles. This low-yield nuclear X-ray laser would be kept in a suitable orbit over the earth (it is generally not possible to launch it to a high enough altitude to shoot down enemy missiles over a large area when an attack is detected) to replace the high-yield 'Spartan' nuclear X-ray ablation warhead ABM developed successfully by America in the 1960s and 1970s, but never deployed for fear of EMP collateral damage. Ablation can be explained very simply and is very well understood because it's the mechanism by which fission primary stages ignite fusion stages inside thermonuclear weapons: 80% of the energy of a nuclear explosion is in X-rays and the X-ray laser would make those X-rays coherent and focus some of them on to the metal case of an incoming enemy missile. The result is the blow-off or 'ablation' of a very thin surface layer of the metal (typically a fraction of a millimetre). Although only a trivial amount of material is blown off, it has a very high velocity and carries a significant momentum. The momentum isn't immense but it creates a *really massive force* on account of the small time (about 10 nanoseconds) over which it is imparted (this is because force is the *rate of change of momentum,* i.e. $F = dp/dt$), and since pressure is simply force per unit area, you get an immense pressure due to Newton's 3rd law of motion (action and reaction are equal and opposite, the rocket principle).

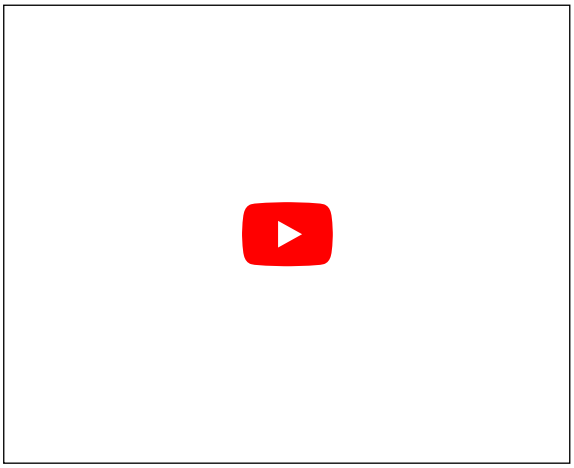
Hans Bethe and W. L. Bade in their paper *Theory of X-Ray Effects of High Altitude Nuclear Bursts and Proposed Vehicle Hardening Method* (AVCO Corp., Mass., report RAD-TR-9(7)-60-2, April 1960) proposed that missiles can be hardened against X-ray induced ablative recoil by using a layer of plastic foam to absorb reduce the force within the missile by spreading out the change of momentum over a longer period of time, but although this will protect some *internal* components from shock damage, the missile skin can still be deflected, dented and destroyed by ablation recoil. Inside the atmosphere, low-yield neutron bomb warheads in 'Sprint' missiles were developed in the 1960s and 1970s for ABM inception (penetrating neutrons would heat up the fissile material in warheads, melting it out of shape and making the bombs fizzle), and Star Wars proposed to replace them with chemical lasers.

Above: President Ronald Reagan's 12 June 1987 speech at the Brandenburg Gate of the 1961 Berlin Wall:

> And now the Soviets themselves may, in a limited way, be coming to understand the importance of freedom. We hear much from Moscow about a new policy of reform and openness. Some political prisoners have been released. Certain foreign news broadcasts are no longer being jammed. Some economic enterprises have been permitted to operate with greater freedom from state control. Are these the beginnings of profound changes in the Soviet state? Or are they token gestures, intended to raise false hopes in the West, or to strengthen the Soviet system without changing it? We welcome change and openness; for we believe that freedom and security go together, that the advance of human liberty can only strengthen the cause of world peace. There is one sign the Soviets can make that would be unmistakable, that would advance dramatically the cause of freedom and peace. General Secretary Gorbachev, if you seek peace – if you seek prosperity for the Soviet Union and Eastern Europe – if you seek liberalization: come here to this gate! Mr. Gorbachev, open this gate! Mr. Gorbachev, tear down this wall!
>
> I understand the fear of war and the pain of division that afflict this continent - and I pledge to you my country's efforts to help overcome these burdens. To be sure, we in the West must resist Soviet expansion. So we must maintain defences of unassailable strength. Yet we seek peace; so we must strive to reduce arms on both sides. Beginning 10 years ago, the Soviets challenged the Western alliance with a grave new threat, hundreds of new and more deadly SS-20 nuclear missiles, capable of striking every capital in Europe. The Western alliance responded by committing itself to a counter deployment unless the Soviets agreed to negotiate a better solution; namely, the elimination of such weapons on both sides. For many months, the Soviets refused to bargain in earnestness. As the alliance, in turn, prepared to go forward with its counter deployment, there were difficult days - days of protests like those during my 1982 visit to this city-and the Soviets later walked away from the

table.

But through it all, the alliance held firm. And I invite those who protested then - I invite those who protest today - to mark this fact: Because we remained strong, the Soviets came back to the table.



Above: on 9 November 1989, the people of a free Berlin tore down the Wall because the failure of communist will in the face of overwhelming Western strength had demoralized the hard liners and permitted Gorbachev to gain power and reform the Soviet Union, withdrawing the 500,000 Soviet troops in Eastern Europe who were required to keep the population from staging an uprising. With the troops and tanks gone, the people could demolish the wall with relative impunity.

'It is natural, after a series of events such as this book has dealt with, to look for some single underlying cause which links them all. In the inmediate aftermath of the revolutions some right wing journalists and politicians in Western Europe, innately suspicious of the influence of television over the minds of people, ascribed the revolutionary process to the influence of broadcasters. It won't do, of course. Television may have alerted people to the revolutionary moment in Romania, but only by accident. In East Germany and Czechoslovakia it remained in the hands of Party loyalists until the critical moment had come and gone; people saw little or nothing of the revolution on their television screens.

'There is a far more obvious link between each of the major events I have dealt with in these pages. Hungary and Poland eased away from Soviet Authority with the tacit approval of Mikhail Gorbachev. His policies and his visit to Peking encouraged Chinese students and intellectuals to occupy Tiananmen Square [that revolt against communism in China was suppressed, unlike the revolt in Europe in 1989, because Gorbachev had removed 500,000 Soviet troops from Europe and paved the way for reform; which was not the case in hard line controlled China in 1989]. At the very least, the revolutions in Central and Eastern Europe took place because he disapproved of the old leaders and made it clear he would not intervene to save them.'

- BBC correspondent John Simpson, *Despatches from the Barricades: An Eye-Witness Account of the Revolutions that Shook the World 1989-90,* Hutchinson, London, 1990, p. 309.

On 1 September 1983, the evil Soviet General Secretary Andropov's orders to frontier guard troops and air defense forces to shoot down any 'intruder' aircraft caused the murder of 269 passengers aboard Korean Airlines flight KE007, which accidentally used a magnetic compass not inertial guidance for its automatic pilot and as a result entered the edge of Soviet airspace. President Reagan called it the 'murder of 269 innocent people in a defenseless airliner'. He was opposed by Andropov who lied on the 28 September 1983 that the airliner was on 'a militarist course which poses a grave threat to peace ... engineered by U.S. special services.' Apologists for Andropov blamed Reagan for Navy Secretary John Lehman's military overflights of Soviet airspace to test their air defenses, but that sick claim is precisely the same fanatical propaganda as the fascist blaming of the West for the Holocaust by saying that 'Hitler would never have had to gas 6 million Jews if the West hadn't put pressure on the Nazi regime by fighting it'. In other words, these apologists for dictatorships are nefarious. This incident gave Reagan the moral authority to oppose the Soviet Union by declaring it to be an 'evil' empire, just as Kennedy had stated in his 26 June 1963 speech in Berlin (above). Furthermore, Reagan used a variety of tactics to demoralize the Soviet Union's military might and encourage reform. E.g., Reagan's 'Evil Empire' speech on 8 March 1983 to the National Association of Evangelicals in Orlando, Florida:

The reality is that we must find peace through strength. I would agree to a freeze if only we could freeze the Soviets' global desires. A freeze at current levels of weapons would remove any incentive for the Soviets to negotiate seriously in Geneva and virtually end our chances to achieve the major arms reductions which we have proposed. Instead, they would achieve their objectives through the freeze. A freeze would reward the Soviet Union for its enormous and unparalleled military buildup. It would prevent the essential and long overdue modernization of United States and allied defenses and would leave our aging forces increasingly vulnerable. And an honest freeze would require extensive prior negotiations on the systems and numbers to be limited and on the measures to ensure effective verification and compliance. And the kind of a freeze that has been suggested would be virtually impossible to verify. Such a major effort would divert us completely from our current negotiations on achieving substantial reductions. ... It was C. S. Lewis who, in his unforgettable 'Screwtape Letters,' wrote: 'The greatest evil is not done now in those sordid 'dens of crime' that Dickens loved to paint. It is not even done in concentration camps and labor camps. In those we see its final result. But it is conceived and ordered (moved, seconded, carried and minuted) in clear, carpeted, warmed, and well-lighted offices, by quiet men with white collars and cut fingernails and smooth-shaven cheeks who

> do not need to raise their voice.' Well, because these 'quiet men' do not 'raise their voices,' because they sometimes speak in soothing tones of brotherhood and peace, because, like other dictators before them, they're always making 'their final territorial demand,' some would have us accept them at their word and accommodate ourselves to their aggressive impulses. But if history teaches anything, it teaches that simple-minded appeasement or wishful thinking about our adversaries is folly. It means the betrayal of our past, the squandering of our freedom. So, I urge you to speak out against those who would place the United States in a position of military and moral inferiority. You know, I've always believed that old Screwtape reserved his best efforts for those of you in the church. So, in your discussions of the nuclear freeze proposals, I urge you to beware the temptation of pride—the temptation of blithely declaring yourselves above it all and label both sides equally at fault, to ignore the facts of history and the aggressive impulses of an evil empire, to simply call the arms race a giant misunderstanding and thereby remove yourself from the struggle between right and wrong and good and evil. I ask you to resist the attempts of those who would have you withhold your support for our efforts, this administration's efforts, to keep America strong and free, while we negotiate real and verifiable reductions in the world's nuclear arsenals and one day, with God's help, their total elimination. While America's military strength is important, let me add here that I've always maintained that the struggle now going on for the world will never be decided by bombs or rockets, by armies or military might. The real crisis we face today is a spiritual one; at root, it is a test of moral will and faith. ... I believe we shall rise to the challenge. I believe that communism is another sad, bizarre chapter in human history whose last pages even now are being written. I believe this because the source of our strength in the quest for human freedom is not material, but spiritual. And because it knows no limitation, it must terrify and ultimately triumph over those who would enslave their fellow man. For in the words of Isaiah: 'He giveth power to the faint; and to them that have no might He increased strength. ... But they that wait upon the Lord shall renew their strength; they shall mount up with wings as eagles; they shall run, and not be weary. ...' Yes, change your world. One of our Founding Fathers, Thomas Paine, said, 'We have it within our power to begin the world over again.' We can do it, doing together what no one church could do by itself. God bless you, and thank you very much.

Soviet General Secretary Andropov was quoted on 27 March 1983 in *Pravda* responding to Reagan in the following clearly demoralized way:

> The intention to secure for itself the possibility of destroying, with the help of the ABM defenses, the corresponding strategic systems of the other side, that is of rendering it unable of dealing a retaliatory strike, is a bid to disarm the Soviet Union in the face of the U.S. nuclear threat.

In London, the Campaign for Nuclear Disarmament (CND) which had been a self-appointed committee from 1959-65 when it became a membership organization, staged a demonstration against Reagan in Hyde Park on 22 October 1983. Journalist Ann Leslie wrote about it in her *Daily Mail* newspaper article published on 25 October 1983, *How Mothers Like Me are Driven to Join the Big Peace Demos; CND blackmail at our school gates:*

> On Friday morning, the day before the demos, I and other mothers were delivering our tiny sons and daughters to their North London primary school. This humdrum, happy, chattering little scene was briefly overshadowed by a sudden glimpse of apocalyptic terror in the form of two leaflets handed out to use at the gates. The first said: 'October 23. Where will you be?' The second, from the Camden Labour Party, told us why we should be there on Saturday. Cruise missiles, due to be installed in December, will 'make nuclear war more likely. ...' It didn't of course mention that the Soviets already have over 150 SS20s installed, each with three warheads, two-thirds of which are targeted on Western Europe. ... Nor is there any illusion at NATO ... that America could fight a limited nuclear war in Europe. As General Rogers, the American Supreme Allied Commander, Europe, said: 'The Soviets have said that any American weapon system being fired at Soviet soil will be cause for her to attack the United States with strategic weapons.' ... Many in the crowd used the demonstration to promote a whole variety of separate causes. Like the seller of the Hard-Left newspaper who told me we must 'defend the Soviet Union against Western imperialism.'

The Marxist historian E. P. Thompson, an elected CND National Council member, wrote a book called 'Protest and Survive' to attack the **government's 'Protect and Survive' civil defense campaign (while ignoring all the scientific facts about civil defense).** On 18 June 1982, journalist Marjory Davidson had written an article in *The Sun* newspaper called *CND, Is It All a Russian Con Trick - Moscow's making fools of our ban the bomb brigade:*

> The 19 very important visitors were welcomed to Moscow in the style of Heads of State. Police escorted their motorcade as it swept through red lights on the way from Sherenritovo Airport to a downtown hotel. Visits to the Bolshoi Ballet, the old Czarist capital, Leningrad and the fabled cities of Tashkent and Samarkand were on the programme. And it was red carpet treatment all the way. ... Who were the lucky 19? Not pop stars, or soccer players or even astronauts. They were members of the Campaign for Nuclear Disarmament and fellow sympathisers ... They are part of a campaign that is orchestrated and financed [via the Soviet funded so-called 'World Peace Council', which was strongly linked to CND, *et al*.] by the Soviet Union with the direct purpose of weakening the West, her resolve and her strength, while Russia continues to build up the most fearsome military machine in history. ... The naive band of travellers were campaigning for Britain to scrap all nuclear weapons. When they hesitantly asked the Kremlin to make a possible 10% reduction in its nuclear arsenal, the reply was a brutal 'Niet.' In Britain, the ban-the-bomb campaign is booming. Membership has increased from 3,000 to 37,000 in 18 months and includes many idealistic young people. Brezhnev flew from Moscow to meet the 1,000 Soviet-subsidised deligates in Sofia. ... They seek a power base in Britain. They aim to get it by exploiting the fear and horror felt by decent men and women at the idea of nuclear war. They have formed special sections - Youth CND and Christian CND - to extend their sphere of influence.

Paul Mercer gives the following 1983 flowchart in his excellent anti-propaganda book, *'Peace' of the Dead: The Truth Behind the Nuclear Disarmers* (Policy Research Publications, London, 1986), page 91:

Soviet Union Politburo, Candidate Member: *Boris Ponomarev*
|
Central Committee of the Soviet Communist Party, Secretary: *Boris Ponomarev*
|
International Department, Head: *Boris Ponomarev*; Oleg Kharkhardin (Vice-President of Soviet Peace Committee)
|
World Peace Council, President: Romesh Chandra; Oleg Kharkhardin (Vice-President of Soviet Peace Committee)
|
International Liaison Forum of Peace Forces, Chairman: Romesh Chandra; Executive Secretary: Oleg Kharkhardin; Vice-Chairmen: Arthur Booth and Sean MacBride
|
(member body)
|
International Peace Bureau, Chairman: Arthur Booth; President: Sean MacBride; Vice-President: Bruce Kent
|
(member body)
|
Campaign for Nuclear Disarmament (CND), General Secretary: Bruce Kent; Irish CND Committee: Sean MacBride

Mercer states that the delegation which CND sent to Moscow in May 1982 consisted of Lord Hugh Jenkins (1980-1 CND Chairman), Joan Ruddock (then the current CND Chairman), Roger Spiller (who was soon to be elected Vice-Chairman of CND), Sally Davison (full-time National Organiser of CND, 1979-81), and Gerard Holden. On 31 May 1982, Joan Ruddock, the Chairman of CND, was in session with Yuri Zhukov, the Chairman of the Soviet 'World Peace Council' anti-Western propaganda lobby. Soviet news agency TASS on 28 May 1982 reported that Lord Jenkins said CND 'had a high opinion of the Soviet peace initiative', neglecting all the Soviet funded invasions and wars on democracy throughout the world! CND's control by Soviet communism continued right up to the end of the Cold War. For example, see Dr Julian Lewis's article, 'CND's New Stalinist Leader' in the December 1990 issue of *Freedom Today* (**available online**):

'CND has appointed the former National Organiser of the British branch of the World Peace Council (WPC) as its new General Secretary – the position held by Bruce Kent when leading CND in the early 1980s. Mr Gary Lefley, who takes up CND's top full-time salaried post in the new year, can accurately be described as an agent of President Brezhnev's propaganda machine at the height of the Soviet "peace offensive" against NATO's planned deployment of cruise and Pershing II missiles. ... Before the 1983 General Election, CND published a list of 120 Labour MPs amongst its members. This total had risen to 133 by the time of the 1987 General Election. Currently, CND refuses to reveal either the total or the names of their supporters in the Parliamentary Labour Party. This is undoubtedly because it would run counter to Labour's attempts to conceal its continuing unilateralism. Now that the organisation is to be run by a propagandist for the Brezhnev regime, there is yet another reason for Labour's CND MPs to keep their membership a secret.'

Above: the British media was the stage for a war of terror between nuclear weapons effects exaggerating CND and Prime Minister Maggie Thatcher's pro-civil defence, pro-deterrence, anti-intimidation elected government. At the 1983 General Election, CND went so far as to try to get voters to elect Neil Kinnock's Labour Party due to its declared unilateral nuclear disarmament policy, which would have removed Britain from its 'unsinkable aircraft carrier' role for American nuclear weapons in the effort to deter a Soviet invasion of Western Europe! CND did this by exaggerating the effects of nuclear weapons as well as downplaying the horrendous suffering that living under communist dictatorship would entail and also downplaying the incredible effectiveness of simple civil defense countermeasures against thermal radiation, blast and fallout radiation! Despite all her widely-attacked and tragic failings on domestic policy, Thatcher stood up for freedom effectively in foreign policy: unlike most scientifically inept politicians, she was a former research chemist, who - despite her widely perceived domestic policy failings as a right-wing woman - backed the morality of civil defence and on foreign policy issues stood up to terrorist state dictator Leonid Brezhnev, echoing Clayton's pragmatic outlook on war in her address to the United Nations General Assembly on disarmament on 23 June 1982, when she pointed out that in the years since the nuclear attacks on Hiroshima and Nagasaki, 10 million people were killed by 140 non-nuclear conflicts, so:

'The fundamental risk to peace is not the existence of weapons of particular types. It is the disposition on the part of some states to impose change on others by resorting to force against other nations ... Aggressors do not start wars because an adversary has built up his own strength. They start wars because they believe they can gain more by going to war than by remaining at peace.'

Charles J. Hitch and Roland B. McKean of the RAND Corporation in their 1960 book *The Economics of Defence in the Nuclear Age,* Harvard University Press, Massachusetts, p. 310, stated:

'With each side possessing only a small striking force, a small amount of cheating would give one side dominance over the other, and the incentive to cheat and prepare a preventative attack would be strong... With each side possessing, say, several thousand missiles, a vast amount of cheating would be necessary to give one side the ability to wipe out the other's striking capability.'

For example, America used two nuclear weapons against Japan in desperation to stop World War II fighting when it had no nuclear stockpile at all, *but resisted from using nuclear weapons at all when it had a massive stockpile of nuclear weapons, even when it had superiority over the Soviet Union until the 1960s*. At the end of *The Economics of Defence in the Nuclear Age,* p. 357, the authors stress: 'the more extensive a disarmament agreement is, the smaller the force that a violator would have to hide in order to achieve complete domination. Most obviously, "the abolition of the weapons necessary in a general or 'unlimited' war" would offer the most insuperable obstacles to an inspection plan, since the violator could gain an overwhelming advantage from the concealment of even a few weapons.'

Thus, reducing the scale of nuclear deterrence may not result in increased security. This fact is not opinion, and it doesn't matter if it opposes 'consensus thinking' or 'groupthink'. Such a fact is not a pro-nuclear bias, or propaganda, but is countering lying propaganda. We have to work with natural facts in the real world, regardless of whether popular ideologies and utopias are contrary to them.

The popular theories of nuclear disarmament campaigners ignore these facts, and claim that the massive number of nuclear weapons in existence is due to misunderstanding of the 'total annihilation' effects of nuclear weapons by insane politicians and scientists. Similarly, many oppose American anti-ballistic missile (ABM) systems as being contrary to deterrence. However, Hitch and McKean on page 180 of the same book in 1960 pointed out:

'An American force that can make a devastating first strike but is easily destroyed on the ground is more likely to invite direct attack than to deter it.'

For this reason, a first strike capability alone is not a sufficient capability to deter war, and may cause a war instead. To resist intimidation, it is necessary to be credibly able to survive a first strike by the enemy so you have control over how you decide to respond later. If your forces are 'soft targets', i.e., are not protected from the effects of a first-strike by the enemy, then you will have no choice but to launch all your weapons in panic when you detect a first-strike coming. This won't help you, and makes deterrence unstable because false alerts could cause you to start a nuclear war by accident (e.g., missile tests, asteroid showers, confusion during training exercises, etc., could set off a war in the absence of a second-strike capability).

Only with such a second strike capability, i.e., the ability to fight a nuclear war slowly without panic or total annihilation, are you able to intimidate the opponent into deciding *not* to start a war with you. Furthermore, if you have both a first and a second strike capability, you may have political leverage to bring to bear on an opponent that goes past merely preventing war. After all, deterring Germany in 1939 from provoking a war would have prevented war but it would not have prevented ill-treatment of the Jews. *Only by having more capability than is merely required for deterrence,* can you hope to *intimidate an evil dictatorship* into *political reform.* E.g., on 29 October 1982, British Prime Minister Maggie Thatcher stated of the Berlin Wall:

> 'You may chain a man, but you cannot chain his mind. You may enslave him, but you will not conquer his spirit. In every decade since the war the Soviet leaders have been reminded that their pitiless ideology only survives because it is maintained by force. But the day comes when the anger and frustration of the people is so great that force cannot contain it. Then the edifice cracks: the mortar crumbles ... one day, liberty will dawn on the other side of the wall.'

Leonid Brezhnev fortunately died on 10 November 1982, while Reagan and Thatcher challenged the Soviet Union's nuclear superiority with increased civil defence efforts coupled to military expenditure in a successful effort to bankrupt and reform the corrupt Soviet terrorist system.

On 22 November 1990, Thatcher was able to declare:

> 'Today, we have a Europe ... where the threat to our security from the overwhelming conventional forces of the Warsaw Pact has been removed; where the Berlin Wall has been torn down and the Cold War is at an end. These immense changes did not come about by chance. They have been achieved by strength and resolution in defence, and by a refusal ever to be intimidated.'

A Gallup Poll in Britain in 1983 found that 67% of the population opposed CND's stated objective of unilateral (i.e., Britain only) disarmament. On October 1983, the London *Guardian* newspaper commissioned an opinion poll which showed that 77% of Britain's population were in support of either keeping or improving Britain's nuclear deterrent in the face of the Soviet threat. Despite these facts, the **antinuclear-biased BBC** gave enormous coverage to the CND anti-nuclear protests and the British Labour Party took up a pro-CND unilateral disarmament policy, which was one reason why it lost the general election on 9 June 1983 owing to unpopularity. (CND supporters then set up so-called 'Nuclear Free Zones' in the false belief that signposts would protect people against radiation from fallout, which was disproved when the Soviet Chernobyl reactor exploded in April 1986, contaminating such propaganda-spin zones!)

Traditionally, bigoted anti-ABM, pro-appeasement physicists like Nobel Laureate Dr Hans Bethe would **attack any new ABM idea**, but

they were unable to effectively discredit Reagan's Star Wars because if they debunked Star Wars, then they would be discrediting Andropov's claim that Reagan's ABM really *was* a threat! So they were caught in a trap: whatever they said would help Reagan! *Reagan, by threatening to make Soviet military might impotent and obsolete, stumped the whole basis of Marxist ideology which was a substitute for religion: the belief that in the future they would one day force a world revolution. By taking away that Marxist belief system, the Soviet Union had to change its belief from one based on military might to one based on capitalism.*

Gorbachev was born in 1931 and saw his own family suffer when Stalin used mass starvation to force Soviet farmers to give up all they owned and move on to collective farms. Any who tried to defend themselves from the lazy, dictatorial Bolsheviks with their hunting guns were simply outnumbered and murdered, and their children and wives were then carted off to collective farms. They had no chance, no hope of freedom, not even to live simple lives off their land. His wife Raisa, whom he met in 1953 at Moscow University, had suffered a similar childhood. Gorbachev was nominated to lead the U.S.S.R. by the disillusioned Soviet foreign minister Andrei Gromyko (the liar who had tried to delude President Kennedy over the Cuban missiles crisis, claiming that none of the weapons the Soviet Union supplied Cuba were offensive in nature) on 11 March 1985.

Gorbachev then replaced Gromyko with Anatoly Chernyaev, who was keen for reform. Due to their personal experiences of the terror of totalitarian evil, they had a sympathy with President Reagan's hopes for freedom and reform. Gorbachev required merely two Russian words, glasnost (openness) and perestroika (restructuring), to describe the changes he wanted to make to the Soviet Union. When German student pilot Matthias Rust was able to penetrate Soviet air defenses and land his plane in Red Square, Gorbachev used the event as leverage to purge his military of all remaining resistance to perestroika. On 7 December 1988, Gorbachev initiated the withdrawl of 500,000 troops from Eastern Europe, allowing the fall of the Berlin Wall in November 1989. A year later, in November 1990, the Conventional Forces in Europe Treaty was signed which forced the Soviets to destroy 28,000 battle tanks in order to equalize Warsaw Pact and NATO forces. Finally in August 1991, a hard line communist coup was attempted which arrested Gorbachev but not Boris Yeltsin, who took control of the U.S.S.R. and signed a draft for its dissolution at a December 1991 meeting with the leaders of the Ukraine and Belarus. Gorbachev, his presidency then obsolete, resigned on 25 December 1991. It is instructive when considering *The Effects of Nuclear Weapons* to examine the relevant background, the Cold War and the use of nuclear weapons effects for intimidation by all parties.

1994 revised Introduction to Kearny's Nuclear War Survival Skills, by Dr Edward Teller, January 14, 1994:

> 'If defense is neglected these weapons of attack become effective. They become available and desirable in the eyes of an imperialist dictator, even if his means are limited. Weapons of mass destruction could become equalizers between nations big and small, highly developed and primitive, if defense is neglected. If defense is developed and if it is made available for general prevention of war, weapons of aggression will become less desirable. Thus defense makes war itself less probable. ... One psychological defense mechanism against danger is to forget about it. This attitude is as common as it is disastrous. It may turn a limited danger into a fatal difficulty.'

Before 9/11, Weinberger was quizzed by skeptical critics on BBC News Talking Point on Friday, 4 May, 2001, *Caspar Weinberger quizzed on new US Star Wars ABM plans:*

> 'The [ABM] treaty was in 1972 ... The theory ... supporting the ABM treaty ... that it will prevent an arms race ... is perfect nonsense because we have had an arms race all the time we have had the ABM treaty, and we have seen the greatest increase in proliferation of nuclear weapons that we have ever had. We are up to 7,000 plus, the Russians are up to 6,900 plus. On intercontinental missiles the Russians have 23,000 nuclear warheads. So the ABM treaty preventing an arms race is total nonsense. ... I don't know how any networking is going to prevent North Korea from doing everything it can to get more nuclear weapons than they have now particularly when China and Russia are perfectly willing to sell them all of the technology required. Intelligence sources aren't going to prevent a country from doing it.
>
> 'You have to understand that without any defences whatever you are very vulnerable. **It is like saying we don't like chemical warfare - we don't like gas attacks - so we are going to give up and promise not to have any defences ever against them and that of course would mean then we are perfectly safe. ...**
>
> 'The Patriot was not a failure in the Gulf War - the Patriot was one of the things which defeated the Scud and in effect helped us win the Gulf War. One of two of the shots went astray but that is true of every weapon system that has ever been invented. ...
>
> **'The fact that a missile defence system wouldn't necessarily block a suitcase bomb is certainly not an argument for not proceeding with a missile defence when a missile that hits can wipe out hundreds of thousands of lives in a second**. ...
>
> 'The **curious thing about it is that missile defence is not an offensive weapon system - missile defence cannot kill anybody. Missile defence can help preserve and protect your people and our allies, and the idea that you are somehow endangering people by having a defence strikes me almost as absurd as saying you endanger people by having a gas mask in a gas attack.** ...
>
> 'My worry is when we have Russia and China being the most vociferous opponents of the plan to abandon the ABM treaty and go to a defensive system. Why are they so vociferous about their hatred of the idea of having a defensive system? **The answer, I am afraid is rather clear - it is because they have offensive plans that they think would be thwarted by a defensive system and so they are doing everything they can to try to block it.** ...
>
> ***'Tensions are on the rise because very aggressive powers know that the one system that will never be defended against if we follow the ABM treaty ... are these nuclear and chemical warhead carrying missiles. Now if you tell an aggressive nation that is the one system weapons that is never going to be defending against - what are they going to do? They are going to make every effort to get that kind of system of weapons. That is what is happening and that is why there is an increased tension. The greatest force for proliferation is the ABM treaty.***

> ‘So that is why it seems to me that it is vital that we get rid of the ABM treaty concept as soon as possible and proceed with the construction of an effective defence to protect ourselves and our allies. ...
>
> ‘President Bush said that we were going ahead with the defensive system but we would make sure that nobody felt we had offensive intentions because we would accompany it by a unilateral reduction of our nuclear arsenal. It seems to me to be a rather clear statement that proceeding with the missile defence system would mean fewer arms of this kind.
>
> ‘You have had your arms race all the time ABM treaty was in effect and now you have an enormous accumulation and increase of nuclear weapons and that was your arms race promoted by the ABM treaty. Now if you abolish the ABM treaty you are not going to get another arms race - *you have got the arms already there* - and if you accompany the missile defence construction with the unilateral reduction of our own nuclear arsenal then it seems to me you are finally getting some kind of inducement to reduce these weapons.’

On 29 September 1982, Elliott Abrams, the Assistant Secretary of State for Human Rights and Humanitarian Affairs in the U.S. Government, gave the following brilliant address to the Chicago World Affairs Council:

> It was primarily two things that saved us from the danger of nuclear war which we faced in the 1950s. The first was the development in the mid-1950s of an intellectual understanding of deterrence: that what deters nuclear war is not simply more weapons but a protected strategic force that can strike back even if it is attacked first. Such a force removes the temptation to strike first. It is vital to realize that the development of the theory of deterrence was the most important act of arms control in the postwar era; more important than any negotiation or treaty we have engaged in. The second thing that kept nuclear annihilation at a distance was the development of new weapons that were shaped by this theory of deterrence. ... The *missile silo* ... able to last out a first strike and retaliate; The *ballistic missile submarine,* which was more invulnerable because it was hidden in the depths of the sea; and the *spy satellite,* which for the first time gave an accurate accounting of the other side's strategic forces, thus reducing uncertainty and nervousness. Arms control agreements like SALT 1 (Strategic Arms Limitation Talks, number 1) would not have been possible without this weapon, because they would have been wholly impossible to verify.
>
> These facts constitute a genuine paradox: that the moral result of avoiding nuclear war was achieved through certain weapons. I believe we must face this paradox squarely ... We face an appalling danger in nuclear war and have limited resources to cope with it. Since the 1950s, one of the resources that has been most useful is the redesign of weapons so that they will contribute to a true deterrent.

The neutron bomb, which we will discuss in detail below since both Samuel Glasstone and Philip J. Dolan have analyzed it in detail, is one example of a possible future for the decreasing nuclear deterrent. The neutron bomb is a miniature Teller-Ulam thermonuclear weapon which, in addition to a very small primary stage fission yield, has a deuterium-tritium fusion yield of 1 kt and would be detonated at a sufficient height (500 metres or so) to prevent local fallout and any serious blast or thermal effects on the ground: the energy partition of both of these effects is suppressed, since in deuterium-tritium fusion the products are an alpha particle and a neutron which have equal momentum, hence the neutron moves four times faster than the alpha particle, and thereby takes 4/5ths or 80% of the total kinetic energy of the fusion process! If the high-yield nuclear stockpiles of the free world were replaced with neutron bombs, collateral damage would be averted and thus nuclear deterrence would be grossly enhanced!

The nuclear threat from North Korea is a good example of the need to publish for the first the unbiased, uncensored, untwisted facts about the effects of radiation, etc., from nuclear weapons testing: terrorist dictatorships are today being ***encouraged*** *to go into nuclear proliferation by groupthink-based obscene exaggerations from the well-known terrorist-supporting fascist propaganda groups of the effects of nuclear weapons which we expose below. Mainstream physicists in the West have lied that there is no such thing as effective easy improvised civil defense against the bomb, while exaggerating the effects of nuclear weapons in total disagreement with the hard facts from Hiroshima, Nagasaki and other nuclear explosions, as we will see in this blog post.*

This exaggeration is the cause of nuclear proliferation, and the cause of the threat to civilization. What the evil, groupthink-obsessed scum don't realize is that no amount of pacifist hot air will protect you against radiation, but civil defense countermeasures will! No amount of sanctions will do anything but increase the suffering of the oppressed people, and harden the resolve of the leadership which isn't affected by the sanctions anyway. Sanctions punish the innocent. Political diplomacy and sanctions are no use against dictatorship, as proved by the case of dictatorships in history. All they do is to hand the dictatorship some real facts to supplement its lying propaganda, showing that the West really increases the suffering of its perfectly innocent, impoverished people out of Western paranoid delusions, etc., and claiming that it is merely trying to get the same nuclear security as the West to protect itself from war and thus maintain the peace by deterring aggressors.

Praemonitus praemunitus - forewarned is forearmed. *Civil defence, to be taken seriously, requires the publication of solid facts about believable threats.* Secrecy over the effects of nuclear weapons tests hinders civil defence planning against threats; it does not hinder plutonium and missile production by rogue states!

The same year as the publication of *The Effects of Atomic Weapons,* 1950, the **Top Secret British Home Office Scientific Advisory Branch report SA/16** concluded:

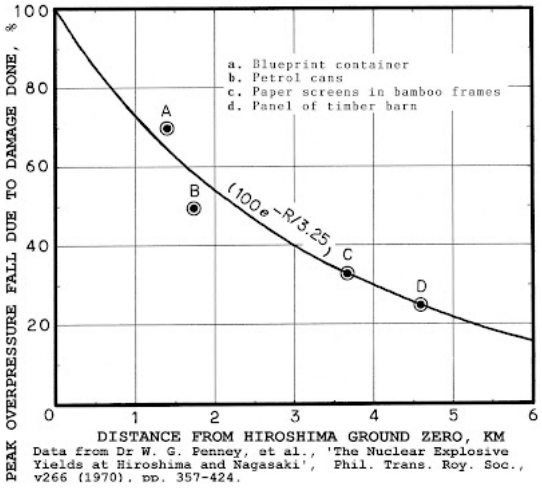
> ‘The wide publicity given to the appalling destruction caused by the atomic bombs at Hiroshima and Nagasaki has possibly tended to give an exaggerated impression of their effectiveness. Perhaps the best way to counteract this impression, and to help to get the atomic bomb to scale, is to consider the numbers of atomic bombs that would have to be dropped on this country and

on Germany to have caused the same total amount of damage as was actually caused by attacks with high explosive and incendiary bombs.

'During the last war a total of 1,300,000 tons [of bombs] were dropped on Germany by the Strategic Air Forces [of Britain and America]. If there were no increase in aiming accuracy, then to achieve the same amount of material damage (to houses, industrial and transportational targets, etc.) would have required the use of over 300 atomic bombs together with some 500,000 tons of high explosive and incendiary bombs for targets too small to warrant the use of an atomic bomb ... the total of 300,000 civilian air raid deaths in Germany could have been caused by about 80 atomic bombs delivered with the accuracy of last war area attacks, or by about 20 atomic bombs accurately placed at the centres of large German cities ...'

This vital report, **SA/16,** was kept Top Secret for 8 years, and then Restricted for another 22 years. **It was never published, for fear of undermining the value of the nuclear deterrent against Russian expansion**.

CUMULATIVE BLAST WAVE PRESSURE REDUCTION BY DAMAGE CAUSED



Above: some of Penney's 1970 published data for the attenuation of peak blast overpressure by the act of causing destruction in Hiroshima and Nagasaki, which lowers the peak overpressure in a city relative to that over unobstructed terrain. This effect means that the desert nuclear test-validated cube-root distance scaling law severely exaggerates peak overpressures at large distances from nuclear weapons exploding in or over cities. The very first edition of Glasstone's nuclear effects handbook, *The Effects of Atomic Weapons,* 1950, on page 57 has a section written by John von Neumann and Fredrick Reines of Los Alamos (it is attributed to them in a footnote) stating factually:

"... the structures ... have the additional complicating property of not being rigid. This means that they do not merely deflect the shock wave, but they also absorb energy from it at each reflection.

"The removal of energy from the blast in this manner decreases the shock pressure at any given distance from the point of detonation to a value somewhat below that which it would have been in the absence of dissipative objects, such as buildings."

This was removed from future editions. This isn't speculative guesswork: it's down to the conservation of energy. I emailed Dr Harold L. Brode and other experts about why it isn't included in American nuclear weapons effects manuals. Dr Brode kindly replied with some relevant and interesting facts about non-radial energy flows in Mach waves and the transfer of energy from the blast wave to flying debris (which, alas, travels slower than the supersonic shock front because the blast wind is always slower than the shock front velocity). It is true that the energy loss from the blast wave near ground level is partially offset by downward diffraction of energy from the diverging blast wave at higher altitudes. However, this downward diffraction process is not a 100% efficient compensator for energy loss, particularly for the kinetic energy of the air (the dynamic pressure or wind drag effect). The dynamic pressure (which in unobstructed desert or ocean nuclear tests makes the blast more hazardous for higher yield weapons) is an air *particle* effect not a *wave* effect so it does not diffract like a wave, and it is cut down severely when transferring its energy to building debris. Even if every house absorbs just 1% of the incident energy per unit of area incident to the blast, then the destruction of a line of 100 houses cuts the blast energy down to 0.99^{100} = 0.366 of what it would be over a desert surface. Basically, this chops down the collateral blast damage from large yield weapons detonated in cities and affects the usual scaling laws, making nuclear weapons even less dangerous than predicted by the textbook equations and curves.

Cumulative irreversible peak overpressure reduction in the Hiroshima shock front as it propagated and diverged, due to energy used in damaging wooden buildings, calculated from accurate natural blast gauges*

Gauge used to determine peak overpressure	Ground range	Reduction
Bent lightning conductor	940 m	7 %
Overturned memorial stones	1,310 m	14 %
Partially collapsed blue-print container	1,400 m	30 %
Partially collapsed petrol cans	1,740 m	50 %
Broken paper screens and bamboo frames	3,660 m	66 %
Broken panel of timber barn	4,570 m	75 %

*The average density of ground coverage by buildings in Hiroshima determined from aerial photographs of the target taken before

detonation was 5,400 buildings per square kilometre (the values in most British cities vary from about 5,000 near the centre to 2,000 near the outer boundaries). It is recommended that the housing density for modern Western cities be taken as half that in Hiroshima. (Data from **Penney, et al., 1970**.)

Lord William Penney visited Hiroshima and Nagasaki with the American occupation forces, measured all of the damage and shipped it back to Britain for laboratory analysis. He determined the bending moments for steel poles by the blast wave, the overpressures required to reduce the volume of blueprint containers and petrol cans, and many other natural blast wave gauges. The value of these studies was proved in the 1946 *ABLE* nuclear test, where the bomb was dropped off target by accident and Penney had to determine the air pressures from the collapse of petrol cans. This is a precise measurement because by filling the petrol can with water before and after partial collapse by blast, the volume reduction is measured, which correlates with the blast wave peak overpressure. Therefore, several items of this type can be used to get a statistically good measurement, unlike the piezoelectric electronic blast sensors used at the *TRINITY* test in 1945 which were of course wrecked by EMP (as predicted by Enrico Fermi). Later, Penney used empty toothpaste tubes to measure the peak overpressure at early British nuclear tests, averting the risk of EMP damage to electronic sensors.

Penney used the Hiroshima and Nagasaki data to do a secret study of the reduction in peak overpressure caused by the irreversible energy loss from the blast wave as it flattened house after house in each radial line outward from ground zero. Penney found that at both Hiroshima and Nagasaki, the peak overpressure fell faster than in British nuclear tests at similar scaled burst heights over smooth unobstructed desert. The peak blast overpressure fell exponentially due to the cumulative irreversible energy loss done in blowing up successive buildings.

At a distance of 1.74 km from ground zero in Hiroshima, the peak overpressure was only 50% of what it would have been over an ideal smooth desert without houses. This figure applies only to the wooden houses in Hiroshima where there were 5,400 houses per square kilometre. In most modern Western cities the number of buildings per square kilometre is on average only half that figure, but the buildings are brick or concrete and this means that they can absorb more energy in the act of being blown up by the blast wave. In a modern British city, the peak overpressure could therefore fall by 50% every 340 metres that the shock wave progressed, causing a dramatic reduction in damage at great distances, compared to the effects predicted for unobstructed ideal desert terrain in Glasstone and Dolan's 1977 book *The Effects of Nuclear Weapons*. The reduction factor for peak blast overpressure at Hiroshima due to destruction caused was: (peak overpressure in built up area) / (peak overpressure over unobstructed ideal desert terrain in nuclear tests) = $e^{-0.41R}$ where R is ground range in kilometres; for typical Western brick and concrete cities they estimated the reduction factor to be $e^{-2.0R}$.

It is important to note that this irreversible cumulative energy loss from the blast wave is a straightforward consequence of the laws of physics and is not speculative: the work energy E needed to push in a brick wall the distance X against resistance force F is simply $E = FX$. This is a simple property of physics. The energy lost from the supersonic shock front is converted into relatively slow-moving debris and a heating of the rubble, there is no mechanism for it to get back into the blast wave. This process of irreversible energy loss has nothing to do with the mere scattering of blast waves by multiple reflections between the walls of buildings which is the basis of the obfuscating discussion in Glasstone and Dolan, 1977. Analysis of the Hiroshima and Nagasaki data by Penney showed that after 75 wooden buildings had been damaged in a radial line from ground zero, the peak overpressure had fallen to only half that which would have occurred on an unobstructed ideal desert surface.

Penney kept this secret until 1970 when he gave some details in a **published paper comparing the Hiroshima and Nagasaki blast waves to British nuclear test data for ideal terrain**. Penney had earlier supported some experiments at the Atomic Weapons Research Establishment by W. Worsfold, published in the 1957 secret report *The Effects of Shielding a Building from Atomic Blast by Another of the Same Size and Shape,* AWRE-E4/57 (declassified only in May 1985) and further experiments in the report AWRE-E8/57. Each individual building causes only a trivial net reduction in the peak overpressure (1-5 % as shown in the following table), but after some tens or hundreds of houses in any radial line from ground zero have been totalled, the blast wave is seriously depleted in energy. Hence, predictions of blast damage using desert nuclear test data with the cube-root scaling law are massive exaggerations.

Net irreversible energy loss per building damaged in a radial line from ground zero by a diverging blast wave, computed from the reduction in overpressure and dynamic pressure impulse *

Type of structure	*20 kt*	*1 Mt*
2-story wood-frame house	0.9 %	1.6 %
Single-story light steel-frame building	1.1 %	1.7 %
Single-story brick veneer house or 2-story brick detached house	1.8 %	2.2 %
Brick terrace residential housing (2-4 stories)	3.7 %	4.0 %
Multistory steel-frame office complex building (3-10 stories) or high-rise building (10-20 stories)	5.1 %	6.0 %

*Data are computed for a peak overpressure of 50 kPa (7.2 psi) for the total energy loss in the blast wave, which is why there is a dependence on the weapon yield. The longer duration blast winds from a higher yield weapon loses more energy in accelerating blast debris than the shorter duration blast wave from a low yield weapon. However, the amount of reduction in the peak overpressure (at the front of the shock wave) by causing damage will be independent of the blast wave duration. It is therefore recommended that the data for 20 kilotons be used for estimating the percentage reduction in peak overpressure, regardless of the blast wave duration or weapon yield.

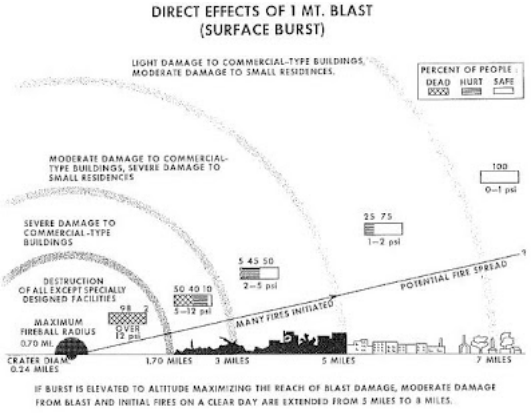
All buildings tend to absorb approximately the same fraction of the blast wave energy regardless of the peak overpressure when struck because the amount of kinetic energy imparted by the blast wave to the debris and damaged materials *increases approximately in direct proportion to the energy in the blast wave*. Therefore, regardless of the weapon yield, in a modern American city the blast reduction factor for blast overpressure due to energy loss in causing the damage done to structures will be roughly exp(-d/750) where d is distance in metres. This will obviously have a more dramatic effect on reducing damaged areas for high yield weapons (where the low levels of blast overpressure cover immense distances on unobstructed desert terrain) than low yield weapons (where the damage distances are small in any case).

But even in the case of a 1 kt terrorist surface burst in an American city, the data in Glasstone and Dolan 1977 are still gross exaggerations! The 600 R initial nuclear radiation radius will be reduced from 808 m in Nevada tests to 245 m by buildings due to the elimination of most direct (line of sight) unscattered relativistic radiation by structures *long before such structures can be destroyed by the much slower-moving blast wave!* The 5 cal/cm^2 thermal flash burn radius of 750 m in Nevada tests will be practically eliminated because the thermal pulse from such a small weapon will be over before the fireball becomes buoyant (this happens when its density falls below ambient air density, in the late stages) and rises into view above the structures which have yet to be destroyed by the blast wave. The 5 psi

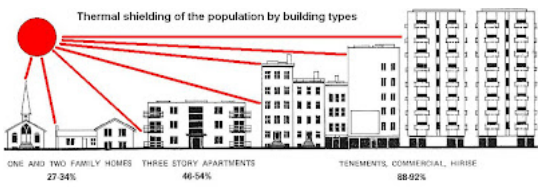
peak overpressure radius for severe damage to light residential structures will be reduced from 442 m in Nevada tests to 350 m, and the 2.5 psi peak overpressure radius for serious flying debris and glass injuries to persons standing behind windows will be reduced from 640 m in Nevada tests to 460 m. Because damaged areas are proportional to the *square* of the radius, the actual number of casualties and amount of damage reduction is far more impressive than these figures for radii suggest.

Figure 12.7. Area around ground zero at Nagasaki before and after the atomic explosion (1,000-foot radius circles are shown).

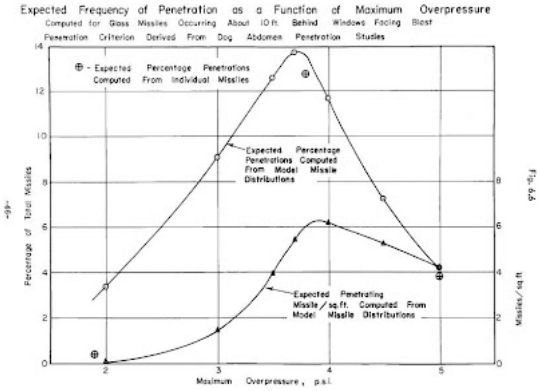
Above: photo of Nagasaki before and after the bombing: the number of houses destroyed by the blast wave in any given radial line from ground zero can be added up easily on the upper photo (click for close-up view). Each house damaged turned about 1% of the blast wave energy into the kinetic energy of debris, irreversibly depleting energy from the blast wave itself. After 75 houses had been damaged along any radial line, the blast peak overpressure was halved by the loss of energy. This factor was never included by the Americans in blast predictions, which instead used false calculations based on blast waves measured over totally unobstructed deserts.



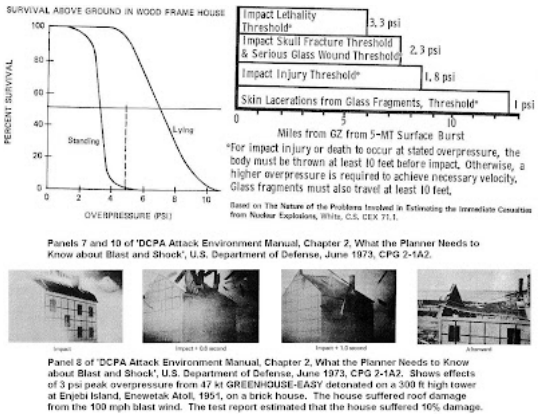
Above: the official U.S. nuclear weapons effects horror story; it is a gross exaggeration, showing how the U.S. government lied about the effects of nuclear weapons during the cold war. They predicted blast effects to buildings in cities assuming that the terrain was unobstructed and ignored the irreversible loss of energy in the blast as it flattens house after house in any radial line outward from ground zero, which quickly soaks up the energy in the ground level diverging blast wave and contains the damaged area (particularly in large explosions). They also exaggerated the fire situation by neglecting the fact that piles of concrete and bricks don't burn (as proved in Britain in World War II, and by the fact that firestorms only occurred in wooden medieval cities in Europe such as ancient wooden parts of Hamburg and Dresden, and wooden cities in Japan; and even then this was not due to thermal radiation but due to a mixture of high explosives to damage the houses by blast and incendiaries to get inside, or in Hiroshima and Nagasaki where detonations occurred at breakfast and lunch time respectively so that charcoal cooking braziers were overturned by the blast amidst bamboo and paper screens, starting the tindering fires inside wooden houses), and by ignoring the shielding of thermal radiation by shadowing effects:



Panel 3 of 'DCPA Attack Environment Manual, Chapter 3, What the Planner Needs to Know about Fire Ignition and Spread', U.S. Department of Defense, June 1973, CPG 2-1A3.



Above: dangerous abdominal penetration 3 metres behind windows (when glass fragments have been accelerated to high speed by the blast winds) during *OPERATION TEAPOT* Nevada nuclear tests in 1955. Notice that at low overpressures, there is no danger from low-overpressure broken windows because the blast wind behind the shock front is far too weak to accelerate the large fragments to high momenta, while at very high overpressures the window gets broken into dust-sized fragments that are simply far too small to carry enough momentum to penetrate clothing or skin. Thus, like Goldilocks' porridge, the peak overpressure ideally needs to be *just right (2-5 psi)* to break windows into big fragments that carry enough momentum to penetrate the abdomen when accelerated by the blast winds behind the shock front. Ducking and covering under a table or desk would avert this danger, and even dropping flat on the floor would help because the most dangerous fragments are blasted *horizontally* from the window. Contrary to lying propaganda films of nuclear explosions, the blast wave *NEVER ACCOMPANIES THE VISIBLE FLASH, BUT IS ALWAYS DELAYED LIKE THUNDER AFTER LIGHTNING, ALWAYS MAKING DUCK AND COVER POSSIBLE.* The graph is taken from: **I. G. Bowen, D. R. Richmond, M. B. Wetherbe and C. S. White, *Biological effects of blast from bombs. Glass fragments as penetrating missiles and some of the biological implications of glass fragmented by atomic explosions,* Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico, U.S. Atomic Energy Commission progress report AECU-3350, June 1956, p. 46.**



Panels 7 and 10 of 'DCPA Attack Environment Manual, Chapter 2, What the Planner Needs to Know about Blast and Shock', U.S. Department of Defense, June 1973, CPG 2-1A2.

Panel 8 of 'DCPA Attack Environment Manual, Chapter 2, What the Planner Needs to Know about Blast and Shock', U.S. Department of Defense, June 1973, CPG 2-1A2. Shows effects of 3 psi peak overpressure from 47 kt GREENHOUSE-EASY detonated on a 300 ft high tower at Enjebi Island, Enewetak Atoll, 1951, on a brick house. The house suffered roof damage from the 100 mph blast wind. The test report estimated that the house suffered 10% damage.

Above: a more recent report based on nuclear test research at *OPERATION TEAPOT* in 1955 and *OPERATION PLUMBBOB* in 1957 for house debris injury and also human displacement by blast is Dr Anatol Longinow's 161 pages long report *Survivability in a Nuclear Weapon Environment,* DCPA Contract DCPA01-77-0229, for Defense Civil Preparedness Agency, Washington, D.C. 20301, report ADA076026, May 1979, which estimates the following casualties in framed buildings (steel and concrete), of up to four stories with weak exterior walls (weak curtain walls, large glass windows, etc.) when subject to 1 Mt weapon:

90 % survival at a peak overpressure of 5 psi
50 % survival at a peak overpressure of 7 psi
10 % survival at a peak overpressure of 11 psi

Above: because it didn't contain charcoal cooking stoves surrounded by paper screens and bamboo furnishings, this American two-story wood frame house survived unburned 25 cal/cm^2 thermal radiation with just white-washed paint (which was quickly charred off) before the house was blown up by 5 psi (35 kPa) peak overpressure at 3,500 feet from 16 kt *UPSHOT KNOTHOLE-ANNIE* on 17 March 1953, Nevada Test Site; anti-civil defense propaganda in 2004 Cornell-published book by Lynn Eden *Whole World on Fire* while quoting in detail Dr Glasstone's 1957 *Effects of Nuclear Weapons* statement that the house had whitewash on it (just like most wooden houses) completely ignores the **fact that Dr Glasstone states in paragraph 7.30 on page 292 of the 1957 *Effects of Nuclear Weapons*: 'a material which blackens (or chars) readily in the early stages of exposure to thermal radiation behaves essentially as black, i.e., *as a strong absorber irrespective of its original color.* [Emphasis added.]** On the other hand, if smoke is formed [by dark coloured wood] it will partially shield the underlying material from the subsequent radiation.' Lynn Eden also ignores the facts that:

(1) the ordinary white-washed (quite normal) house did *not* ignite or burn despite being charred by the thermal flash and covered in black smoke due to thermal radiation. Lynn falsely claims that the whitewash was a 'heroic' precaution to avoid ignition. But it was burned off. Even unpainted poles in Hiroshima didn't catch fire, they just charred. Window blinds were blown in by the blast. So these things which Lynn biasedly sees as *bad* didn't prevent fire, *because as other tests like ENCORE (which we will discuss below in detail) proved it takes more than a brief pulse of heat to set thick wood on fire.* Anyway, the safeguards aren't 'bad' but are actually good benefits which would help survival by minimising glass fragments and flash burns. Contrary to the totally false and civil defence demeaning impression given by Lynn Eden's prejudiced, partial quotations from Dr Glasstone's 1957 edition, *rooms don't need metal window blinds: in an attack warning you can instantly protect rooms containing beds or upholstered furniture and a window which would potentially let in thermal radiation by simply drawing curtain, or by simply taping sheets of white paper over the inside of the window glass - which will protect against thermal radiation for the crucial interval of time until the delayed arrival of the blast wave!*

(2) the basement survived, and

(3) the house was not knocked over by the blast overpressure; the front was cracked by the reflected overpressure and the roof was peeled off by the blast winds, but then the house exploded due to the *low pressure (suction) phase of the blast occurring while there was still overpressure trapped inside the house (which had entered through the windows but could not escape as fast as the external pressure dropped). This is vital because it shows that most of the debris (with the exception of window glass) was blown outwards from the exploding house, not inwards against the occupants. Although debris landed on the family car and dented the roof, it could still be driven away after the explosion, illustrating that the debris load from the collapse of a house is not always the end of the universe as portrayed by evil propaganda:*

'We have often been accused of underestimating the fire situation ... we are unrepentant in spite of the television utterances of renowned academic scientists ... Air cannot get into a pile of rubble 80% of which is incombustible anyway. This ... is the result of a very complete study of some 1,600 flying bomb incidents ... Secondly, there is a considerable degree of shielding of one building by another ... Thirdly, even when the windows of a building can "see" the fireball, and something inside is ignited ... even with the incendiary bomb the chance of a continuing fire developing in a small room is only 1 in 5 ...'

– George R. Stanbury, 'The Fire Hazard from Nuclear Weapons', *Fission Fragments,* Scientific Civil Defence Magazine, No. 3, August 1962, pp. 22-6, British Home Office, Scientific Adviser's Branch, originally classified 'Restricted'.

'Dense smoke, and even jets of flame, may be emitted, but the material does not sustain ignition... smoke formed in the early stages will partially shield the underlying material from subsequent radiation. This behaviour is illustrated in the photographs taken of one of the wood-frame houses exposed in the 1953 Nevada tests... the house front became covered with a thick black smoke... within less than 2 seconds from the explosion, the smoke ceased... Ignition of the wood did not occur... The thermal energy incident upon the material was apparently dissipated in the kinetic energy of the "exploding" surface molecules before the radiation could penetrate into the depth of the material.'

– Dr Samuel Glasstone and Philip J. Dolan, editors, *The Effects of Nuclear Weapons,* U.S. Department of Defence, 1977, pp. 285-6.

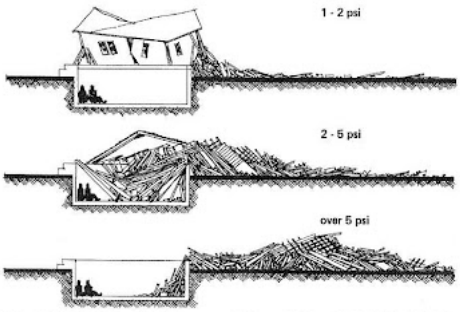
'The measured total radiation at [9.1-km] from the centre was 0.29 calories/cm^2 ... Examination of the specimen exposed at [975 m] shows ... the charred layer does not appear to be thicker than 1/10 millimetre.... scorching of the fir lumber used to support signal wires extended out to about [1.9 km] ... the risk of fire due to the radiation ... is likely to be much less than the risk of fire from causes existing in the buildings at the time of explosion.' – W. G. Marley and F. Reines, *July 16th Nuclear Explosion: Incendiary Effects of Radiation,* Los Alamos report LA-364, October 1945, originally Secret, pp. 5-6.

'Persons exposed to nuclear explosions of low or intermediate yield may sustain very severe burns on their faces and hands or other exposed areas of the body as a result of the short pulse of directly absorbed thermal radiation. These burns may cause severe superficial damage similar to a third-degree burn, but the deeper layers of the skin may be uninjured. Such burns would heal rapidly [emphasis added; this is true unless the person also receives a concurrent massive nuclear radiation dose], like mild second-degree burns.'

– Dr Samuel Glasstone and Philip J. Dolan, editors, *The Effects of Nuclear Weapons,* U.S. Department of Defence, 1977, p. 561.

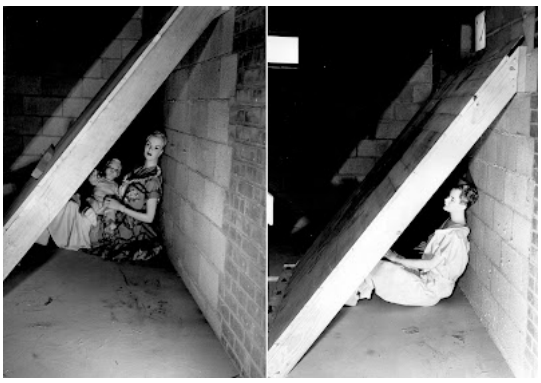
The 1950 edition of the U.S. Department of Defense *Effects of Atomic Weapons,* edited by Dr Glasstone, on pages 392-9 justifies each protective action:

'If a person is in the open when the sudden illumination is apparent, then the best plan is instantaneously to drop to the ground, while curling up so as to shade the bare arms and hands, neck and face with the clothed body. ... A person who is inside a building or home when a sudden atomic bomb attack occurs should drop to the floor, with the back to the window, or crawl behind or beneath a table, desk, counter, etc.; this will also provide a shield against splintered glass due to the blast wave. The latter may reach the building some time after the danger from radiation has passed, and so windows should be avoided for about a minute, since the shock wave continues for some time after the explosion. ... planning will be necessary to avoid panic, for mass hysteria could convert a minor incident into a major disaster.'



Panel 12 of 'DCPA Attack Environment Manual, Chapter 2, What the Planner Needs to Know about Blast and Shock', U.S. Department of Defense, June 1973, CPG 2-1A2. Effects of blast on wood frame homes in the 1953-55 Nevada test series.

Above: although American wood-frame houses offer less blast protection indoors than brick houses, they mostly have basements which are ideal for improvised shelters such as strong tables, because nuclear test data from *OPERATION UPSHOT-KNOTHOLE* at Nevada in 1953 and *OPERATION TEAPOT* at Nevada in 1955 showed that the blast winds carry most of the debris past the house, so that the debris load on the basement is minimal and survival is easy there (below).



'This report contains information on protective capabilities of a variety of different personnel shelters against prompt effects of nuclear weapons. This information was collected from previous studies performed for DCPA in this subject area. Protective capabilities are expressed in terms of 'people survivability functions' which relate the probability of survival (or percent survivors) to the free field overpressure at the shelter site. Respective shelters are described in terms of their geometry and material properties. The following shelter categories are included. (1) Existing Engineered Buildings (Upper Stories and Basements), (2) Designed Basements, (3) Single-Purpose Shelters, (4) Dual-Purpose Shelters, (5) Expedient and Special Purpose Shelters and (6) Expediently Upgraded Shelters.'

'Casualty mechanisms included blast translation terminating in impact with hard surfaces and interaction with debris from the breakup of the building walls, partitions, furniture, etc.'

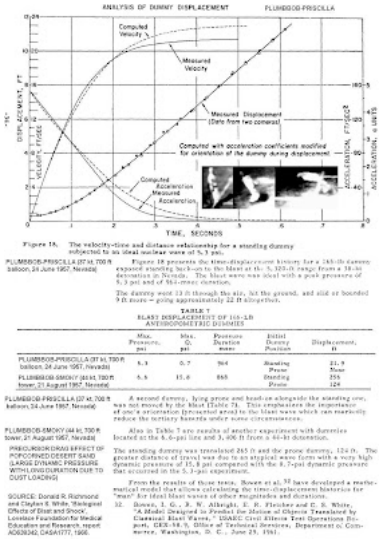


Figure 18. The velocity-time and distance relationship for a standing dummy subjected to an ideal nuclear wave of 5.3 psi.

PLUMBBOB-PRISCILLA (37 kt, 700 ft balloon, 24 June 1957, Nevada)

Figure 18 presents the time-displacement history for a 24-in-diameter exposed standing back-on to the blast at th. 5, 320-ft range from a 38-kt detonation in Nevada. The blast wave was ideal with a peak pressure of 5.3 psi and of 964-msec duration.

The dummy went 13 ft through the air, hit the ground, and slid or bounded 9 ft more – going approximately 22 ft altogether.

TABLE 7
BLAST DISPLACEMENT OF 165-LB ANTHROPOMETRIC DUMMIES

	Max. Pressure, psi	Max. Q, psi	Pressure Duration msec	Initial Dummy Position	Displacement, ft
PLUMBBOB-PRISCILLA (37 kt, 700 ft balloon, 24 June 1957, Nevada)	5.3	0.7	964	Standing Prone	21.9 Moved
PLUMBBOB-SMOKY (44 kt, 700 ft tower, 21 August 1957, Nevada)	5.5	11.6	865	Standing Prone	255 124

PLUMBBOB-PRISCILLA (37 kt, 700 ft balloon, 24 June 1957, Nevada)

A second dummy, lying prone and head-on alongside the standing one, was not moved by the blast (Table 7). This emphasizes the importance of one's orientation (presented area) to the blast wave which can drastically reduce the tertiary hazards under some circumstances.

PLUMBBOB-SMOKY (44 kt, 700 ft tower, 21 August 1957, Nevada)

Also in Table 7 are results of another experiment with dummies located at the 5.6-psi (ex and 3, 600 ft from a 44-kt detonation.

PRECURSOR DRAG EFFECT OF POPCORNED DESERT SAND (LARGE DYNAMIC PRESSURE WITH LONG DURATION DUE TO DUST LOADING)

The standing dummy was translated 255 ft and the prone dummy, 124 ft. The greater distance of travel was due to an atypical wave form with a very high dynamic pressure of 11.6 psi compared with the 5.7-psi dynamic pressure that occurred in the 5. 3-psi experiment.

From the results of these tests, Bowen et al.[32] have developed a mathematical model that allows calculating the time-displacement histories for "men" for ideal blast waves of other magnitudes and durations.

SOURCE: Donald R. Richmond and Clayton S. White, "Biological Effects of Blast and Shock", Lovelace Foundation for Medical Education and Research, report AD638342, DASA1777, 1966.

32. Bowen, I. G., J. N. Albright, E. R. Fletcher and C. S. White, "A Model Designed to Predict the Motion of Objects Translated by Classical Blast Waves," USAEC Civil Effects Test Operations Report, CEX-58.5, Office of Technical Services, Department of Commerce, Washington, D. C., June 25, 1961.

Above: proof of duck and cover effectiveness for reducing the blast wind drag from standing and lying anthropometric dummy human beings at an ideal peak overpressure of 5.3 psi / 37 kPa (with 0.964 second positive phase duration) at 1,622 metres from *PLUMBBOB-PRISCILLA* (37 kt, 700 ft balloon, 24 June 1957, Nevada) where the standing dummy was blasted 13 feet in the air before hitting the ground and tumbling for 9 feet, coming to rest 22 feet from the starting point, *but the lying dummy was not even moved.* In the *PLUMBBOB-SMOKY* test (44 kt, 700 ft tower, 21 August 1957, Nevada), dummies were exposed to a non-ideal precursor-type blast wave such as occurs over dark coloured desert sand (which is popcorned into a hot dust cloud which increases the density of the air and increases the dynamic pressure and duration of the blast wave while reducing the peak overpressure) and were displaced considerably larger distances by the increased dynamic pressure impulse of the precursor (like a dust storm). However, for cities which are not covered in dark desert sand, a precursor will not occur, as demonstrated by nuclear tests over water and light colour surfaces. (Source: Donald R. Richmond and Clayton S. White, *Biological Effects of Blast and Shock,* Lovelace Foundation for Medical Education and Research, report AD638342, DASA1777, 1966. **'We were fortunate enough at a 5 psi station in one of the 1957 shots in Nevada to photograph the time-displacement history of a 160-pound [standing] dummy, and we were able from analysis of the movies to determine the maximal velocity reached ... about 21 feet per second. This velocity developed in 0.5 second. The total displacement of the dummy was near 22 feet ... It was this piece of empirical information that helped greatly in getting an analytical "handle" on the "treatment" of man as missile.' – Dr Clayton S. White, who worked on nuclear weapon blast effects at Nevada test series' Upshot-Knothole (1953), Teapot (1955) and Plumbbob (1957), Testimony to the *U.S. Congressional Hearings, 22-26 June 1959, Biological and Environmental Effects of Nuclear War,* U.S. Government Printing Office, 1959, pp. 364-5**.)

'... it must be recognised that the amount of protection that will be available to individuals is, in a large degree, directly related to the extent of public knowledge concerning nuclear weapons effects and associated protective measures ... By falling prone and covering exposed portions of the body or getting behind opaque objects, much of the thermal radiation may be avoided, especially in the case of large-yield detonations ... Staying behind thick walls or lying in a deep ditch may help to avoid initial nuclear radiation ... the above actions will also help to decrease the possible danger from the blast wave.' - Samuel Glasstone, *The Effects of Nuclear Weapons,* U.S. Department of Defense, 1962, pp. 660-1.

Further evidence on blast displacement is available from British nuclear test studies of human displacement. In 1948, R. H. A. Liston of the Atomic Research Establishment, UK, did a theoretical study of the displacement of man by a blast wave (*The kinematic effect of blast*

on a man in the open, ARE Report 1/48), in which he assumed a drag coefficient for a standing man of 0.8, and predicted that a standing 76 kg man would be displaced 20 feet by a blast of 7 psi peak overpressure from a 20 kt bomb. For a peak overpressure of 3 psi, he predicted a displacement of 4 ft. On 27 September 1956 Liston's theory was checked out and found to make perfect predictions for a nearly ideal blast wave and soft ground at the 15 kt *BUFFALO-1* nuclear test at Maralinga, Australia, by W. J. H. Butterfield et al., *The Effects of Blast on Dummy Men Exposed in the Open,* Atomic Weapons Reearch Establishment report AWRE-T2/59 (1959). For a peak overpressure of 6.4 psi, standing dummies facing *BUFFALO-1* were displaced 16 feet, while those standing sideways were displaced only 10 feet. At a peak overpressure of 4.3 psi, standing dummies facing the burst were displaced 4 feet, while those standing sideways to the burst were only displaced 3 feet:

Psi	*Facing burst*	*Sideways to burst*
10	10.5 m	6 m
8.5	9 m	5 m
6.4	5 m	3 m
4.3	1.25 m	1 m
2.4	0.67 m	0 m

Information on the effects of human impacts and displacements are plentiful: car accidents and impact fall statistics are available. A person free-falling 1 m gains a velocity, $v = (2gH)^{1/2} = 4.4$ m/s. If the person lands prepared, feet-first with the knees slightly bent (to avoid transmitting the shock to the spine), this fall is usually safe; but head first this impact speed can result in being knocked unconscious and possibly suffering a cracked skull. If a person falls from a great altitude (such as suicide attempts from a high cliff, bridge or aircraft) without a parachute, then air drag becomes important and causes an average terminal velocity of $v = [2g/$(acceleration coefficient * air density)$]^{1/2} = 51$ m/s, which almost always proves to be lethal. However, there are cases of survival due to luck or to landing on soft surfaces, even from great heights. For example, see Christopher K. Kepler, et al., 'Orthopaedic Injuries Associated With Fall From Floor Forty-Seven', *Journal of Orthopaedic Trauma,* vol. 23, No. 2, Feb. 2009, pp. 154-158: 'This case report provides background reviewing mortality rates associated with falls from height before detailing the clinical history of a patient who survived a fall from a height of 43 stories.'

For a curve of survival incidence versus number of stories fallen, see: Sylvia M. Ramos and Harry M. Delany, 'Free Falls From Heights: A Persistent Urban Problem', *Journal of the National Medical Association,* vol. 78, no. 2, February 1986, pp. 111–115.
U.K. data for road accidents indicates that 50% lethal trauma occurs for a person hit by a car moving at only 13.4 m/s (such casualties suffer additional injuries from tumbling after the initial impact). There is also good survival data from patients jumping out of windows in burning hospitals: W. S. Lewis, et al., 'Jumpers syndrome: The trauma of high free fall as seen at Harlem Hospital' *Journal of Trauma,* vol. 5, no. 6, Nov. 1965, pp. 812-8. Suicide attempts from bridges and cliffs as well as parachute failure data also help to determine the exact effects from decelerative impact to different parts of the body, which we will discuss in detail in a later post.

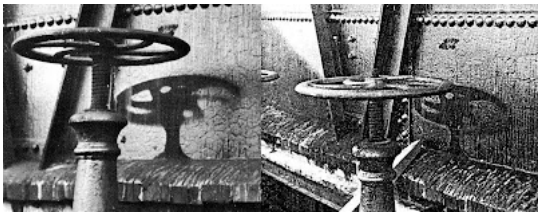
'Collapse of a brick house is expected to result in approximately 25% mortality, 20% serious injury and 10% light injury to the occupants. Reinforced concrete structures, though much more resistant to blast forces, will produce almost 100% mortality on collapse ... based on data from British World War II experience ... for cases where the population expects bombing and most personnel have selected the safest places in the buildings.' – Philip J. Dolan, editor, C*apabilities of Nuclear Weapons,* U.S. Department of Defence, DNA-EM-1, 1978, c. 10, p. 5, Secret – Restricted Data. This data comes in part from the effects of the 12,000 German V1 subsonic cruise missiles and V2 supersonic rockets, each armed with a similar-sized 0.001 kt warhead. *Because the V1 cruise missile was subsonic and made a well-known pulsating engine sound, people had more time to take cover and therefore each V1 only killed an average of 2.8 people, compared to 5 people per V2 supersonic rocket because there was no warning*. The first sound from the V2 was the explosion shock.

The collapse of buildings creates voids since the weight of debris depends just on the mass of the building, not upon the blast pressure, so survival under a strong table or staircase in a brick house proved possible during World War II. In wood frame houses at Hiroshima, about 50% of people trapped were able to free themselves and escape before the firestorm (5% were rescued by others), while in brick houses in Britain only 25% could escape of their own accord, because the brick debris was much heavier. Bricks cannot burn, so there is a lower fire risk in brick houses. The major problem is explained clearly in Robert Jungk's book, *Children of the Ashes,* Heinemann, London, 1961, which cites a report in Hiroshima by American psychologist Woodbury Sparks called *Panic Among A-Bomb Casualties at Hiroshima* which showed that due to their surprise at the effects of the nuclear explosion, only 26 percent (153 out of a random sample of 589 bomb survivors in Hiroshima) gave any assistance at all to anybody else after the explosion. Seeing that the majority of the people in each city survived and that a major cause of death was the burning of blast damaged wooden houses containing persons trapped by blast debris, a lot more could have been done if people had been prepared. This is one of the civil defence lessons from Hiroshima: the emotional shock prevented proper action. Effective civil defence training in the solid, unvarnished facts about nuclear effects phenomenology can avert this shock, enabling help to be given more efficiently where and when practical to save lives and minimise injury.

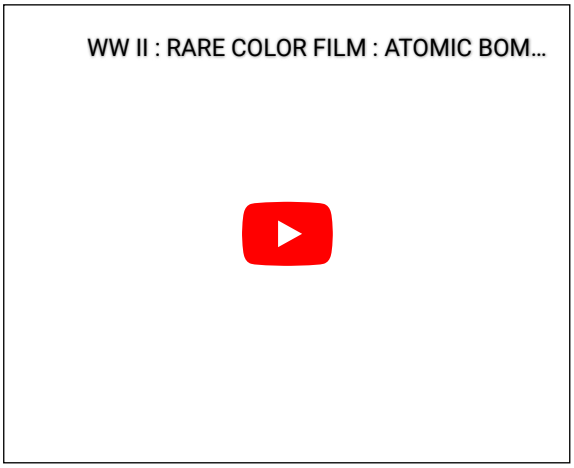
Regarding vehicle displacement, four heavy British Army Daimler Scout Cars were exposed to the 6-kt *ANTLER-2* test at Maralinga, 25 September 1957 (report AWRE-T6/59). The car exposed side-on to a peak overpressure of 76-kPa at 527 m was just turned on its side without significant displacement, and cars exposed at 48-kPa or less (671 m or more) were unmoved, although the flash scorched the paint and 'slightly charred' tyres facing detonation.

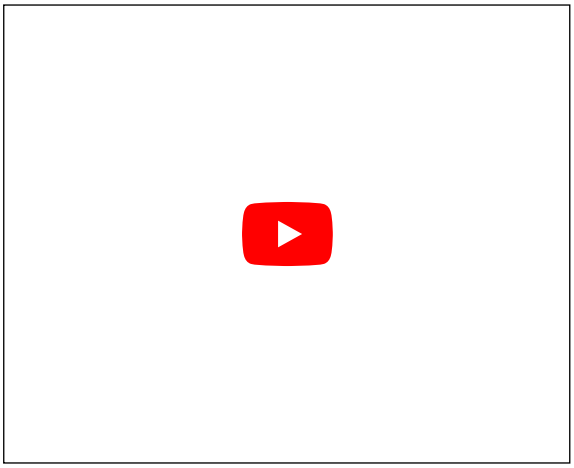
Operation SAILOR HAT, 0.5 kt shot CHARLIE, at Kahoolawe island, Hawaii, on 16 April 1965. The displacement effects to a standing observer at a peak overpressure of 6 psi (41 kPa) were simulated by using a realistic (fully articulated) dummy.

Above: effects of blast wind drag on a standing anthropometric dummy human being at a peak overpressure of 6 psi (41 kPa) during the 0.5 kt *SAILOR HAT-CHARLIE* shot at Kahoolawe Island in Hawaii on 16 April 1965. The dummy briefly behaves like superman, taking off and flying, then summersaulting gymnastically through the air before hitting the camera. A basketball beside the dummy shows the motion of a less aerodynamic object to this blast wave. You can see the 0.5 kt explosion fireball in the background. Contrary to anti-civil defense propaganda, duck and cover would have saved a human being in this situation: 'it requires about 8 times the blast wind force to move a person who is lying down compared to a standing person. People crouched or lying down also offer a much poorer target to glass shards and debris missiles. [Not to mention thermal radiation shadowing.]' (Panel 11 of *DCPA Attack Environment Manual: Chapter 2, What the Planner Needs to Know about Blast and Shock*, U.S. Department of Defense, report CPG 2-1A2, June 1973.)



Above: the gas holder paint (actually bitumen) deception by the Americans: the photo on the left was taken by the U.S. Strategic Bombing Survey and published as Figure 7.50b the 1962 book *The Effects of Nuclear Weapons* as being 'Paint on gas holder scorched by the thermal radiation, except where protected by the valve (1.33 miles from ground zero at Hiroshima)', while that on the right is **the British Government's Photo No. 23 of the *Report of the British Mission to Japan*, 1946, showing that there was no scorched paint at that distance, but just melted bitumen, stating: 'Shadow cast by valve-wheel on side of gasholder 1.25 miles from the centre of damage. The bituminous coating on the steel plates was affected by heat radiation except where shielded by the wheel and spindle.'** Since bitumen melts more easily than paint scorches, the American book gives a wildly deceptive exaggeration of the true thermal effect. *The shadow effect in fact proves that direct, not scattered, thermal radiation predominates even at large distance where scattering is significant, which makes simple line-of-sight shielding effective.* Notice that the valve that cast the shadow has not been vaporised! Anti-civil defense propaganda shows similar shadows cast by people with the false and pathetic claim that (since the person walked away) they 'must' certainly have been vaporised. Many political American and British anti-civil defence propaganda organisations, formerly funded by the Soviet Union, published a photo of a human shadow, claiming that the person was vaporised, 'ceased to exist'. The objective was to discourage any duck-and-cover civil defence as being 'useless'. In fact, the shadow is not the ash of a vaporised person but the shadow of a person with very painful skin flash burns! The vast amount of energy necessary to vaporise a human being (mainly water), compared to the thermal energy delivered, disproves the vaporisation claim (a myth invented to devalue civil defence by those either ignorant or sinisterly inhumane for political purposes): those exposed directly who did not 'duck and cover' received very painful burns, window glass fragments, and unshielded nuclear radiation.





Above: Hiroshima wasn't vaporised. A firestorm developed half an hour later (by which time the radioactive mushroom cloud had been blown several miles downwind) from thousands of blast-overturned charcoal cooking braziers (being used at breakfast time when the Hiroshima bomb was dropped; the Nagasaki bomb was dropped at lunch time) inside wood frame houses filled with bamboo furnishings and paper screens. There had been no rain for many weeks. The mechanisms used to achieve the appalling effects were deliberately exaggerated for military propaganda purposes during the war, because the aim was to end the war, saving a million American and Japanese lives in the invasion of Japan, rather than to inform people how to survive and mitigate the effects for civil defence! This worked, because the two bombs convinced Russia - which Japan had hoped would help it negotiate a surrender - to suddenly declare war on Japan so as to be included as a victor when Japan surrendered. As a result of Russia's declaration of war on Japan (caused directly by the two nuclear attacks), Japan surrendered. America accepted their surrender. The use of two nuclear bombs over just three days was a propaganda tool to make it look as if America had a large number of bombs available, which it didn't due to the very slow production of oralloy (enriched U-235) and Pu-239. The effects of those weapons would have been rather different if used against Western brick and concrete buildings which are not surrounded by tens of thousands of easily inflammable wooden houses. *This is the whole reason why the hydrogen bomb was developed, and why much higher yields than the Hiroshima and Nagasaki weapons would be needed today to achieve the same effects.*

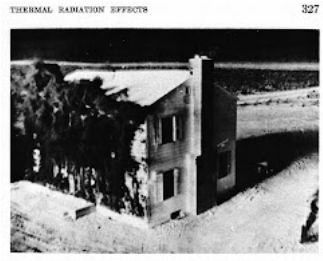


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Figure 7.33a. Thermal effects on wood-frame house 1 second after explosion (about 25 cal/sq cm).

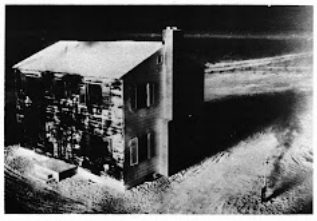

Figure 7.33b. Thermal effects on wood-frame house about ½ second later.

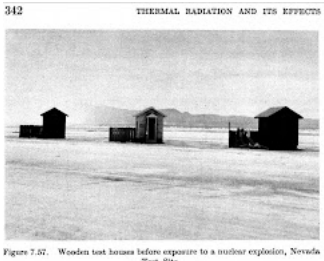

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Figure 7.37. Wooden test houses before exposure to a nuclear explosion, Nevada Test Site.

Figure 7.38. Wooden test houses after exposure to a nuclear explosion.

Above: thermal ignition nuclear test pages from **Glasstone, 1964.** Normal white-washed wood can't be ignited readily by yields below about 100 megatons unless it has paper trash piled around it or is decayed, because the thermal pulse is so short that a cloud of black smoke forms by ablation of less than 1 mm thickness of the wood. The smoke screens the underlying wood, preventing ignition as will be demonstrated.

"THERMAL IGNITION OF FRAMEHOUSES", testimony y Dr Frank H. Shelton (Technical Director of the U.S. Armed Forces Special Weapons Project), on page 28 of the U.S Congressional Joint Committee on Atomic Energy, Special Subcommittee on Radiation, Hearings entitled *The Biological and Environmental Effects of War,* June 22-26, 1959

Dr Shelton was asked to resolve the uncertainty as to whether persistent ignition can occur to a wooden house in a nuclear attack (in Hiroshima and Nagasaki, no houses were ignited by direct thermal radiation on the wood; instead the blast wave overturned charcoal cooking braziers used at breakfast time 8:15 am in Hiroshima and for preparing lunch at 12:01 pm in Nagasaki, although a few fires were ignited as we shall see in black-colored air raid "black out" curtains in windows - which are no longer used, modern light-colored curtains requiring far larger ignition energies). Shelton responded by assembling extracts from four paragraphs (7.62, 7.93, 7.82 nd 7.38) of **Glasstone's** June 1957 ***Effects of Nuclear Weapons*** as follows:

"7.62 Wood is charred by exposure to thermal radiation, the depth of the char being closely proportional to the energy received. For sufficiently large amounts of energy, wood in some massive forms may exhibit transient flaming, but persistent ignition is improbable under the conditions of a nuclear explosion. However, the transitory flame may ignite adjacent combustible material which is not directy exposed to the radiation. ...

"7.93 From the evidence of charred wood found at both Hiroshima and Nagasaki, it was originally concluded that such wood had actually been ignited by thermal radiation and that the flames were subsequently extinguished by the blast. But it now seems more probable that, apart from some exceptional instances, such as [the ignition of adjacent combustible trash by the transient flames], there was no actual ignition of the wood. The absorption of the thermal radiation caused charring in sound wood but the temperatures were generally not high enough for ignition to occur. Rotted and checked wood and excelsior, however, have been known to bur completely, and the flame is not greatly affected by the blast wave.

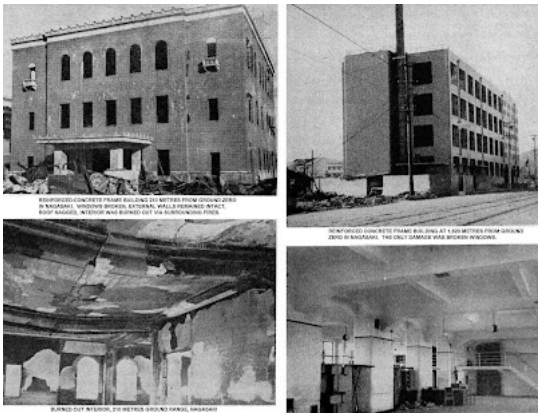
"7.82 The fact that accumulations of ignitable trash close to a wooden structure represent a real fire hazard was demonstrated at the nuclear tests carried out in Nevada in 1953. In these tests, three miniature wooden houses, each having a yard enclosed with a wooden fence, were exposed to 12 calories per square centimeter of thermal radiation. One house, at the left, had weathered siding showing considerable decay, but the yard was free from trash. The next house also had a clean yard; and, further, the exterior siding was well maintained and painted. In the third house, at the right, the siding which was poorly maintained, was weathered, and the yard was littered with trash.

"7.38 The state of the three houses after the explosion was as follows: the third house, at the right, soon burst into flame and was burned to the ground. The first house, on the left, did ignite but it did not burst into flame for 15 minutes. The well-maintained house in the center with a clean yard suffered scorching only."

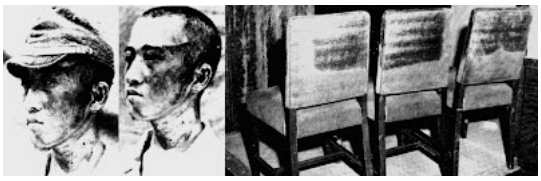
It's curious how attitudes have changed since World War II. The American Institute of Public Opinion in the United States for the Fall 1945 found that 85 percent of Americans supported the use of atomic bombs against Japan in the war, while a poll taken by Dr Arthur Holly Compton and others of 150 Manhattan Project nuclear weapons researchers at the same time gave *exactly* the same result! In 1950, the *Bulletin of the Atomic Scientists* reported a Gallup Poll which found that 61 percent of Americans said yes in reply to the question, 'Should the U.S. use the atom bomb if it gets into another world war?'

From Dr Glasstone's *Effects of Nuclear Weapons* (1962/64 ed., page 631):

> 'At distances between 0.3 and 0.4 mile from ground zero in Hiroshima the average survival rate, for at least 20 days after the nuclear explosion, was less than 20 percent. Yet in two reinforced concrete office buildings, at these distances, almost 90 percent of the nearly 800 occupants survived more than 20 days, although some died later of radiation injury.
>
> 'Furthermore, of approximately 3,000 school students who were in the open and unshielded within a mile of ground zero at Hiroshima, about 90 percent were dead or missing after the explosion. But of nearly 5,000 students in the same zone who were shielded in one way or another, only 26 percent were fatalities. ... survival in Hiroshima was possible in buildings at such distances that the overpressure in the open was 15 to 20 pounds per square inch. ... it is evident ... that the area over which protection could be effective in saving lives is roughly eight to ten times as great as that in which the chances of survival are small.'



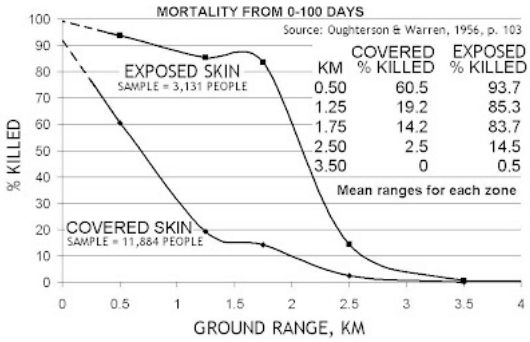
Above: photos of exterior and interior of reinforced concrete frame buildings surviving at distances of 210 metres and 1,620 metres from ground zero in Nagasaki. In the interior photo of the building at 210 metres, you can see that the roof sagged down slightly due to the downward regular blast reflection pressure on the roof. The interior was burned out causing the roof plaster to spall due to fire ignited by the bamboo furnishings and paper screens in the surrounding wooden houses which suffered overturned charcoal cooking stoves from the blast of the lunch-time detonation. There is no damage to exterior walls which remained intact and uncracked. If fire sprinklers had been installed, they would have prevented the fires. In the building at 1,620 metres from ground zero, the only damage is broken windows. (**Photographs are from Figures 5.54a and b on pp. 140-1 of Glasstone's 1950 *Effects of Atomic Weapons,* U.S. Department of Defense**.)



Above: line-of-sight shadowing in Hiroshima (Glasstone and Dolan, 1977). **What really angers people who are against terrorism is the the fact that the anti-civil defence lobby uses this evidence for pseudo-scientific purposes, claiming falsely that anything in Hiroshima and Nagasaki which cast a burns shadow was 'vaporized'. People who cast 'shadows' on otherwise burned materials were not vaporized, they were painfully burned, and if they had ducked and covered behind anything opaque, they wouldn't have been.** E.g., 'A soldier on picket duty at Nagasaki was vaporised by the explosion even though he was 3.5 km from the centre of the blast.' – Professors Tony Hey and Patrick Walters, *The Quantum Universe,* Cambridge University Press, 1989, p. 69. The soldier was only subject to skin reddening because of the brief pulse, which even a leaf or a sheet of paper stopped. The wooden panel behind the person was slightly scorched where shielded by the person. Hey and Walters' are unaware that it takes more energy to evaporate water (people are 70% water) than to burn dry wood! If the flash had been sufficient to 'vaporise' anyone, the wooden panel would have burned first. Totally ignorant and shameful abuse of 'scientific authority' from two physics professors. Shameful to the publishers' physics editor at Cambridge University Press, too.

ABOVE: **U.S. Army photo** showing how a mere leaf of *Fatsia japonica* attenuated the heat flash enough to prevent scorching to the bitumen on an electric pole near the Meiji Bridge, 1.3 km range, Hiroshima. It didn't even vaporize the leaf before the pulse ended, let alone did it somehow ignite the wooden pole (most photos claiming to show thermal flash radiation effects in Hiroshima and Nagasaki purely show effects from the fires set off by the blast wave overturning cooking stoves, which developed 30 minutes to 2 hours later).

'Even blades of grass cast permanent shadows on otherwise badly scorched wood. The [Hiroshima nuclear bomb heat] flash lasted less time than it took the grass to shrivel.' - Chapman Pincher, *Into the Atomic Age,* Hutchinson and Co., London, 1950, p. 50.



Above: people in Hiroshima mainly died from combined flash burns and radiation exposure (data from: Dr Ashley Oughterson and Dr Shields Warren, *Medical Effects of the Atomic Bomb in Japan,* McGraw-Hill, New York, 1956). The graph shows the impact of any kind of *light shadow* (not nuclear radiation shielding) from the line of sight of the fireball to the person, on survival probability. Nuclear radiation interfered with burn recovery, turning mild superficial burns into a lethal source of infection when the white blood cell count was depressed during the recovery phase by the fact that the burns were accompanied by concurrent nuclear radiation exposure. *Hiroshima's wood-frame houses shielded the heat flash, as did vehicles, trees, hills, bridges, tunnels and clothing, and by removing thermal burns, nuclear radiation became survivable. Glass/debris impacts are also avoided by ducking down since the blast is delayed like thunder after lightning. Notice that 'duck and cover' action would have increased survival probability at 1.75-2.5 km by a factor of 5.8-5.9.*

'Don't stand behind windows in an attack. First you will get burned and then you will have fine glass splinters driven into you very deeply within distances like 7 miles from a 1-megaton burst. ... Glass in any disaster like the Texas City disaster is one of the primary materials found in the normal home which can result in blinding and all other types of effects due to the flying small splinters of glass.'

- Dr Frank H. Shelton, Technical Director of U.S. Armed Forces Special Weapons Project, testimony to U.S. Congressional Hearings on the Biological and Environmental Effects of Nuclear War, 22-26 June 1959, page 41. (Although windows are just *broken* by the peak overpressure out to 25 miles from a 1 Mt surface burst, the hazard from the *blast wind pressure accelerating the glass fragments into a missile threat* only extends to 7 miles. E.g., many windows were **broken in Las Vegas after Nevada tests due to the refraction of blast waves, but the glass fell vertically to the ground without hurting anybody**.)

Nuclear radiation by itself was an extremely survivable effect, but in combination with thermal flash burns and blast debris injuries, there was a synergism which decreased the LD50 dramatically. Burns wounds which would not be fatal in the absence of simultaneous radiation exposure proved lethal even where the amount of nuclear radiation was not by itself lethal. The mechanism is that the moderate doses of nuclear radiation depressed the white blood cell count for several weeks after exposure, which proved lethal when the patient also had infected burns wounds, because of the absence of enough white blood cells to combat the infection during this crucial time.

A month before nuclear weapons were exploded at Hiroshima and Nagasaki on 6 and 9 of August 1945, weather aircraft were sent over the cities daily to 'accustom the Japanese to seeing daytime flights of two or three bombers' (autobiography of 509th bombing group commander and Hiroshima pilot, Colonel Paul Tibbets). B-29 weather aircraft preceded the nuclear B-29 bomber, giving a false sense of security. In Hiroshima the air-raid warning sounded at 7 am, and the all-clear at 7:30 am, but the bomb was dropped at 8:09 am. People cooked breakfasts with charcoal braziers in inflammable wood homes, with paper screens and bamboo furniture. Blasted red-hot charcoal and screens in the wooden houses started fires. In Nagasaki, the air-raid siren sounded at 7:50 am but was cleared before the bomb fell at 11 am.

Figure 12.52a. Tunnel shelters in hillside, very close to ground zero in Nagasaki, protected the occupants from blast and from thermal and nuclear radiations.

Above: photo of the tunnel shelters in the hillside near ground zero, Nagasaki. According to both the originally secret U.S. Strategic Bombing Survey 1947 detailed report on Nagasaki and also the openly-published 1956 book *The Medical Effects of the Atomic Bomb in Japan,* these tunnel shelters had places for 70,000 people but fewer than 400 were in them when the bomb dropped, because the small number of American aircraft passing daily over the cities for weeks beforehand (to build up weather data and target surveillance, as well as to get the anti-aircraft gunnery crews complacent so that the nuclear bomb aircraft would not be shot down before dropping the bomb) without attacking the cities, had gradually worn down the civil defence response to small groups of aircraft passing overhead. People in the shelters survived all the effects intact, as they provided adequate shielding. If the people had taken used the shelters, they would have survived. **This photo is Figure 12.52a on page 389 of Glasstone's *The Effects of Atomic Weapons,* U.S. Department of Defense, 1950.**

The originally 'secret' May 1947 U.S. Strategic Bombing Survey report on Nagasaki states (vol. 1, p. 10): '... the raid alarm was not given ... until 7 minutes after the atomic bomb had exploded ... less than 400 persons were in the tunnel shelters which had capacities totalling approximately 70,000.' This situation, of most people watching lone B-29 bombers, led to the severe burns by radiation and flying debris

injuries in Hiroshima and Nagasaki. The originally 'secret' May 1947 U.S. Strategic Bombing Survey report on Hiroshima, pp. 4-6:

'Six persons who had been in reinforced-concrete buildings within 3,200 feet [975 m] of air zero stated that black cotton black-out curtains were ignited by flash heat... A large proportion of over 1,000 persons questioned was, however, in agreement that a great majority of the original fires were started by debris falling on kitchen charcoal fires... There had been practically no rain in the city for about 3 weeks. The velocity of the wind ... was not more than 5 miles [8 km] per hour....

'The fire wind, which blew always toward the burning area, reached a maximum velocity of 30 to 40 miles [48-64 km] per hour 2 to 3 hours after the explosion ... Hundreds of fires were reported to have started in the centre of the city within 10 minutes after the explosion... almost no effort was made to fight this conflagration within the outer perimeter which finally encompassed 4.4 square miles [11 square km]. Most of the fire had burned itself out or had been extinguished on the fringe by early evening ... There were no automatic sprinkler systems in building...'

The vital six secret volumes of the U.S. Strategic Bombing Survey consist of three volumes on Hiroshima dated May 1947 and three on Nagasaki dated June 1947. (These are completely separate from the brief unclassified summary on the effects published by the U.S. Strategic Bombing Survey in 1946.) These secret volumes were finally declassified in 1972 and may be inspected at the British National Archives, as documents **AIR 48/160**, **AIR 48/161**, **AIR 48/162**, **AIR 48/163**, **AIR 48/164**, and **AIR 48/165**.

Dr Ashley Oughterson and Dr Shields Warren noted a fire risk in *Medical Effects of the Atomic Bomb in Japan* (McGraw-Hill, New York, 1956, p. 17):

'Conditions in Hiroshima were ideal for a conflagration. Thousands of wooden dwellings and shops were crowded together along narrow streets and were filled with combustible material.'

The British Mission to Japan also analysed the damage and casualties in 1945, and comprised of 10 Home Office scientists who had been studying effects of conventional bombing on Britain, and 6 military scientists. **Some of these Home Office scientists, particularly Frank H. Pavry (principal scientific officer for civil defence at the Home Office from 1948–76), continued to work on nuclear weapons effects at the Home Office throughout the 1950s, and accompanied by George R. Stanbury (who set up Home Office experiments at the first British nuclear test, Hurricane, 1952) and others, worked out civil defence countermeasures.**

The British Mission to Japan, unlike the Americans, discriminated data between the casualties in areas with modern brick houses and those in areas of wood-frame traditional Japanese buildings. The results for Nagasaki were two curves for the percentage dead as a function of distance. For people in wood-frame buildings, the percentage killed was $96*\exp(-0.45R^2)$; for brick houses it was $96*\exp(-0.63R^2)$. In the formulae, based on the curves published in 1946, R is distance from ground zero in km. Each formula applies to the population ignoring air raid warnings and taking no evasive action. For wood-frame areas, 50% mortality occurs at 1.20 km, compared to 1.02 km for brick areas. However, this estimate for brick houses only applies to brick houses in a firestorm area, surrounded by tens of thousands of burning wooden houses, and was **later rejected by those Home Office scientists when they realized from their detailed study of the Hamburg firestorm (Kathleen F. Earp, *Deaths from Fire in Large Scale Air Attack - with Special Reference to the Hamburg Fire Storm,* Home Office Scientific Advisory Branch Report CD/SA 28, April 1953; U.K. National Archives document HO 225/27) that such firestorm conditions - and thus mortality to trapped people in the buildings - would not apply to modern brick and concrete cities where firestorms cannot occur**.

The British Mission to Japan found that the mortality for Nagasaki, assuming the standard wartime population density used for proper comparisons in Britain (45 people/acre) would be 65,000 for wood-frame houses or 50,000 for brick houses in firestorm areas. These figures compare directly to the average of 15 for the Nazi V2 rocket landing on brick housing with the same standard population density (12 for people lying down, 25 for people standing up). Because the V2 was supersonic, no air raid warnings could be given (unlike the case of normal bombing and V1 cruise missiles).

According to the report of the British Mission to Japan, wood-frame house damage was severe: 'Complete collapse of these buildings from blast extended to 1.25 miles from the centre of damage in Hiroshima, and to an average of 1.5 miles in Nagasaki.' This difference is due to the fact that the Nagasaki bomb was 22-kt, compared to 12-kt for Hiroshima, and blast effects radii scale as roughly $\{\text{yield}\}^{1/3}$. The report also notes:

'The provision of air raid shelters throughout Japan was much below European standards. Those along the verges of the wider streets in Hiroshima were comparatively well constructed: they were semi-sunk, [6 m] long, had wooden frames, and [0.5-0.6 m] of earth cover... Exploding so high above them, the bomb damaged none of these shelters.

'In Nagasaki ... most householders had made their own backyard shelters, usually slit trenches or bolt holes covered with [0.3 m] or so of earth carried on rough poles and bamboos. These crude shelters ... nevertheless had considerable mass and flexibility ... Most of these shelters had their roofs forced in immediately below the explosion; but the proportion so damaged had fallen to 50 % at [274 m] from the centre of damage, and to zero at about [805 m].

'These observations show that the standard British shelters would have performed well against a bomb of the same power exploded at such a height. Anderson shelters, properly erected and covered, would have given protection. Brick or concrete surface shelters with adequate reinforcement would have remained safe from collapse. The Morrison shelter is designed only to protect its occupants from the debris load of a house, and this it would have done. Deep shelters such as the refuge provided by the London Underground would have given complete protection.'

Fig. 1.5. Undamaged earth-covered family shelter in Nagasaki.

Fig. D.1. A small, earth-covered backyard shelter with a crude wooden frame—undamaged, although only 300 yards from ground zero at Hiroshima.

Above: photos of crude earth covered wood-frame shelters that survived at 90 metres from ground zero in Nagasaki and 274 metres from ground zero in Hiroshima, amidst the debris from blast and fire effects on the surrounding wooden houses. **These photos were first published as photographs 17 and 18 in the 1946 H.M. Stationery Office publication of the report of the British Mission to Japan, *The Effects of the Atomic Bombs at Hiroshima and Nagasaki.*** They then appeared in the June 1950 published British Home Office Civil Defence Manual, *Atomic Warfare*. They next appeared in a 1963 article by F. X. Lynch entitld 'Adequate Shelters and Quick Reactions to Warning: A key to Civil Defense', published in *Science,* vol. 142, pp. 665-7, and finally in Cresson H. Kearny's 1979 Oak Ridge National Laboratory publication, *Nuclear War Survival Skills.* The Japanese wooden frames (they were very short of steel, due to the war effort using up steel to produce aircraft, ships, etc.) were far less protective than the corrugated steel arches of British Anderson shelters, which survived even better when exposed to measured air blast at the *Operation HURRICANE* nuclear bomb test in 1952. But the basic principle of earth arching worked even with the wooden frame of the Hiroshima shelter, as Kearny's 1979 book explained : 'It's narrow room and a 3-foot-thick earth cover brought about effective earth arching; this kept its yielding wooden frame from being broken.' Earth arching makes the force from the applied air blast loading conduct through the compressed soil, *diffracting around the wood or steel frame* instead of being passed on to the frame. This arch arching mechanism was a late discovery in the nuclear testing programme, but it was extensively investigated in nuclear tests from 1957 onwards.

The report also debunks myths about people being vaporised where shadows were cast on flash-burned material: 'There were cases where a clump of grass or the leaf of a tree has cast a sharp shadow on otherwise scorched wood. Therefore the most intense flash from the ball of fire had ended in a time less than that required to shrivel vegetation.' It also notes that: 'even the thin clothing protected from flash burn.'

Equally important, it debunks some of the horror rumours which were spread: 'a rumour was current which age has made almost respectable, for it appeared in the London Blitz and before that in Barcelona during the Spanish Civil War. This was that large numbers of people had been ripped open by the blast, and their entrails exposed; their eyes and tongues were said also to have hung out. Experience in this country [Britain] has shown that blast pressure alone does not in fact cause these sensational effects ... two Nagasaki survivors who had spoken of seeing hundreds or thousands of such bodies on examination reduced their claim to one or two. Flying debris would be expected to produce a few such injuries.' (**Report of the British Mission to Japan, *The Effects of the Atomic Bombs at Hiroshima and Nagasaki,* H.M. Stationery Office, London, 1946, pp. 17-18**.)

This report does not minimise the nuclear radiation effects, noting that exposed pregnant women suffered miscarriages at up to 3.2 km from ground zero in Hiroshima. Because of the variation of effects with distance, the percentage of the total mortality occurring on the first day fell from 92% within 0.5 km to 49% at 1.5-2 km in Hiroshima. The overall average is that 70% of the deaths occurred on the first day. The major nuclear radiation hazard was the fall in the white blood cell count due to bone marrow damage (bone marrow, which produces the white blood cells that fight bacterial infection are produced inside the bones that shield the marrow from ultraviolet rays). Because this coincided with skin blistering from thermal radiation, many infections resulted which overwhelmed the immune systems of survivors. Deaths from infection due to a lack of white blood cells began within a week of the explosion, reached a peak at 3 weeks after exposure, and ceased at 6-8 weeks.

According to the 1979 U.S. Office of Technology Assessment report *The Effects of Nuclear War,* p. 31: '... on a winter night less than 1 percent of the population might be exposed to direct thermal radiation, while on a clear summer weekend afternoon more than 25 percent might be exposed (that is, have no structure between the fireball and the person).'

The secret 1981 U.S. Department of Defence *Capabilities of Nuclear Weapons* (c. 10, p. 10) states that pain produced by intense thermal radiation provides 'a useful tool in warning an individual to evade the thermal pulse.'

R. A. Langevin and others in 1958 compared the ability of trained troops and the untrained civilian population to duck and turn away, covering exposed skin (*Operations Research,* vol. 6, p. 710). Trained troops duck and cover in 0.75 second when a very bright flash occurs. The untrained civilians fared less well: 2% protected themselves within 1 second, 15% by 2 seconds, 50% by 3 seconds, 70% by 4 seconds, 80% by 5 seconds, 90% by 7 seconds, but 7.5% are still fully exposed at 10 seconds after detonation. The young and the old react most slowly if they lack clear simple knowledge of the dangers. Langevin shows that even this untrained protective reaction increases the amount of energy required to cause burns to an exposed population, especially in the case of high-yield weapons which expose the most people.

Dr Samuel Glasstone and Philip J. Dolan stated in the 1977 edition of *The Effects of Nuclear Weapons* (U.S. Department of Defence, p. 561):

'Persons exposed to nuclear explosions of low or intermediate yield may sustain very severe burns... These burns may cause severe superficial damage similar to a third-degree burn, but the deeper layers of the skin may be uninjured. Such burns would heal rapidly, like mild second-degree burns.'

At Hiroshima and Nagasaki, high mortality from superficial burns occurred despite the slight depth of charred skin, because of synergistic interaction between nuclear and thermal radiation exposure. This was discovered by Dr James W. Brooks et al. in 1952, and published in their paper 'The Influence of External Body Radiation on Mortality from Thermal Burns' (*Annals of Surgery,* vol. 136, p. 533). Although superficial third-degree burns from the brief thermal pulse of a nuclear explosion are easily survived, a concurrent nuclear radiation exposure of 100 r interferes with recovery by suppressing the white blood cell count, allowing otherwise minor infections to become

lethal.

Contrary to antinuclear propaganda claims that people were 'vaporised' in Japanese photographs of human 'shadows' left behind on otherwise melted asphalt paint and road surfaces, the fact that these shadows exist proves that people blocked the thermal radiation without disappearing. The peak skin temperature is reached when the rate of absorption of energy equals the rate of dissipation of energy by re-emission, blood circulation, and air-cooling. The human body (mainly water) could not be vaporised by the thermal exposures present at ground zero, even if the energy could have somehow diffused throughout a person within the time available. Skin has a thermal conductance of 8 kg.cal/m^2/hour/C. Another recurring myth are spectacular keloids (overgrowths of scar tissue) misrepresented as 'nuclear bomb' burns: 'The degree of the keloid formation was undoubtedly influenced by secondary infections, that complicated healing of the burns, and by malnutrition, but more important is the known tendency for keloid formation to occur among the Japanese, as a racial characteristic. Thus, many spectacular keloids were formed after the healing of burns produced in the fire raids on Tokyo.' (Dr Samuel Glasstone, editor, *The Effects of Atomic Weapons,* U.S. Department of Defence, September 1950, p. 337.)

In a controlled sample of 36,500 survivors, 89 people got leukemia over a 40 year period, above the number in the unexposed control group. (Data: Radiation Research, volume 146, 1996, pages 1-27.) Over 40 years, in 36,500 survivors monitored, there were 176 leukemia deaths which is 89 more than the control (unexposed) group got naturally. There were 4,687 other cancer deaths, but that was merely 339 above the number in the control (unexposed) group, so this is statistically a much smaller rise than the leukemia result. Natural leukemia rates, which are very low in any case, were increased by 51% in the irradiated survivors, but other cancers were merely increased by just 7%. Adding all the cancers together, the total was 4,863 cancers (virtually all natural cancer, nothing whatsoever to do with radiation), which is just 428 more than the unexposed control group. Hence, the total increase over the natural cancer rate due to bomb exposure was only 9%, spread over a period of 40 years. There was no increase whatsoever in genetic malformations.

Contrast these hard facts to the propaganda first spread by Dr Harold Jacobson, a nuclear effects ignorant Manhattan Project physicist at Los Alamos, who claimed to the International News Service that Hiroshima will be uninhabitable for 75 years, and then falsely added: 'Any Japanese who try to ascertain the extent of the damage caused by the atomic bomb are committing suicide.' Neutron activity doses were not high enough to do that, and there was no significant local fallout (firestorm soot and moisture rainout occurred an hour after the Hiroshima explosion, by which time the radioactive mushroom cloud was far downwind and did not contaminate the rain).

Examine the post-attack recovery rate in Hiroshima *before* any significant outside help arrived:

7 August (Day 2): Survivors open bridges and roads to pedestrian traffic, clearing away debris: "The [Hiroshima] prefectural governor issued a proclamation on 7 August, calling for 'a rehabilitation of the stricken city and an aroused fighting spirit ...'. To prevent the spread of rumors and brace morale, 210,000 out-of-town newspapers were brought in daily to replace the destroyed local paper." (Source: U. S. Strategic Bombing Survey, *The Effects of the Atomic Bombs on Hiroshima and Nagasaki,* 19 June 1946, page 9.)

8 August (Day 3): Rail tracks cleared and trains to Hiroshima resumed.

9 August (Day 4): Street trolley bus (electric tram) lines return to service.

1 November (Day 86): "the population of Hiroshima is back to 137,000. ... The official Japanese figures summed up the building destruction at 62,000 out of a total of 90,000 buildings in the urban area, or 69%. An additional 6,000 or 6.6% were severely damaged, and most of the others showed glass breakage or disturbance of roof tile. These figures show the magnitude of the problem facing the survivors. ... In view of the lack of medical facilities, supplies and personnel, and the disruption of the sanitary system, the escape from epidemics may seem surprising. The experience of other bombed cities in Germany and Japan shows that this is not an isolated case. A possible explanation may lie in the disinfecting action of the extensive fires. In later weeks, disease rates rose, but not sharply." (Source: U. S. Strategic Bombing Survey, *The Effects of the Atomic Bombs on Hiroshima and Nagasaki,* 19 June 1946, page 9.)

Next, consider what *civil defence did during the post-attack recovery process to help aid survivors in Nagasaki, subjected to a nuclear explosion just 3 days after Hiroshima:*

9 August (Day 1): Emergency rations are brought in to feed 25,000 survivors (though less than the required amount, due to bureaucratic confusion). The survivors lived in the air-raid shelters, which had survived.

10 August (Day 2): Emergency rations are brought in to feed 67,000 survivors: "this represents a remarkable feat of organisation that illustrates the great possibilities of mass feeding." (Source: Fred C. Ikle, *The Social Impact of Bomb Destruction,* University of Oklahoma Press, 1958, p. 147.) "On the morning of 10 August [in Nagasaki], police rescue units and workers from the Kawami-nami shipbuilding works began the imperative task of clearing the Omura-Nagasaki pike, which was impassable for 8,000 feet. A path 6 ½ feet wide was cleared despite the intense heat from smouldering fires, and by August 15 had been widened to permit two-way traffic. No trucks, only rakes and shovels, were available for clearing the streets, which were filled with tile, bricks, stone, corrugated iron, machinery, plaster, and stucco. Street areas affected by blast and not by fire were littered with wood. Throughout the devastated area, all wounded had to be carried by stretcher, since no motor vehicles were able to proceed through the cluttered streets for several days. The plan for debris removal required clearance of a few streets leading to the main highway; but there were frequent delays caused by the heat of smouldering fires and by calls for relief work. The debris was simply raked and shoveled off the streets. By 20 August the job was considered complete. The streets were not materially damaged by the bomb nor were the surface or the abutments of the concrete bridges, but many of the wooden bridges were totally or partially destroyed by fire. ... Despite the absence of sanitary measures, no epidemics broke out here. The dysentery rate rose from 25/100,000 to 125/100,000. A census taken on 1 November 1945 found a population of 142,700 in the city [Nagasaki]. ... Of the 52,000 residential units in the city [of Nagasaki] on 1 August, 14,146 or 27.2 percent were completely destroyed (by Japanese count) (11,494 of these were burned); 5,441 or 10.5 percent were half-burned or destroyed; many of the remaining units suffered superficial or minor damage." (Source: U. S. Strategic Bombing Survey, *The Effects of the Atomic Bombs on Hiroshima and Nagasaki,* 19 June 1946, pages 12-13.)

7 October (Day 60): The first green shoots of recovery appeared on an irradiated and firestorm-burned chestnut tree, photographed by U.S. Air Force observers, and published in the U.S. Congress book, *The Effects of Nuclear War*, 1979:

Above: the U.S. Office of Technology Assessment published a very poorly researched book in May 1979 (full of popular lies about ozone layer damage, and so on) called *The Effects of Nuclear War* in which the one useful disclosure (on page 114) was this U.S. Air Force photo of the leaves and new shoots appearing on a chestnut tree in Nagasaki 2 months after being irradiated with gamma rays and neutrons and then charred and burned in the fires which followed. Predictably, this one piece of honesty is **omitted from the online PDF version of that book** by the Federation of American Scientists **here (which is so poorly scanned for page 114 that not even a single word of the photo caption is readable),** and also hosted by **Princeton University here**. Robert Jungk, *Children of the Ashes* (Heinemann, London, 1961): 'one morning in April 1946, the Vice-Mayor [of Hiroshima] gazed for a long time. For what met his eyes was a sight he had scarcely hoped ever to see again ... The blackness of the branches was dappled with the brilliant white of cherry buds opening into blossom.'

Robert Jungk carefully investigated the history of the recovery in Hiroshima by interviewing the people involved and collecting first hand reports, and gives further interesting details in his book *Children of the Ashes* (Heinemann, London, 1961):

1. On 31 August 1945: 'the first locally produced and locally printed post-war edition of the *Chugoku Shimbun* was on sale in the streets of Hiroshima ... 'Our darkroom was an air-raid shelter dug into the hillside [which survived of course]', one of the editors remembers, 'but our type had to be cast in the open air, under the sunny sky.'

2. On 7 September 1945, the *Chugoku Shimbun* reported that Hiroshima then had a population estimated to be 130,000.

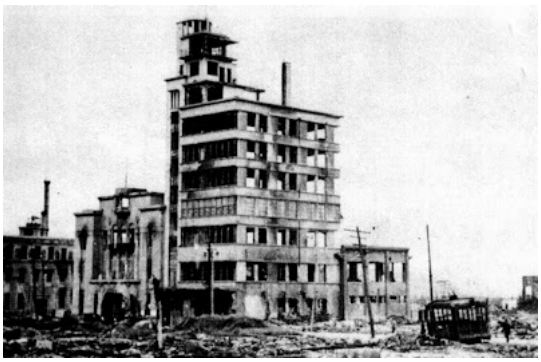
3. On 10 September 1945, electricity was reconnected to some parts of Hiroshima: 'huts made of planks quickly knocked together ... already had electric light.'

4. On 5 November 1945, the *Chugoku Shimbun* reported that - despite inertia and delays due to 'the rigidity of bureaucratic procedure' which was hindering the recovery rate - a lot of progress was being made:

'*Housing*. The building of houses is to be systematically begun on 15 November. ...

'*Tramways*. At present, ten trams are in commission on the main route, eight on the Miyajima route and five muncipal buses. These twenty-three vehicles must cater for an average of 42,000 persons daily.'

Some 70% of the destroyed buildings of Hiroshima had been reconstructed by mid-1949. (Ref.: Research Department, Hiroshima Municipal Office, as cited in *Hiroshima,* Hiroshima Publishing, 1949. Other recovery data are given in U.S. Strategic Bombing Survey, *The Effects of Atomic Bombs on Hiroshima and Nagasaki,* Washington, D.C., 1946, p. 8.)



Above: the Chugoku newspaper building 870 m east of GZ Hiroshima, gutted by fire. Unlike the CND 'survivors would envy the dead' propaganda of big name 'journalists' (anti-civil defense propagandarists) of today, those journalists at Hiroshima didn't let a nuclear attack

deflect them from their duty of reporting news truthfully. They go on with the task of helping to keep morale up, and assisting the flow of information needed to rebuild Hiroshima. They rolled their sleeves up, and got to work, setting type outdoors, processing photographic prints in an old air raid shelter! These journalists are a model for civil defense!

'I must confess that as an expert, my original view, and the view I held during the time I was on the SALT delegation, was that there was no defense against nuclear war and that there was no realistic recovery from it. ... [However, upon checking the actual facts...] The day after the blast, bridges in downtown Hiroshima were open to traffic. Two days later, the trains started to run again, and three days later, some of the streetcar lines were back in operation.'

- Thomas K. Jones, Program and Product Evaluation Manager, Boeing Aerospace Company, Testimony the *Hearings before the Joint Committee on Defense Production,* U.S. Congress, 17 November 1976.

(See also his report: **T. K. Jones, *Industrial Survival and Recovery after Nuclear Attack: A Report to the Joint Committee on Defense Production, U.S. Congress,* Boeing Aerospace Company, Seattle, Washington, ADA041540, 1976**. Another relevant report is: U.S. Defense Civil Preparedness Agency, *Research Report on Recovery from Nuclear Attack,* Information Bulletin No. 307, Washington, D.C., 1979.)

With Enough Shovels: Reagan, Bush and Nuclear War is the title of a 285 pages long pseudoscientific political diatribe against the value of dirt in shielding fallout gamma radiation in civil defense, written by Robert Scheer and published by Vintage Books in 1983. There is an **extract here which clearly shows the pseudoscientific, unbalanced, arm-waving, fact-denying style**. It was reviewed by Andrew J. Pierre in the Spring 1983 issue of *Foreign Affairs*, who clearly doesn't know the first thing about fission product fractionation, the Compton effect, or the low energy of gamma rays from neptunium-239 produced by dirty nuclear weapons with uranium-238 casings:

'The sensationalism of the approach of this widely touted book about the Reagan Administration's attitude toward nuclear war somewhat reduces its credibility. There are too many alarums and extreme statements. Yet it remains a troubling work which emphasizes the degree to which at least some in the current Administration hold views which are outside the mainstream of America's strategic and arms control policy of the past 20 years.'

Notice the way that *mainstream views* are implicitly assumed to be right, contrary to all the lessons of the failure of groupthink dogma for the whole of human history in the fields of politics, war and science. **All of the reader reviews currently on Amazon.com also miss the science. The nearest one to truth (at least in the context of Reagan's Starwars SDI project, which came after Scheer's book) is probably the following by Donovan Colbert (Sacramento, California United States)** who focusses on Sheer's diatribe against President Reagan and his Secretary of Defense Caspar Weinberger who both used Jones' research as the basis for making claims to the media that America could not just survive but actually 'win' nuclear war. In 1982 the Reagan administration presented a program to Congress requesting $4.2 billion for civil defense over seven years, to save 80 percent of the U.S. population in the event of a full scale nuclear war with the USSR. In 1980, presidential candidate, George H. W. Bush, later Reagan's Vice President and President himself, answered Robert Scheer's question about how a super-power can win in a nuclear exchange: 'You have survivability of command and control, survivability of industrial potential, protection of a percentage of your citizens, you have a capability that inflicts more damage on the opposition than it can inflict on you. That's the way you have a winner ...'. It's clear that this 'Hawkish' approach was designed to stand up to the Soviet Union which had just invaded Afghanistan, and make it understand that Reagan's administration was tough on terrorist states, the nuclear threat notwithstanding. Colbert's **review** of Sheer's book states:

'The goal was to convince them to enter into an arms race that they couldn't possibly win, which would cause their economy to collapse and make them reform their Communist system of Government. That loony neocon Mr. Reagan... what a crazy cowboy. How could he ever have thought that this plan could have worked... What... what is that? The Soviet Union suffered an economic collapse and embraced a more democratic society? You don't say... The value of this book is that it the author got it ALL right. Reagan was in a staring contest with the Soviet Union, and he made them blink. He convinced them that he and his administration was crazy, and they were so caught up in that - they bankrupted themselves, causing the collapse of soviet communism.'

Robert Scheer wrote a series of articles in the Los Angeles Times attacking the Reagan people who tried to implement **Cresson H. Kearny's 1979 Oak Ridge National Laboratory book, *Nuclear War Survival Skills*** in national civil defense plans for American survival. In 1983, Scheer in his book *With Enough Shovels: Reagan, Bush and Nuclear War* ridiculed the policies based on the Kearny book without once mentioning or discussing Kearny's book or his prior Oak Ridge National Laboratory research reports. Sheer attacked Thomas K. Jones, the man Ronald Reagan had appointed Deputy Under Secretary of Defense for Research and Engineering, Strategic and Theater Nuclear Forces. Sheer wrote in his yellow bellowied, subversive (non-mentioning) attack on Kearny's research:

'Very late one autumn night in 1981, Thomas K. Jones, the man Ronald Reagan had appointed Deputy Under Secretary of Defense for Research and Engineering, Strategic and Theater Nuclear Forces, told me ... that nuclear war was not nearly as devastating as we had been led to believe. He said, "If there are enough shovels to go around, everybody's going to make it." The shovels were for digging holes in the ground, which would be covered somehow or other with a couple of doors and with three feet of dirt thrown on top, thereby providing

adequate fallout shelters for the millions who had been evacuated from America's cities to the countryside. "It's the dirt that does it," he said.

'What is truly astounding about my conversation with T. K. is not simply that one highly placed official in the Reagan Administration is so horribly innocent of the effects of nuclear war. More frightening is that T. K. Jones's views are all too typical of the thinking of those at the core of the Reagan Administration, as I have discovered through hundreds of hours of interviews with the men who are now running our government.'

This kind of sneering by the media against the people implementing civil defence in the Reagan administration, while ignorantly ignoring the scientific facts from tests as published in Kearny's book, led to the whole civil defence effort being ditched. Sheer also promulgated lies about civil defense evacuation effectiveness, quoting some lunatic who claimed that evacuation of densely populated cities and dispersal of the population could be overcome by the Russians if they 'simply retarget to hit the evacuated populations'. Duh! The whole point of nuclear weapons is that they concentrate the effects in a small area which is why cities could be targets, so they're no use for a dispersed population which is protected against blast, thermal and fallout effects! While you can hit 100 cities with 100 nuclear weapons, you would need millions of nuclear weapons to target a dispersed population, and then you would have to keep re-targetting every weapon non-stop as people moved around (the coordinates of cities are fixed).

America and Britain dropped 1.3 Megatons (1,300,000 tons) of conventional high explosives and incendiaries on Germany, while in August 1945 America dropped two nuclear weapons on Japan. Hiroshima and Nagasaki casualties were about 25% of the population of each city (only 1% of casualties have been due to long-term radiation injuries, such as leukemias), and the cities recovered quickly, despite a lack of assistance from other cities.

Remember that the firestorm in Tokyo from one air raid of conventional incendiaries in March 1945 produced more casualties than either atomic bomb, including long term casualties. Many of the incendiary victims suffered worse injuries than nuclear casualties. There was no significant residual fallout in Japan because the bombs were air bursts. (Compare these scientific facts to popular fiction in newspapers and widely published political books 'explaining' the horrific effects of nuclear weapons compared to other weapons.) Remember than 62 million people were killed by conventional warfare in WWII.

Also remember that the blast effects radius scales as the cube-root of yield, so the area devastated is only proportional to the two-thirds power of yield (for fallout there is an analogous effect, since the bigger areas covered by fallout involve longer fallout arrival times than in the case of smaller weapons, so more fallout decays in transit, reducing the doses below those you would expect from linear scaling). The result is that the 2 megatons of bombs dropped in WWII (in the form of 20 million TNT bombs, each of 100 kg average size) is equivalent to an 'equivalent megatonnage' of 431 nuclear bombs each of 1 megaton yield.

The thing about a big nuclear explosion is that it gives you *more* warning than a conventional low yield bomb - the flash of light travels faster than the blast wave(which takes about 4 seconds to travel one mile), the heat and initial nuclear radiation pulses (the heat and initial nuclear radiation pulse travels at light velocity but is released slowly and takes several seconds to be delivered from the glowing fireball), giving most people time to get out of the line of sight (duck and cover).

Fallout is wind carried dust and again takes time to arrive, giving people who are downwind vital time to evacuate or at least get some shielding in a brick building or one of Kearny's improvised shelters (e.g., each foot of dirt shielding reduces the fallout gamma dose rate by a factor of ten). The nuclear winter hype relies on firestorms, which were feasible in the medieval part of Hamburg and in Japanese cities in 1945, but are not possible with the brick/concrete modern cities around today: any fires get extinguished by rubble. You can't get firestorms. The nuclear winter people like Sagan had to invent a targetting strategy that would put nearly all nuclear bombs on oil refineries. Actually, Saddam set alight all of Kuwait's oil fields before the First Gulf War, but it didn't freeze the planet. Soot layers don't remain stable in the atmosphere: they quickly get dispersed and washed out in the 'black rain' that was seen in Hiroshima (an hour after the radioactive mushroom cloud had been blown miles away by the wind) and conventional firestorm places.

'Nuclear winter' lies debunked by Saddam Hussein in 1991

Saddam Hussein's Iraqi army invaded Kuwait and set all of its oil wells on fire as it was driven back into Iraq by America in 1991. Paul Crutzen, who had started the nuclear winter myth in 1982 (before a well-funded public relations propaganda marketing company, and others like Carl Sagan became involved), in 1991 predicted that the burning of Kuwait's oil wells would cause a nuclear winter which would devastate the northern hemisphere:

'The fears expressed last week centred around the cloud of soot that would result if Kuwait's oil wells were set alight by Iraqi forces ... with effects similar to those of the "nuclear winter" ... Paul Crutzen, from the Max Planck Institute for Chemistry in Mainz, has produced some rough calculations which predict a cloud of soot covering half of the Northern Hemisphere within 100 days. Crutzen ... estimates that temperatures beneath such a cloud could be reduced by 5-10 degrees C ...'

- Peter Aldhous, 'Oil-well climate catastrophe?', *Nature,* vol. 349 (1991), p. 96.

Dr Richard D. Small of Pacific-Sierra Research Corporation, California, responded in *Nature,* vol. 350 (1991), pp. 11-12, that 16,000 metric tons of actual soot is produced from 220,000 metric tons of oil burned every day, and anyway:

'My estimates of the smoke produced by destruction of Kuwait's oil wells and refineries and the smoke stabilization altitude do not support any of the purported impacts. The smoke is not injected high enough to spread over large areas of the Northern Hemisphere, nor is enough produced to cause a measurable temperature change or failure of the monsoons.'

It is significant that oil soot, being 69% elemental carbon, is the most effective particulate known for absorbing sunlight. The nuclear winter propaganda is a hoax. When you look at the data on liquid petroleum tanks exposed at Nevada nuclear tests, they did not rupture let alone ignite at the damaging overpressures which dented them, and which the nuclear winter propaganda people used in their calculations for the ignition of oil facilities! It is true that large above-ground oil tanks exposed to the shrapnel of the conventional chemical explosion inside a steel ship in Texas City in 1947 were ruptured and burned, but the effects of nuclear air blast differ from those produced by the

steel shrapnel thrown out by a chemical explosion inside a ship. The nuclear winter hoax people started off by assuming that brick and concrete cities burn, and when that was debunked as unable to cause nuclear winter, they then exaggerated the ignition and effects of nuclear attacks on oil refineries.

TAPPS 1990 OIL REFINERY TARGETTING ASSUMPTION OF CONVENIENCE

President Reagan in 1982 was talking about civil defense for bolstering U. S. deterrence of 40,000 Soviet main battle tanks (ready to invade the West, take over the resources, and thus shore up the impending economic implosion of communism for another few decades), and that "survival talk" was what led Dr Carl Sagan and others to suggest everyone would be frozen by a nuclear winter in 1983. Then the fake "better red than dead" assumptions of the 1983 calculations were revealed. In 1985, Dr R. D. Small and Dr B. W. Bush of Pacific-Sierra Research Corp assessed the smoke from 4,100 megatons distributed as 2 warheads per target on 3,459 counter-force targets in forests and grassland areas (*Science,* v229, p465). They found the smoke output was 300,000 tons for a January attack and 3,000,000 tons for an August attack. These figures are 100-1,000 times lower than the guesses made by the "nuclear winter" hype of 1982-3, because the smoke is only 3% of the mass of vegetation burned (the rest is CO2 gas and cinders): "The amount varies seasonally and at its peak is less by an order of magnitude than the estimated threshold level necessary for a major attenuation of solar radiation."

One of the original errors was overestimating the soot production by fire. The fraction of the mass burned that becomes smoke is only 1% for wood, 3% for vegetation, 6% for oil and 8% for plastic. So after some negative publicity about the "errors" in the "nuclear winter" hype, TTAPS (Turco, Toon, Ackerman, Pollack and Sagan) public relations experts in 1990 (*Science*, v247, p166) changed their targeting assumptions to make use of the figure of 6% soot emission by burning oil, by now assuming that 50% of primary petroleum stocks would be targets. I.e., they assumed that in a nuclear war, both sides would deliberately use nuclear weapons to create as much soot as possible by targeting oil refineries. This allowed them to go on with the hype. They simply ignored the lesson of Hiroshima, that firestorm soot is hydroscopic, absorbs moisture from the air, condenses in the cool air at high altitude, and falls back as rain within a few hours. But then, they ignored *all* of the civil defense lessons from Hiroshima, so why not also ignore the fate of the soot from fires after a nuclear explosion over an inflammable wood built city? They certainly were *consistent* in ignoring all of the effects of nuclear explosions in their political spin.

The basic equation for the fraction of sunlight absorbed during x metres of passage through a soot cloud containing s grams of soot per cubic metre is e^{-7xs}. However, smoke is rapidly dispersed and removed by the atmospheric weather systems, wind and rain, as occurred at Hiroshima.

Cression H. Kearny explained the following facts in the 1987 revised edition of the Oak Ridge National Laboratory book. *Nuclear War Survival Skills* (Oregon Institute of Science and Medicine), page 18:

'Soviet propagandarists promptly exploited belief in unsurvivable "nuclear winter" ... because raging city firestorms are needed to inject huge amounts of smoke into the stratosphere ... according to one discredited theory ... the Soviets changed their descriptions of how a modern city will burn. Thus, in the Oak Ridge National Laboratory translation (ORNL-TR-2793) of *Civil Defense,* Second Edition (500,000 copies), Moscow, 1970, by Egorov, Shlyakhov and Alabin, we read: "Fires do not occur in zones of complete destruction ... that are characterized by an overpressure exceeding 0.5 kg/cm^2 [7.1 psi or 49 kPa] ... because rubble is scattered and covers the burning structures. As a result, the rubble only smoulders, and fires as such do not occur. Firestoms destroyed the centers of Hamburg, Dresden, and Tokyo. The old-fashioned buildings of these cities contained large amounts of flammable materials ... In a free country, truth will out – although sometimes too late to effectively counter fast-hitting propaganda.'

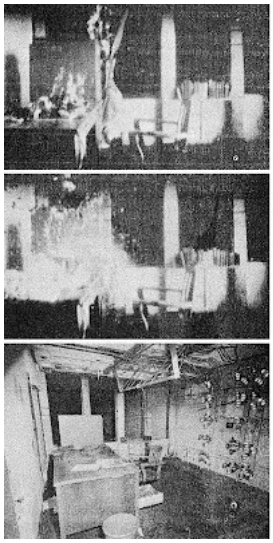
Above: Mannequins at 2.1 km ground range from the 29-kt *TEAPOT-APPLE 2* Nevada 500 ft altitude tower test on 5 May 1955. Clothes did not ignite, but the exposed colour of a dark suit faded while a dark pattern on a dress was burned on to the underwear. Clothing protects skin.

Above: ***UPSHOT KNOTHOLE-ENCORE* 27 kt air burst at 2,423 feet altitude at the Nevada nuclear test, 8 May 1953. Wooden houses, black and white, resisted ignition by a thermal flash of 12 calories/cm^2, despite 'smoking' during exposure. But a badly decayed dark wooden fence and piles of old leaves and newspaper trash set their adjacent houses on fire within 15 minutes. The light-painted house with a tidy yard survived.** *Far right:* two wooden houses 10-by-12 feet in size with large windows facing ground zero were exposed to 17 calories/cm^2 from *ENCORE.* In one house piles of inflammable newspaper trash indoors set a house on fire due to thermal radiation from *ENCORE* entering the large window, but an identical house beside it survived *because inflammable trash had been removed!* Page 343 of the 1962 edition of *The Effects of Nuclear Weapons* explains the significance of this *ENCORE* test:

'The value of fire-resistive furnishings in decreasing the number of ignition points was also demonstrated ... where the thermal radiation exposure was 17 calories/cm^2 ... draperies were of vinyl plastic, and rugs and clothing were made of wool ... the recovery party, entering an hour after the explosion, was able to extinguish the fires.'

Note that the house which *did burn* which was loaded with trash with a large window facing the fireball and underwent *immediate room 'flashover' with no delay because all the easily ignited trash in it simultaneously burst into flames*. Lynn Eden falsely makes a great issue out this fact in her 2004 book *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation,* on pages 256-7, where she simply ignores the vitally important civil defence fact that the identical house with the trash like old newspapers and highly inflammable old type furniture removed did *not* undergo instant flashover!

The immediate flashover effect was confirmed at the 1 kt high explosive test *DIRECT COURSE* in New Mexico, October 1983. There was no surprise there: light tinder filled rooms facing the fireball and irradiated with 17 cal/cm^2 instantly burst into flame, *but clean tidy rooms without trash don't, even if they face the fireball.* This is what *ENCORE* proved!



Thermal radiation from a simulated 1 megaton burst ignites curtains and papers, then the 1 psi peak overpressure blast wave arrived and blew the fires out. At 1 psi, 50% of burning curtains are extinguished by the blast wave. At and above 2.5 psi peak overpressure, 100% of fires were extinguished by the blast wave. Blast winds displace flames and cool the burning material to temperatures below those needed for ignition, thus extinguishing fires. Burning beds and upholstered furniture are only extinguished by peak overpressures of 2.5 psi and higher. They continue to smoulder, and can rekindle into fires after 15 minutes or more. During this time it is easy to stamp out the potential fires.

Curtains and drapes should be closed across windows in an impending nuclear attack, to shield beds and upholstered furniture from thermal radiation. Ignition of curtains is easily blown out by the blast wave. This occurred at Hiroshima, where the main source of fires was the overturning of charcoal braziers in wooden houses by the blast wave.

SOURCE:
Thomas Goodale, 'Effects of Air Blast on Urban Fires', URS Research Company, California, report URS 7009-14, also AD723429, December 1970.

Thomas Goodale's report *Effects of Air Blast on Urban Fires,* URS Research Company, California, report URS 7009-14, also AD723429, December 1970, showed that where thermal radiation from a simulated 1 megaton burst ignites curtains and papers, the blast wave arrived and blew fires out. At 1 psi, 50% of burning curtains are extinguished by the blast wave, burning fragments from the remainder can be blown into the room by a peak overpressure of 1 psi. But in all case above 2.5 psi peak overpressure, 100% of incipient fires were extinguished by the blast wave, unless the whole room was filled with tindering like newspaper trash and directly facing the fireball so as to suffer immediate 'flashover' like the trash filled room exposed to *ENCORE.*

Blast winds displace flames and cool the burning material to temperatures below those needed for ignition, thus extinguishing fires. *Burning beds, all curtains and upholstered furniture are only extinguished by peak overpressures of 2.5 psi and higher.* The beds and upholstered furniture may then continue to smoulder, and can rekindle into fires after 15 minutes or more. *During this time it is very easy to stamp out the potential fires.*

Lynn Eden falsely comments on Goodale's research in her 2004 book *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation,* where she writes on page 218 that:

'The next year [1971] Goodale conducted more experiments ... One experiment examined the effects of blast overpressures of up to 9 psi on the smoulder that remained after the flames had been blown out. These findings, however, were not conclusive: "The higher overpressures did not produce a smoulder-extinction counterpart to the blowout of flames. No trend was evident".'

This statement about the trend in smoulder extinction with increasing peak overpressure, *has nothing to do with the fact that blast waves do extinguish 100% of solid fuel (not burning liquid fuel pans or burning papers and trash such as in the ENCORE room) of incipient fires above 2.5 psi, even if some are left in a smouldering condition at high overpressures and can re-ignite if not dowsed with water or stamped out*.

Lynn Eden continues:

'Another experiment showed a very different outcome in which low blast pressure could increase fire spread. In this study, Goodale subjected burning curtains to blast overpressures of 1 psi "only to discover that transport of burning curtain fragments may become a considerable hazard under suitable conditions".'

Ignition of curtains depends on the curtain colour (curtains with common white linings are resistant to ignition by thermal radiation), but if they are ignited it is true that when blasted into a room they can cause fires under some conditions. yet this does not discredit the finding that other internal room fires are blown out by the blast wave. Burning curtain fragments are easy to deal with, by stamping out. It is not an immediate flashover mechanism, like the trash filled *ENCORE* room.

Even where rooms are ignited by thermal radiation, this does not instantly spread burn the house down, unless the room is filled with fine tindering such as trash newspapers, magazines, etc., as in the *ENCORE* room which burned rapidly by immediate flashover (contrasted to the identical room without trash which did *not* undergo immediate flashover and was extinguished an hour later by the recovery party). It takes 17 minutes for 50% of normal living room fires to 'flashover' so that the whole room bursts into flame, and 8 minutes for 50% of bedroom bed ignitions to flashover to the rest of the room. (F. J. Vodvarka and T. E. Waterman, *Fire Behavior, Ignition to Flashover,* IIT Research Institute, Chicago, report AD618414, June 1965.) Until flashover occurs, it remains possible to extinguish the fire with water, sand, or by beating it out with wet blankets.

Collaborated evidence from observers at Hiroshima shows that the ignition of dark air raid blackout curtains occurred at up to 1.1 km from ground zero, whereas the more likely blast ignition due to overturned charcoal cooking stoves caused a firestorm to burn everything within an average radius of 1.9 km. Curtain ignition was limited to rooms facing the explosion with uninterrupted line-of-sight to the fireball. Now that upholstery fabrics are fire retardant by law, research has been done into the risk of internal house fires being started by bits of ignited window curtains being thrown into rooms. The main risk occurs if there are piles of old newspapers in the rooms which can act as tinder, because the wood used in flooring and furniture is too thick to be ignited before curtain fragments burn out. (Thomas Goodale, *The Ignition Hazard to Urban Interiors During Nuclear Attack due to Burning Curtain Fragments Transported by Blast,* URS Research Corp., San Mateo, California, report URS-7030-5, 1971.)

There are lots of simple countermeasures against thermal ignition in the threat of a nuclear attack. For rooms containing ignitable items like beds, upholstered furniture, or rugs: choose light-coloured curtains, paint a mixture of flour and water on to the inside of windows with a potential view of the fireball, or even better simply tape sheets of aluminium cooking foil over those particular windows. For other rooms and offices: dispose of loose combustible materials like newspapers, magazines and trash, and place in the rooms buckets filled with water or sand to use to extinguish fires before they can spread. Blankets soaked with water are useful to beat out tindering fires before they spread.

Lynn Eden goes on (pages 218-9):

'Many studies followed, but the results were inconclusive. One experiment undertaken in the spring of 1973 ... subjected twenty pans of burning fuel to blast ... "no fire at any of the three stations was extinguished by the shock wave". ... Some experiments ... appeared to bear out Goodale's findings, others did not.'

This is dishonest because burning liquid in pans involves the circulation of hot convection currents of liquid with a much higher specific heat capacity (heat retaining ability) than air. Solid fuels only circulate hot gases, which have a low specific heat capacity and so are easily blown out by a blast of relatively cool air. But burning liquid is totally different and can be much harder to extinguish once the liquid is heated to ignition temperature by convection currents within it. This has nothing to to with the extinguishing nature of the blast wave on burning solid fuels: it is patiently and fundamentally dishonest to compare experiments on dissimilar phenomena and then claim that they are contradictory so that those which support civil defence can be ignored as 'inconclusive'. That is just fact ignoring pseudoscience, a political dodge with no place in fact-based science.

Lynn Eden states on page 219:

'... In the "doughnut hole", the area immediately surrounding the detonation, collapsed strustures would prevent fires from burning or would extinguish incipient fires; farther away, fires would burn vigorously. ... at Hiroshima ... there was no "hole" near the detonation, nor was there evidence of such a hole at Nagasaki.'

This is a dishonest 'comparison' because Hiroshima and Nagasaki were wood frame cities, not brick and concrete. The few brick and concrete buildings survived in each city, often with minor damage. It is dishonest for Lynn Eden and her sources like Postol and Brode to ignore the fact that brick and concrete can't burn but wood can burn. The May 1947 U.S. Strategic Bombing Survey report on Hiroshima, pp. 4-6:

‘Six persons who had been in reinforced-concrete buildings within 3,200 feet [975 m] of air zero stated that black cotton black-out curtains were ignited by flash heat... **A large proportion of over 1,000 persons questioned was, however, in agreement that a great majority of the original fires were started by debris falling on kitchen charcoal fires**. [Emphasis added.] ... There had been practically no rain in the city for about 3 weeks. The velocity of the wind ... was not more than 5 miles [8 km] per hour....

‘The fire wind, which blew always toward the burning area, reached a maximum velocity of 30 to 40 miles [48-64 km] per hour 2 to 3 hours after the explosion ... Hundreds of fires were reported to have started in the centre of the city within 10 minutes after the explosion... almost no effort was made to fight this conflagration within the outer perimeter which finally encompassed 4.4 square miles [11 square km]. Most of the fire had burned itself out or had been extinguished on the fringe by early evening ... There were no automatic sprinkler systems in building...’

The British Home Office *Manual of Civil Defence, Vol. 1, Pamphlet No. 1, Nuclear Weapons,* 2nd edition, 1959, states that the 'main fire zone' in a British brick built city will not exist within the radius of peak overpressure 11 psi because the rubble will exclude air and prevent significant fires within that radius. It specified four damage zones:

A - 11 psi (75 kPa) peak overpressure: complete destruction of ordinary houses, so brick rubble extinguishes fires.

B - 6 psi (40 kPa) peak overpressure: brick walls cracked or demolished, houses irreparably damaged, streets blocked with debris until cleared with mechanical aids.

C - 1.5 psi (10 kPa) peak overpressure: doors and roofs smashed in addition to broken windows and tiles blown off roofs.

D - 0.75 psi (5 kPa) peak overpressure: light damage, just glass and tiles.

Russian nuclear test based civil defence data indicated that brick houses do not burn at overpressures above 7 psi because the rubble prevents fires, as quoted Cresson H. Kearny, *Nuclear War Survival Skills, Updated and Expanded 1987 Edition,* Oak Ridge National Laboratory/Oregon Institute of Science and Medicine, 1987, Chapter 1:

'Soviet propagandists promptly exploited belief in unsurvivable "nuclear winter" to ... demoralize their enemies. Because raging city firestorms are needed to inject huge amounts of smoke into the stratosphere and thus, according to one discredited theory, prevent almost all solar heat from reaching the ground, the Soviets changed their descriptions of how a modern city will burn if blasted by a nuclear explosion. ... [before nuclear winter hype in 1983] Russian scientists and civil defense officials realistically described ... the burning of a

city hit by a nuclear weapon. Buildings in the blasted area for miles around ground zero will be reduced to scattered rubble - mostly of concrete, steel, and other nonflammable materials - that will not burn in blazing fires. Thus in the Oak Ridge National Laboratory translation (ORNL-TR-2793) of *Civil Defense, Second Edition* (500,000 copies), Moscow, 1970, by Egorov, Shlyakhov, and Alabin, we read: "Fires do not occur in zones of complete destruction . . . that are characterized by an overpressure exceeding 0.5 kg/cm^2 [7 psi peak overpressure], because rubble is scattered and covers the burning structures. As a result the rubble only smolders, and fires as such do not occur." ... No firestorm has ever injected smoke into the stratosphere, or caused appreciable cooling below its smoke cloud.

'The theory that smoke from burning cities and forests and dust from nuclear explosions would cause worldwide freezing temperatures was conceived in 1982 by the German atmospheric chemist and environmentalist Paul Crutzen, and continues to be promoted by a worldwide propaganda campaign. This well funded campaign began in 1983 with televised scientific-political meetings in Cambridge and Washington featuring American and Russian scientists. A barrage of newspaper and magazine articles followed, including a scaremongering article by Carl Sagan in the October 30, 1983 issue of *Parade,* the Sunday tabloid read by millions. The most influential article was featured in the December 23,1983 issue of *Science* (the weekly magazine of the American Association for the Advancement of Science): "Nuclear winter, global consequences of multiple nuclear explosions," by five scientists, R. P. Turco, O. B. Toon, T. P. Ackerman, J. B. Pollack, and C. Sagan. Significantly, these activists listed their names to spell TTAPS, pronounced "taps," the bugle call proclaiming "lights out" or the end of a military funeral.

'Until 1985, non-propagandizing scientists did not begin to effectively refute the numerous errors .... A principal reason is that government organizations, private corporations, and most scientists generally avoid getting involved in political controversies ... Stephen Schneider has been called a fascist by some disarmament supporters for having written "Nuclear Winter Reappraised," according to the *Rocky Mountain News* of July 6, 1986. Three days later, this paper, that until recently featured accounts of unsurvivable "nuclear winter," criticized Carl Sagan and defended Thompson and Schneider in its lead editorial, "In Study of Nuclear Winter, Let Scientists Be Scientists." In a free country, truth will out - although sometimes too late to effectively counter fast-hitting propaganda.'

***DPA Attack Environment Manual: Chapter 3, What the Planner Needs to Know about Fire Ignition and Spread,* U.S. Department of Defense, report CPG 2-1A3, June 1973, Panels 3 and 5:**

'Of course, hardly anyone lives in an area where they would be certainly exposed to thermal radiation ... There would be buildings, trees, hills ... Virtually any opaque material will serve to shield against the thermal pulse. ... nearly all of the radiation would be shielded out by objects before they are damaged or moved by the blast wave. ... tinder fuels do not usually contain sufficient energy by themselves to cause a sustained fire. What is needed is a "fuel array" containing both tinder and other burnables. ... Hardly anyone puts black curtains at their windows. In the thousands of sites that have been surveyed, none have been found. Crumpled newspaper and dry leaves are found in urban areas but, like people in the streets, they are very often not in a position to "see" the fireball and rarely are they located with other burnables to form a sufficient fuel array to cause a building fire. ... Some fire analysts consider only upholstered furniture and beds as the fuel arrays of significance. About 35 to 40 calories per square centimetre are required for ignition by a 5-Mt weapon.'

Curtains and drapes should be closed across windows in an impending nuclear attack, to shield beds and upholstered furniture from thermal radiation. Ignition of curtain fragments are easily stamped or doused out. This occurred at Hiroshima, where the main source of fires was the overturning of charcoal braziers in wooden houses by the blast wave.

John McAuliffe and Kendall Moll studied the blast wave role in starting fires in their 224 pages long report, *Secondary Ignitions from Nuclear Attack,* Stanford Research Institute, California, report AD625173, July 1965. They found that flying debris and building collapse data on fire ignition was available from the Hiroshima and Nagasaki nuclear bombings, high explosive disasters such as the massive Texas City ship explosion in 1947, World War II bombings, earthquakes and tornadoes. They concluded that for American cities (which don't use Japanese charcoal cooking braziers in indoors in homes filled with paper screens and bamboo furnishings), there are only 0.006 fires ignited by the blast wave per 1,000 square feet of floor area damaged by peak overpressures of 2 psi or more. This is approximately 1% ignition of typical American homes, one fire in every three blocks, or 80 fires per square mile in an area which is 25% builtup with 2-story buildings. Electrical wiring and gas piping were considered equally vulnerable. (Actually, this will be an overestimate because the source-region cable pick up of light-speed EMP current surges will automatically shut down transformers within a few microseconds of a surface burst or low air burst on a city; power stations and substations may be ignited by the EMP, but it will prevent secondary ignitions of electrical fires by blast wave debris in homes.)

A theoretical study of the combined effects of both primary thermal ignition of American homes by thermal radiation and also blast wave effects in extinguishing most of those fires but causing some secondary fires by damaging electrical and gas installations (they ignored the role of EMP) is the 97 pages long report by R. K. Miller et al., *Analysis of Four Models of the Nuclear-Caused Ignitions and Early Fires in Urban Areas,* the Dirkwood Corporation, New Mexico, report AD 716807, August 1970. This report used a combination of computer models to show that a 5 megaton surface burst on Detroit would ignite 2% of buildings at 8 miles from ground zero where the peak overpressure was 2 psi, rising linearly to a maximum of 10% of buildings at 5 miles (and within 5 miles) where the peak overpressure was 5 psi or more.

The poorly researched 1979 U.S. Congressional Office of Technology Assessment report *The Effects of Nuclear War* ignorantly used these figures of 2% ignition at 2 psi and 10% at 5 psi without understanding that they include thermal radiation effects and therefore do not scale with peak overpressure!

Another study of fires ignited in Detroit by a 5 Mt burst is Arthur N. Takata and Frederick Salzberg, *Development and Application of a Complete Fire-Spread Model: Volume II,* IIT research Institute, Chicago, report AD684874, June 1968, found that 3.8% of all buildings could be ignited initially, but that firespread could burn down many more if initial ignitions were not stamped out. Radiation from a burning wooden building emits about 4 cal/cm^2/sec, and it takes only 0.4 cal/cm^2/sec to ignite wood, so whenever another wooden house occupies more than 10% of the field of view of a burning house, it will be ignited. (Takata and Salzburg note that in the Darmstadt fire of 11 September 1944, where firebrands were negligible, thermal radiation from burning wooden houses caused a 72% probability of igniting immediately adjacent houses, a 50% probability of igniting houses 8 metres away, and a 10% probability of igniting houses 12 metres away.)

This short-ranged radiation firespread mechanism could nearly double the number of house ignitions in Detroit over the first hour, from

3.8% to 6.5% of houses burning at one hour post attack. After an hour, firebrands from burning houses would start to seriously contribute to the ignition of fires at much greater distances than the heat radiation from burning wooden buildings, so by 3 hours 18% of buildings in Detroit could be burnt out, and by 28 hours the figure could rise to 50%. *Unlike a firestorm, this would be a very slow process, like the Great Fire of London in 1666 where only 8 people were killed when 32,000 homes were burned over 1.8 km^2, because the fire spread very slowly over 4 days; and the Chicago Fire of 1871 where only 50 people were killed when 17,500 homes burned over an area of 8.6 km^2 over a period of 3 days.* (Wind carried burning firebrands from the Great Baltimore Fire of 1904 caused fires to wooden houses at distances of up to 800 metres downwind. Landing on wooden roofs, they are very difficult to deal with when the fire brigade is preoccupied with the existing fire zone.)

In Hiroshima, the secret May 1947 report of the U.S. Strategic Bombing Survey (Fig 5-IX) found that for wooden houses, the probability of one burning house igniting another by firebrands is 50% for a separation distance of 26 m, and shows (Fig 4-IX) that the risk of fire spread is 50% where 21% of the ground area is covered by wooden houses or 32% of the ground area is covered by industrial buildings.

‘Considerable war-time experience in the UK established beyond doubt that the chance of a continuing fire in an ordinary British house spreading and involving another house is less than 40%.’ – George R. Stanbury, *The number of fires caused by nuclear attack,* British Home Office, Scientific Adviser’s Branch, report SA/PR 90, 1965.

Many American buildings are wood-frame. For the brick and concrete type buildings that prevail in Britain, the Home Office Scientific Advisory Branch *Scientific Advisers' Operational Handbook,* Scottish Home and Health Department, H. M. Stationery Office, Edinburgh, 1979, states on page 39:

'The density of initial ignitions in the main fire zone, for UK houses, is likely to be very roughly one house in thirty, with a fire-spread factor of about 2 [i.e., each initial ignition will on average ignite one other building by thermal radiation, wind blown convection flames, and hot burning firebrands]. About one house in fifteen is expected to become burnt out. This situation would not constitute a "firestorm" or "mass fire", and the number of fire casualties should be small.'

Firestorms have always required at least 50% of buildings to be ignited. A 71 pages long report by Robert M. Rodden, Floyd I. John, and Richard Laurino, *Exploratory Analysis of Fire Storms,* Stanford Research Institute, California, report AD616638, May 1965, identified the following parameters required by all firestorms:

(1) More than 8 pounds of fuel per square foot (40 kg per square metre) of ground area. Hence firestorms occurred in wooden buildings, like Hiroshima or the medieval part of Hamburg. The combustible fuel load in London is just 24 kg/m^2, whereas in the firestorm area of Hamburg in 1943 it was 156 kg/m^2. The real reason for all the historical fire conflagrations was only exposed in 1989 by the analysis of L. E. Frost and E.L. Jones, ‘The Fire Gap and the Greater Durability of Nineteenth-Century Cities’ (*Planning Perspectives,* vol. 4, pp. 333-47). *Each medieval city was built cheaply from inflammable ‘tinderbox’ wooden houses, using trees from the surrounding countryside.* By 1800, Britain had cut down most of its forests to build wood houses and to burn for heating, so the price of wood rapidly increased (due to the expense of transporting trees long distances), until it finally exceeded the originally higher price of brick and stone; so from then on all new buildings were built of brick when wooden ones decayed. This rapidly reduced the fire risk. Also, in 1932, British Standard 476 was issued, which specified the fire resistance of building materials. In addition, new cities were built with wider streets and rubbish disposal to prevent tinder accumulation in alleys, which created more effective fire breaks.

(2) More than 50% of structures ignited initially.

(3) Initial surface winds of less than 8 miles per hour.

(4) Initial ignition area exceeding 0.5 square mile.

The fuel loading per unit ground area is equal to fuel loading per unit area of a building, multiplied by the builtupness fraction of the area. E.g., Hamburg had a 45% builtupness (45% of the ground area was actually covered by buildings), and the buildings were multistorey medieval wooden constructions containing 70 pounds of fuel per square foot. Hence, in Hamburg the fuel loading of ground area was 0.45*70 = 32 pounds per square foot, which was enough for a firestorm.

By contrast, modern cities have a builtupness of only 10-25% in most residential areas and 40% in commercial and downtown areas. Modern wooden American houses have a fuel loading of 20 pounds per square foot of building area with a builtupness below 25%, so the fuel loading per square foot of ground is below 20*0.25 = 5 pounds per square foot, and would not produce a firestorm. Brick and concrete buildings contain on the average about 3.5 pounds per square foot of floor area, so they can't produce firestorms either, even if they are all ignited.

On the night of 9-10 March 1945, 334 B-29 aircraft dropped 1,667 tons of high explosives (to open up buildings to allow incendiary bombs inside) and incendiaries on Tokyo, creating a firestorm which burned down 41 km^2 or 15.8 square miles, killing more people than at Hiroshima (where only 4.7 square miles was burned down) or Nagasaki (where the valley geography meant that only 1.8 square miles burned down). These data come from the U.S. Strategic Bombing Survey report, *The Effects of Atomic Bombs at Hiroshima and Nagasaki,* 1946.

THE BOMBING OF HAMBURG AND HOW THE FIRESTORM WAS PRODUCED

London was bombed in 1940 by about 200 aircraft for 61 consecutive nights. Prime Minister Winston Churchill wrote in September 1940 that ‘The bombers alone will provide the means of victory’, but in August 1941 an analysis of British night-time bombing raids showed that only 10-33 % of British bombers dropped their bombs within 8 km of their targets, the lower (10 %) figure being due to heavy anti-aircraft artillery in Ruhr. In conclusion, it was decided that precision attacks on small targets by bombers were a waste of time, and cities would be targeted instead. Arthur Harris became chief of bomber command on 25 February 1942 and wanted to accumulate a vast number of aircraft and to pound Germany’s capital city, Berlin, into submission. In a filmed statement, Harris said: ‘There are a lot of people who say that bombing can never win a war. My answer to that is: it has never been tried yet, and we shall see.’

However, Churchill rejected Harris' demand to concentrate on Berlin. Churchill then nick-named Harris 'Bomber' (Arthur 'Bomber' Harris) and personally instructed him to bomb other German cities, such as Dresden, to support the Russian attack on Germany. On 14 February 1942, bomber command had received a directive stating: 'the primary object of your operations should now be focussed on the morale of the enemy civil population and in particular, of the industrial workers.'

George R. Stanbury, the Home Office scientist who conducted Civil Defence research int fallout protection at Monte Bello for *Operation HURRICANE,* Britain's first nuclear test in 1952, explains in detail how the Hamburg firestorm was produced in his originally restricted article, 'The Fire Hazard from Nuclear Weapons', *Fission Fragments,* Scientific Civil Defence Magazine, Home Office, London, No. 3, August 1962, pp. 22-6, British Home Office, Scientific Adviser's Branch, originally classified Restricted:

Above: effect of the Hamburg firestorm.

'We have often been accused of underestimating the fire situation ... we are unrepentant in spite of the television utterances of renowned academic scientists who know little about fire. ... Firstly ... the collapse of buildings would snuff out any incipient fires. Air cannot get into a pile of rubble, 80% of which is incombustible anyway. This is not just guesswork; it is the result of a very complete study of some 1,600 flying bomb [V1 cruise missile] incidents in London supported by a wealth of experience gained generally in the last war. Secondly, there is a considerable degree of shielding of one building by another in general. Thirdly, even when the windows of a building can "see" the fireball, and something inside is ignited, it by no means follows that a continuing and destructive fire will develop. ... A window of two square metres would let in about 10^5 calories at the 5 cal/cm^2 range. The heat liberated by one magnesium incendiary bomb is 30 times this and even with the incendiary bomb the chance of a continuing fire developing in a small room is only 1 in 5; in a large room it is very much less. Thus even if thermal radiation does fall on easily inflammable material which ignites, the chance of a continuing fire developing is still quite small. In the Birmingham and Liverpool studies, where the most generous values of fire-starting chances were used, the fraction of buildings set on fire was rarely higher than 1 in 20.

ABOVE: the heat flash radiation which causes the scorching is so unscattered or unidirectional that any shading from the fireball source stops it even if you are exposed to the scattered radiation from the rest of the sky: shadows still present in October 1945 in the bitumen road surface of Yorozuyo Bridge, 805 m SSW of ground zero, Hiroshima, pointed where the bomb detonated (U.S. Army photo).

'And this is the basis of the assertion that we do not think that fire storms are likely to be started in British cities by nuclear explosions, because in each of the five raids in which fire storms occurred (four on Germany - Hamburg, Darmstadt, Kassel, Wuppertal and a "possible" in Dresden, plus Hiroshima in Japan - it may be significant that all these towns had a period of hot dry weather before the raid) the initial fire density was much nearer 1 in 2. Take Hamburg for example:

'On the night of 27/28th July 1943, by some extraordinary chance, 190 tons of bombs were dropped into one square mile of Hamburg. This square mile contained 6,000 buildings, many of which were [multistorey wooden] medieval.

'A density of greater than 70 tons/sq. mile had not been achieved before even in some of the major fire raids, and was only exceeded on a few occasions subsequently. The effect of these bombs is best shown in the following diagram, each step of which is based on sound trials and operational experience of the weapons concerned.

'102 tons of high explosive bombs dropped -> 100 fires
'88 tons of incendiary bombs dropped, of which:
'48 tons of 4 pound magnesium bombs = 27,000 bombs -> 8,000 hit buildings -> 1,600 fires
'40 tons of 30 pound gel bombs = 3,000 bombs -> 900 hit buildings -> 800 fires
'Total = 2,500 fires

'Thus almost every other building [1 in 2 buildings] was set on fire during the raid itself, and when this happens it seems that nothing can prevent the fires from joining together, engulfing the whole area and producing a fire storm (over Hamburg the column of smoke, observed from aircraft, was 1.5 miles in diameter at its base and 13,000 feet high; eyewitnesses on the ground reported that trees were uprooted by the inrushing air).

'When the density was 70 tons/square mile or less the proportion of buildings fired during the raid was about 1 in 8 or less and under these circumstances, although extensive areas were burned out, the situation was controlled, escape routes were kept open and there was no fire storm.'

Often people point to bits of glass melted by the firestorm in Hiroshima, and ignorantly claim it was a special effect of nuclear weapons. Alas, such melted glass occurred in the GreatFire of London, 1666, and it didn't need a nuclear explosion:

'Having stayed, and in an hour's time seen the fire rage every way, and nobody, to my sight, endeavouring to quench it, but to remove their goods, and leave all to the fire; and, having seen it get as far as the Steelyard, and the wind mighty high, and driving it into the City; and everything, after so long a drought, proving combustible... So near the fire as we could for smoke; and all over the Thames, with one's face in the wind, you were almost burned with a shower of fire-drops... took up, which I keep by me, a piece of glass of Mercers' chapel in the street, where much more was, so melted and buckled with the heat of the fire like parchment.' – Samuel Pepys (1633-1703), Great Fire of London, *Diary,* September 1666.

The Hamburg air raid be compared directly to the eventual policy of the U.S.A.F. bombers that were attacking Japan. The man who would pilot the nuclear bomber to Hiroshima, Paul Tibbets, who had been in Europe, advised General C. E. LeMay 'many Japanese buildings were constructed of flammable material. Paper houses, we called them. "All you need to do is 'area bomb' these cities [using incendiaries]," I said.' [P. W. Tibbets, *The Tibbets Story,* Stein & Day, 1978.]

LeMay took Tibbet's advice and in his 1965 book (*Mission with LeMay,* Doublesday) explained why this was acceptable in World War II: 'It was their system of dispersal of industry. All you had to do was visit one of those targets after we'd roasted it, and see the ruins of a multitude of tiny houses, with a drill press sticking up through the wreckage of every home. The entire population got into the act and worked to make those airplanes or munitions of war ... men, women, children.'

After the single Tokyo air raid killed 83,600 people on 10 March 1945, Dr Robert Oppenheimer predicted that a nuclear air raid at night (people indoors) would kill 20,000 people. Oppenheimer wanted the attack done at night to prevent women and children receiving flash burns in the daytime. He received a very cold reception from people like LeMay, owing to the insignificance relative to conventional air raids. Oppenheimer then began to sell the nuclear bomb as a thermal and nuclear radiation killer, instead of a blast device to be used at night.

Colonel Paul Tibbets was instructed by LeMay to ignore Oppenheimer's wish and only to drop the bombs in the daytime visually to prevent the risk of a serious radar aiming error. He maximised casualties by minimising warning (although this was done for the deliberate purpose of minimising the risk of serious anti-aircraft gun attacks on the bombing aircraft): for weeks before dropping the bombs, the cities that had been carefully spared incendiaries were daily flown over by weather and photographic aircraft. This was to prevent surprise when the plane carrying the bomb appeared. Tibbets recorded in his autobiography that this 'would accustom the Japanese to seeing daytime flights of two or three bombers over their target ... we hoped they would be lulled into ignoring us, when we came to deliver the real thing ... air raid sirens would sound when we came overhead.'

This 'lulling' meant that many people outside would merely watch the planes without taking shelter, and receive serious facial burns and direct exposure to other effects. Nobody was vaporised; the skin burns were deep enough near ground zero to be lethal in combination with the nuclear radiation exposure. In the case of Hiroshima, the weather survey aircraft caused a night time air raid, and a final weather aircraft ahead of the nuclear bomber set off air raid alarms at 7:30 am (cancelled by an all clear at 8 am), before the nuclear armed bomber arrived at 8:15 am. Mrs Nakamuru, a widow with three children had only just arrived back home after the 'all clear' from the weather aircraft-caused alarm, as described by John Hersey in his 1946 book *Hiroshima:*

'They reached home a little after 2:30 am and she immediately turned on the radio, which, to her distress, was just then broadcasting a fresh warning. When she looked at the children and saw how tired they were, and she thought of the number of trips they had made in the past weeks, all to no purpose, she decided that inspite of the instructions on the radio, she simply could not face starting out all over again.' When the all clear sounded at 8 am, she lit her stove and started cooking rice. She was in a wood frame house 1,230 metres from ground zero: 'everything flashed whiter than any white she had ever seen. She had taken a single step when something picked her up and she seemed to fly into the next room over the raised sleeping platform, pursued by parts of her house ...' Others were burned when they looked up at the B-29 and received facial flash burns, some behind windows which resulted in glass fragment lacerations in addition.

Tibbets remarked in his autobiography, *The Tibbets Story:* 'Of course, one hopes that civilians will have the good sense to seek protection in bomb shelters.' If so, there would have been far fewer casualties, and less impact, and Tibbets admitted: 'In the case of Hiroshima, I was to learn later that Eatherly's weather plane ... had set off air raid sirens but, when nothing happened, ours were ignored.' The Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan, *Medical Effects of the Atomic Bomb in Japan* (Oughterson and Warren, editors, McGraw-Hill, New York, 1956), found 'there only about 400 people in the tunnel shelters [Nagasaki] which had a capacity of 70,000' and that such people survived 'even directly below the bomb.' Describing the situation in Hiroshima, it stated:

'Most of the people were at home preparing breakfast; consequently thousands of fires were burning in charcoal braziers. Only a few people were in modern buildings.'

DR HAROLD L. BRODE AND FIRESTORM ERRORS IN LYNN EDEN'S BOOK, 'WHOLE WORLD ON FIRE'

'At a range of more than 1 nautical mile [= 6,076 feet = 1,851 m = 1.15 statute mile], more than half the buildings [in Hiroshima] were gutted by fire. At that point, the peak overpressure of the nuclear blast wave was about 3 psi, and the fireball heat or thermal fluence was about 8 or 9 cal/cm^2.'

- Dr Harold L. Brode and Dr R. D. Small, *A Review of the Physics of Large Urban Fires,* in *The Medical Implications of Nuclear War,* U.S. National Academy Press, 1986, page 79.

This correlation of thermal radiation to the firestorm radius is totally bogus, because no fires at that radius were ignited by thermal radiation! Some 100% of house fires at that radius were *ignited by the blast wave overturning charcoal cooking braziers inside wooden houses filled with paper screens and bamboo furnishings.* Dr Brode and Dr Small might as well have correlated the radius of the firestorm to the EMP field or to the mushroom cloud radius, for all the relation that there was between thermal radiation and the firestorm radius in Hiroshima. They neglected the physical mechanism entirely, and practised the worst form of pseudoscience.

Brode on page 84 states that 'Threshold ignition levels ... for common susceptible materials in an urban environment increase with yield roughly as ... $3.5W_{kt}^{0.113}$ cal/cm^2. This gives 9 cal/cm^2 for 5 Mt, when as we have seen it actually takes four times more energy to ignite beds and upholstry in a sustained way which won't be blown out by the blast or die out without spreading to the rest of the room, *even when the window can 'see' the fireball:*

'About 35 to 40 calories per square centimetre are required for ignition by a 5-Mt weapon.' - ***DPA Attack Environment Manual: Chapter 3, What the Planner Needs to Know about Fire Ignition and Spread,* U.S. Department of Defense, report CPG 2-1A3, June 1973, Panels 3 and 5.**

Lynn Eden, who had numerous interviews and discussions with Dr Brode since the late 1980s, is also duped entirely by this outrageous anti-civil defence lie in her 2004 book *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation,* where she writes on page 120:

'At Hiroshima, the perimeter of mass fire ... occurred about one mile from the detonation ... at this distance, the thermal fluence deposited was estimated at 10 cal/cm^2 ... The deposition of thermal fluence of 10 cal/cm^2 is the basic measure used in much of Theodore Poston's published work on fire damage ...'

Theodore Poston in his ignorant paper 'Possible Fatalities from Superfires following Nuclear Attacks in or Near Urban Areas', in the 1986 U.S. National Academy of Sciences book *The Medical Implications of Nuclear War,* assumes falsely that brick and concrete cities can burn like the small areas of medieval German cities and like Brode and Small, he simply ignores the mechanism for the firestorm in Hiroshima which had nothing to do with thermal radiation but was just due to overturned breakfast charcoal braziers. Theodore Poston also falsely complains that wooden houses exposed to nuclear tests didn't burn because they had white paint on them and shutters over the windows. *That discredits Theodore Poston's whole anti-civil defence countermeasure tirade by actually PROVING the value of simple civil defense; but actually if you open your eyes, you find that most wooden houses are painted white, and in a real city - unlike the empty Nevada desert - few windows will have a line of sight to the fireball anyway!*

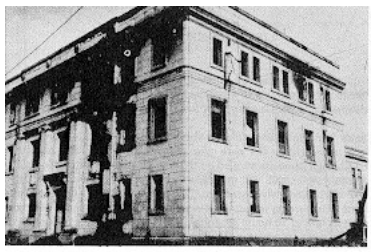
The pseudoscientific fanatical thuggery against civil defence countermeasures to nuclear terrorism must be deplored. (Another basic scientific error Lynn makes is trying to use firestorm data from incendiary phosphorus bombing in humid weather to discredit the fact that thermal ignition depends on humidity! *Unlike nuclear weapons thermal radiation which demands dry tindering to cause ignition,* phosphorus is actually ignited by water! You must never pour water on a phosphorus bomb, or it will flare up. Ignorance of such basic chemistry is lethal.)

Brode and Small make the worst error of all when they state on page 94: 'Despite a well-organized German civil defense, firefighting, rescue operations, and emergency medical aid were severely limited in many of the fires and totally ineffective in the intense fire storms.'

They incorrectly ignores all the evidence that the civil defence operations were hampered by the extended period of air raid bombing, which did not occur at Hiroshima or Nagasaki where only a single bomb was dropped. They ignorantly take no account or make any mention whatsoever of all the studies done on the efficient, extremely easy and effective firefighting that readily saved buildings near Hiroshima's ground zero, well within the firestorm area, reported by the U.S. Strategic Bombing Survey. For example, the Bank of Japan, Hiroshima branch, was a 3-story reinforced concrete frame building at just 400 m from ground zero. There were no initial ignitions at all by either blast or thermal radiation. However, 1.5 hours afterwards a a firebrand started a fire in a room on the second floor. The survivors in the building simply extinguished the fire with buckets of water! Duh! Hiroshima in the very middle of the intense fire storm?! Buckets of water? Yes. They simply put the fire out. Later another firebrand ignited the third floor, and the survivors this time ran out of water and just shut the doors and allowed it to burn out. The fire did not spread to the lower floors.

This incident is explained in **panel 26 of the *DPA Attack Environment Manual: Chapter 3, What the Planner Needs to Know about Fire Ignition and Spread,* U.S. Department of Defense, report CPG 2-1A3, June 1973**, which adds that the Geibi Bank Company in the firestorm area of Hiroshima also survived the bomb with no thermal or blast ignitions: 'However, at about 10:30 A.M., over 2 hours after the detonation, firebrands from the south exposure ignited a few pieces of furniture and curtains on the first and third stories. The fires were extinguished with water buckets by the building occupants. Negligible fire damage resulted.'

It is either incompetent or else dishonest of Dr Harold L. Brode and Dr R. D. Small to try to discredit civil defense countermeasures against firestorms in nuclear attack by giving the false example of German bombing raids and totally ignoring the experiences of the Hiroshima firestorm to nuclear warfare (below).



Bank of Japan, Hiroshima branch, was a 3-story reinforced concrete frame building at 400 m from ground zero. Because the bomb detonated almost directly overhead, there were no initial ignitions at all by either blast or thermal radiation. However, 1.5 hours afterwards a a firebrand started a fire in a room on the second floor. The survivors in the building simply extinguished the fire with buckets of water! Duh! Hiroshima in the very middle of the intense fire storm?! Buckets of water? Yes. They simply put the fire out. Later another firebrand ignited the third floor, and the survivors this time ran out of water and just shut the doors and allowed it to burn out. The fire did not spread to the lower floors.

BANK OF JAPAN BUILDING AFTER ATTACK ON HIROSHIMA

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GEIBI BANK CO. BUILDING AFTER ATTACK ON HIROSHIMA

Britain's Prime Minister from 1946-51, Clement Attlee, had secretly ordered Dr Penney to begin producing a nuclear weapon in January 1947. In February 1948, Czechoslovakia was seized by the Soviet Union, just as it had been by the Nazis a decade before. In 1949, the year the Soviets exploded their first nuclear weapon, Dr Penney's secret *Symposium on the Physical Effects of Atomic Weapons* had been held at Britain's Atomic Research Establishment.

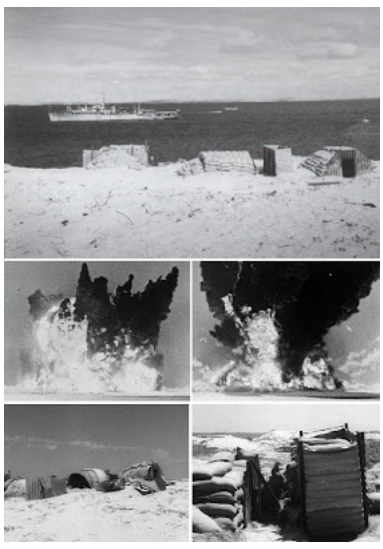
The furthest that Prime Minister Attlee would go towards openly supporting civil defence was to personally censor the vague Home Office pamphlet called *Atomic Warfare* in June 1950 (the month that the Korean War broke out), adding his own political Foreword by the Prime Minister to the pamphlet, stating:

'Although nearly two years ago nine out of the eleven members of the United Nations Atomic Energy Commission agreed on what they considered to be a really effective plan for the control of atomic energy, and although this plan was subsequently approved by the overwhelming majority of the General Assembly of the United Nations, the Soviet Union has so far refused to accept it, and has instead put forward counter-proposals which were rejected in the Commission by a nine to two vote on the ground that they did not provide an adequate basis for effective international control… we must proceed with our Civil Defence preparations on the basis that, in the event of war, we might be subjected to atomic attack, and with the object of minimising the casualties which must inevitably accompany such an attack.'

In 1951, Winston Churchill was re-elected as Prime Minister after a national newspaper (the Daily Mirror) front page headline asked this question on 25 October (General Election day): 'Whose finger do you want on the trigger when the world situation is so delicate?'

Churchill was then surprised to learn that Attlee had secretly spent £100 million of Britain's money developing nuclear weapons. It is extremely important from the nuclear proliferation standpoint to emphasise this: Britain, *a relatively democratic nation,* **clandestinely developed nuclear weapons,** only admitting it when the bomb production was well advanced!

Then Churchill authorised Britain's civil defence nuclear effects test, 25 kiloton *Hurricane,* fired at Monte Bello in the ship H.M.S. Plym on 3 October 1952. **The photograph of Anderson back-garden air raid shelters on an island with the bomb ship in the sea directly behind (before the explosion), and another photograph showing the shelters still safe but the ship blown to pieces, were classified secret**.



Above: All that happened to the Anderson shelters 400 yards from the 25 kt Hurricane nuclear test on 3 October 1952 was that a few sand bags were blown off by the arrival of the blast wave, but by that time the initial nuclear radiation and thermal radiation pulses were

already over, so the sandbags had shielded the radiation. Frank H. Pavry, who as part of the British Mission to Japan had observed the surviving air raid shelters near ground zero in both Hiroshima and Nagasaki in 1945, organized the construction of 15 Anderson shelters. In World War II, two types of shelters were issued by the U.K. government to householders: the **'Morrison' (a steel table designed to resist the debris load from the collapse of a house, which was introduced in March 1941 and named after the Home Secretary, Herbert Morrison),** and the **'Anderson' which was an outdoor shelter supplied to 2,100,000 householders (a 14-gauge corrugated steel arch shelter, 2 m long, 1.4 m wide and 1.8 m high, designed to accommodate 6 people and to be sunk to 1.2 metre depth and covered by at least 40 cm of earth; it was invented in 1938 and named after Sir John Anderson, who was in charge of U.K. Air Raid Precautions/Civil Defence).**

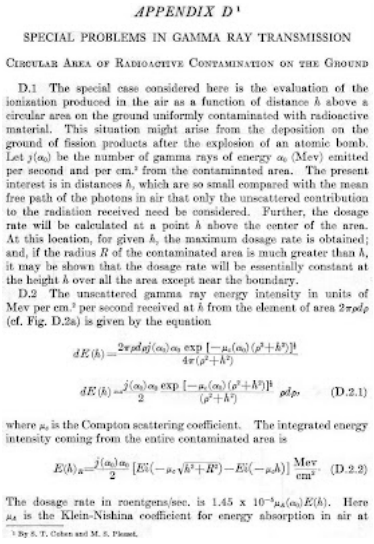
Frank H. Pavry's report, *Operation HURRICANE: Anderson Shelters, Atomic Weapons* Research Establishment, AWRE-T17/54, was originally classified 'Secret - Atomic'. The 15 Anderson shelters had survived very well. Nearest to the bomb ship, they survived a peak overpressure of 55 psi or 380 kPa without internal damage: sand bags on the outside were hurled off when the blast wave arrived, but by that time they had done their job of shielding the initial neutron and gamma radiation. (They could have been replaced before fallout arrived.) At a peak overpressure of 12 psi or 83 kPa, even the sandbags on the outside remained intact. (Pavry had used sand bags instead of the recommended packed earth as a convenience.)

This rightly gave conviction to the British Home Office civil defence effects team. The bomb ship HMS Plym, can be seen moored in 40 feet of water 400 yards off Trimouille Island, Monte Bello group. **The public information film on Operation Hurricane states**: 'At Montebello the advance party is already at work: 200 Royal Engineers had arrived in April to find an empty wilderness of salt, bush and spinifex ... Within the danger zone they erected the familiar [World War II British civilian] Anderson shelters, well-protected by sandbags ... These tests would influence the pattern of civil defence against some future atomic attack. ... On shore, they find many of the Anderson shelters have survived the ordeal remarkably well – better than some of the concrete-block houses.' (The full report on the Anderson shelters exposed at Operation Hurricane is **'Operation Hurricane: Anderson Shelters', Atomic Weapons Research Establishment, Aldermaston, report AWRE-T17/54, 1954, UK National Archives** reference **ES 5/19** and also duplicated at DEFE 16/933. See also 'Penetration of the gamma flash into Anderson shelters and concrete cubicles', AWRE-T20/54, 1954, UK National Archives ref ES 5/22 duplicated at DEFE 16/935.) For more about British civil defence nuclear weapons effects testing programme, and the influences of Glasstone's 1957 book and Dolan's 1974 NATO version of *Capabilities of Nuclear Weapons*, see **this post**.)

Overall lifesaving civil defence effectiveness in Britain and Germany during World War II

German bombing damaged or destroyed 2 million houses in Britain during World War II, but the 60,595 people killed from bombing in Britain was 0.030 persons killed per house destroyed or damaged. In London alone, 1,200,000 houses were damaged or destroyed, and 29,890 were killed by bombing, 0.025 persons killed per house destroyed or damaged. Without civil defence, the ratio of the number of people killed per house destroyed could have been much greater than 0.025-0.030. Assuming just 2 persons per house, this means that the assumption of 100% killed per damaged or destroyed house exaggerates deaths from bombing by a factor of 2/0.025 to 2/0.030 or 67 to 80.

In Germany, where there were firestorms in medieval wooden areas of Dresden and Hamburg, 300,000 people were killed and 3,600,000 houses were destroyed, a ratio of 0.083 persons killed per house destroyed. 7,500,000 people were made homeless, so there had been roughly 2 persons living in each house destroyed. Hence, the assumption of 100% killed in destroyed houses would exaggerate deaths by a factor of 2/0.083 = 24 times.



APPENDIX D[1]

SPECIAL PROBLEMS IN GAMMA RAY TRANSMISSION

CIRCULAR AREA OF RADIOACTIVE CONTAMINATION ON THE GROUND

D.1 The special case considered here is the evaluation of the ionization produced in the air as a function of distance h above a circular area on the ground uniformly contaminated with radioactive material. This situation might arise from the deposition on the ground of fission products after the explosion of an atomic bomb. Let $j(\alpha_0)$ be the number of gamma rays of energy α_0 (Mev) emitted per second and per cm.^{2} from the contaminated area. The present interest is in distances h, which are so small compared with the mean free path of the photons in air that only the unscattered contribution to the radiation received need be considered. Further, the dosage rate will be calculated at a point h above the center of the area. At this location, for given h, the maximum dosage rate is obtained; and, if the radius R of the contaminated area is much greater than h, it may be shown that the dosage rate will be essentially constant at the height h over all the area except near the boundary.

D.2 The unscattered gamma ray energy intensity in units of Mev per cm.^{2} per second received at h from the element of area $2\pi\rho d\rho$ (cf. Fig. D.2a) is given by the equation

$$dE(h) = \frac{2\pi\rho d\rho j(\alpha_0)\alpha_0 \exp\left[-\mu_a(\alpha_0)(\rho^2+h^2)\right]^{\frac{1}{2}}}{4\pi(\rho^2+h^2)}$$

$$dE(h) = \frac{j(\alpha_0)\alpha_0}{2} \frac{\exp\left[-\mu_a(\alpha_0)(\rho^2+h^2)\right]^{\frac{1}{2}}}{(\rho^2+h^2)} \rho d\rho, \quad \text{(D.2.1)}$$

where μ_a is the Compton scattering coefficient. The integrated energy intensity coming from the entire contaminated area is

$$E(h)_R = \frac{j(\alpha_0)\alpha_0}{2}\left[E_1(-\mu_a\sqrt{h^2+R^2}) - E_1(-\mu_a h)\right] \frac{\text{Mev}}{\text{cm}^2} \quad \text{(D.2.2)}$$

The dosage rate in roentgens/sec. is $1.45 \times 10^{-5}\mu_{ak}(\alpha_0)E(h)$. Here μ_{ak} is the Klein-Nishina coefficient for energy absorption in air at

[1] By S. T. Cohen and M. S. Plamet.

Above: Samuel Cohen's calculation of the gamma dose rate from deposited fallout formed Appendix D of Glasstone's 1950 *Effects of Atomic Weapons*. Cohen also contributed the analysis of dose rates to aircraft flying inside the mushroom cloud at various times after detonation. In his fallout calculations (Appendix D), Cohen ignored air scattered gamma ray contributions and just summed the direct gamma ray contributions from a smooth plane. It turned out that this approximation gave results which are accurate for typical *rough* ground if scattered gamma rays are included. For a smooth, infinite, uniformly contaminated surface including the contribution from air scattered gamma rays, 50% of the dose rate at 1 metre height comes from fallout within a 15 metres radius; for Cohen's approximation (ignoring air scatter) this radius is only 8 metres which is about the same as for rough terrain (where the terrain absorbs some of the radiation, particularly from great distances) where air scatter *is included*.

While he did not discuss Dr Samuel T. Cohen's neutron bomb in *The Effects of Nuclear Weapons,* Glasstone in an article called 'Nuclear Weapons' for *Microsoft's Encarta 97* critically argued that 95 % clean neutron bombs are the way forward, to totally avoid collateral damage in nuclear war (published by Microsoft Corporation in the Microsoft Encarta 97 Encyclopaedia CD-ROM, 1997):

> 'If an H-bomb were made with no uranium jacket but with a fission trigger ... as little as 5 percent of the total explosive force might result from fission; the weapon would thus be 95 percent clean. The enhanced radiation fusion bomb, also called the neutron bomb, which has been tested by the United States and other nuclear powers ... is considered a tactical weapon because it can do serious damage on the battlefield [assuming a 1-kt air burst at 500 m altitude], penetrating tanks and other armoured vehicles and causing death or serious injury to exposed individuals, without producing the radioactive fallout that endangers people or structures miles away.'

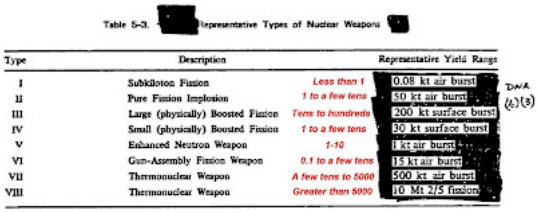


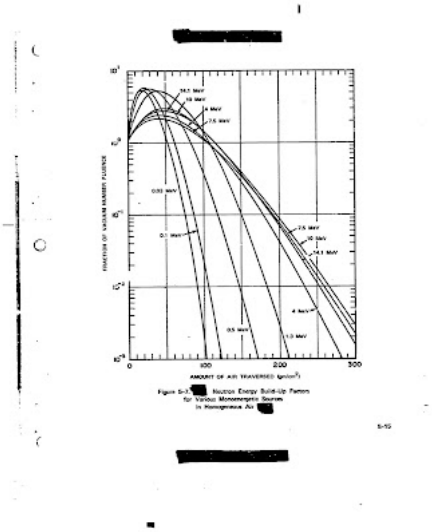
Table 5-3. [redacted] Representative Types of Nuclear Weapons [redacted]

Type	Description		Representative Yield Range
I	Subkiloton Fission	Less than 1	0.08 kt air burst
II	Pure Fusion Implosion	1 to a few tens	50 kt air burst
III	Large (physically) Boosted Fission	Tens to hundreds	200 kt surface burst
IV	Small (physically) Boosted Fission	1 to a few tens	30 kt surface burst
V	Enhanced Neutron Weapon	1-10	1 kt air burst
VI	Gun-Assembly Fission Weapon	0.1 to a few tens	15 kt air burst
VII	Thermonuclear Weapon	A few tens to 5000	500 kt air burst
VIII	Thermonuclear Weapon	Greater than 5000	10 Mt 2/5 fission

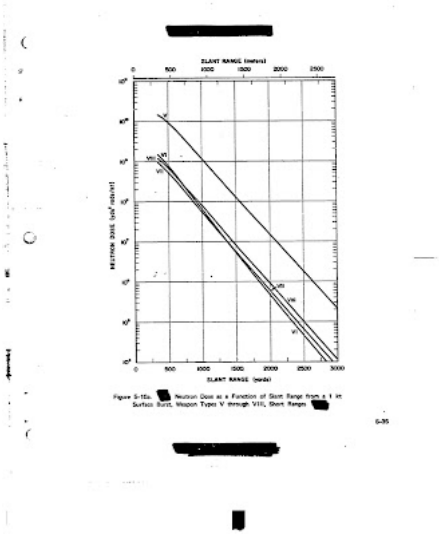
DNA (c)(3)

Above (click on images to enlarge): the neutron bomb is included under the title 'enhanced neutron weapon' in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**. The yield ranges for each category of nuclear weapon given are taken from the declassified initial nuclear radiation computer program 'Weapons Effects', which was developed in December 1984 by Horizons Technology, Inc., of California for the Defense Nuclear Agency; **some specific examples of yields and burst conditions are taken from some of the examples given in DNA-EM-1.** According to the ***Medical NBC Battlebook,* USACHPPM Tech Guide 244, May 2000, page 2-18**, a 3 kt enhanced neutron weapon with a fission yield of 50% (i.e. 5% of yield as residual radiation, which is a trivial effect for the burst height of the neutron bomb) will release 30% of its energy as blast (trivial for the 720 metres height of burst for tactical use of a 3 kt neutron bomb), 20% as thermal radiation (again, relatively trivial even near ground zero, due to yield and burst altitude), and 45% as inital nuclear radiation. These ratios will be altered for other fission yields. At very low yields, there is a problem with using a small fission primary to ignite the fusion stage in a Teller-Ulam device because the fraction of yield released as X-rays by a very low yield fission device is small (it depends strongly on the yield to mass ratio of the primary stage), thus the fusion stage ignition-efficiency due to X-ray ablation induced recoil falls. Most of the energy from a low yield primary stage is in a relatively slow moving (compared to light-velocity X-rays) debris hydrodynamic shock wave, that delivers energy to the fusion stage slowly and without efficient focussing. Fortunately, the neutron bomb is not concerned with maximising Teller-Ulam efficiency, but with producing a small yield with a maximised neutron output!

The basic mechanism of the neutron bomb was discovered by Samuel Cohen of RAND Corporation in 1958 when studying the neutron outputs from two Lawrence Livermore National Laboratory clean (low fission) bomb designs (Dove and Starling) of low yield devices for peaceful explosive uses like excavating harbours, canals, and mountain passes, and is simply that the case thickness needed by a Teller-Ulam device to channel X-rays from primary to secondary scaled as the cube root of the total yield. Hence the casing required is 10 times thicker for 1 Mt than for 1 kt, so in a 1 kt Teller-Ulam device, most of the neutrons can escape from the thin casing, while in a 1 Mt Teller-Ulam device the neutrons are mostly absorbed because of the much thicker casing required. Thus neutron bombs have a yield range of 1-10 kilotons, with fission yield varying from 50% at 1-kiloton to 25% at 10-kilotons (all of which comes from the primary stage). The neutron output per kiloton is 10-15 times greater than for a pure fission implosion weapon.



Above: neutron attenuation in air according to energy, in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision** (the simple geometric inverse square law of divergence of neutrons from a point source isn't included in the shielding curves above). Notice that over small distances in the air, the neutron fluence is higher than in a vacuum, because there is little attenuation by air over a short distance, but you get an additional large neutron dose from neutrons being scattered *back at you* which have gone past (and also through) you, and have then been scattered *back at you,* by large number of nuclei which are obviously located at greater distances (beyond your distance from the detonation!). *This is also why tanks can't be protected with a relatively light weight shield on top of the crew compartment, as we shall see later on: it is not possible to protect tanks existing against neutron radiation without adding so much mass the turret would be retarded and the performance of the tank would be crippled. A tank designed to properly protect its crew against 14.1 MeV neutron bomb neutrons and with a big enough engine to perform reasonably well, would be so heavy it would be swallowed up by the earth and simply disappear into soft ground, being rendered useless (the shielding of 14.1 MeV neutrons has nothing to do - either in mechanism or in amount of shielding - with the easy-to-shield thermalized 0.025 eV neutrons by cadmium control rods in a nuclear reactor).*



Above: neutron bomb doses compared to other weapons, in Philip J. Dolan's originally secret manual *Capabilities of Nuclear Weapons*, DNA-EM-1, U.S. Department of Defense, **Chapter 5, *Nuclear Radiation Phenomena*, August 1981 revision**.

The enhanced neutron weapon or 'neutron bomb' is just a relatively clean very low yield two stage Teller-Ulam device; the low total yield means that only a very thin steel casing is required to reflect X-rays from the fission primary on to the fusion secondary stage. The thin casing of such a weapon ensures that most of the 17.6 MeV fusion energy from deuterium and tritium fusion into helium-4 escapes as neutrons: 80% of the energy is carried by neutrons, and 20% is carried by the helium-4 nucleus or alpha particle. This suppresses the amount of energy available for producing the blast and thermal radiation effects.

The primary strategic uses of clean, low fission yield enhanced neutron warheads are:

(1) to avert EMP collateral damage (due to low fission yield and low total yield) for ABM missiles by using the neutron output to melt and destroy plutonium cores in incoming ICBMs (neutrons have a long range in space);

(2) to deter massed tank attacks in cities or close to friendly forces. The deterrent here is the fact that neutron irradiated tank crews would be disabled within minutes and dead within hours to days; and

(3) to deter warship assaults by the threat of putting them out of action without nearby collateral damage or fallout.

Steel armour is resistant to blast and heat, but provides little shielding against fast fusion neutrons. The well-known neutron absorbers used in nuclear reactor control rods are little use against neutron bomb radiation, because they are good absorbers of 0.025 eV 'thermalized' neutrons in a nuclear reactor with a moderator, but useless against the 14.1 MeV neutrons from neutron bomb fusion, which have 560 million times more energy than thermal neutrons. Heavier armor, like that of the M-1 tank, employs depleted uranium which (although it is not significantly fissioned by low-energy thermal neutrons) actually increases the effectiveness of neutron radiation because it undergoes fission when hit by the 14.1 MeV high energy neutrons from neutron bomb, generating additional neutrons and becoming radioactive.

Because the blast and heat are suppressed in the neutron bomb, they have a similar damaging range to the lethal neutron radiation, so there is no collateral damage outside the target area. In some cases, a few broken windows can occur at greater distances, but there is no risk of dangerous blast-wind accelerated glass fragments, because the blast winds are trivial outside the neutron irradiate area.

Provided that the weapon was not used in a thunderstorm, no fallout effects would occur from the use of a neutron bomb, as the combination of 500 m burst altitude and low yield prevents fallout in addition to significant thermal and blast effects. The reduction in damage outside the target area is a major advantage of such a weapon to deter massed tank invasions. An aggressor would thus be forced to disperse tanks, which would make them easier to destroy by simple hand-held anti-tank missile launchers.

In 1979, Samuel Cohen was in Paris helping the French build neutron bombs, when presidential candidate Ronald Reagan came through on a European tour. Cohen met with Reagan to brief him on the neutron bomb. Reagan grasped the idea of neutron weaponry immediately, and made a pledge to Cohen that he would reverse Carter administration policy by building and deploying neutron bombs.

Sam Cohen's book, ***The Truth About the Neutron Bomb: the Inventor of the Bomb Speaks Out,* William Morrow and Co., New York, 1983**, on page 48 states that he referred to the two 1958 Lawrence Livermore National Laboratory **clean (low fission)** enhanced neutron **Plowshare (peaceful explosives) devices** by their code names Dove and Starling:

'The first time I recall seeing the term "neutron bomb" was in U.S. News and World Report. This was in May 1959, when the magazine revealed that the U.S. was working on a "neutron 'death ray' bomb which would kill man with streams of poisonous radiation, while leaving machines and buildings undamaged.'

Cohen adds in a footnote on that page that the neutron bomb: 'never did catch on at RAND, which was far more of a campus department than an objective think tank. ... However, I did find out that a good-looking blonde down the hall had expressed interest in hearing my briefing. ... some months later I married her.' On page 61 he explains: 'From the very beginning of the neutron bomb saga there has been one thing that particularly impressed - better yet, depressed - me about renowned American scientists. This is their ability to be impeccably careful and responsible when working in their fields of specilization (if they're not, their colleagues will catch them and even punish them) but their sloppiness and irresponsibility when giving their scientific opinion on nuclear weapons when they have an ideological bias against them, because they know that their colleagues, who share their bias, don't give a damn when they do this.'

Above: Cohen's comparison of the destruction he saw first-hand in Korea from conventional war (1950-3), with the nuclear destruction in Hiroshima. The only difference is that Hiroshima had mainly wooden houses which were burned down, whereas Seoul had more brick and concrete buildings. The Hiroshima photo was taken on 12 October 1945 (U.S. Army Photo #SC 290666); the Seoul photo was taken on 1 November 1950 (U.S. Army Photo #SC 352260).

In 1961, Cohen briefed President Kennedy's national security advisor McGeorge Bundy on the neutron bomb (***The Truth About the Neutron Bomb*, 1983, pp. 72-3**): 'His response was that if we had to use nuclear weapons to stop the Red Army from taking over Europe, he would favor hitting them with the biggest weapons we had. My riposte was: "On our allies' soil?" He didn't reply. ... He had gotten the point. That ended the meeting.' Consequently, President John F. Kennedy authorized the 1963 testing of the neutron bomb underground by Livermore scientists in the Nevada, which 'worked out extremely well' (page 83).

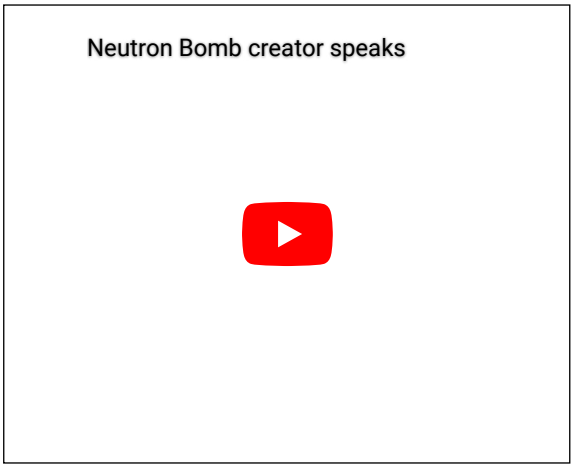
Soviet Premier Nikita Khrushchev fanatically denounced the discriminate neutron bomb in his speech to the Romanian Party Congress in Bucharest: 'More and more frequently now, we hear from statesmen and military leaders, particularly in the United States, that they are working toward the creation of a neutron bomb. ... They are acting on the principle of robbers wanting to kill a man in such a way that his suit will not be stained with blood, in order to appropriate the suit. ... the bestial ethics of the most aggressive representatives of imperialism. ... Man to them is nothing. For them the main thing is to plunder, a quest for profit which prods the imperialists to the most horrible crimes.'

Cohen prints a **Dunagin's people** satire from 1977, showing a politician ordering physicists to modify the neutron bomb to fit Khrushchev's alleged morality:

'There are strong moral objections to a bomb that kills but doesn't destroy buildings. Fix it so it destroys buildings, too.'

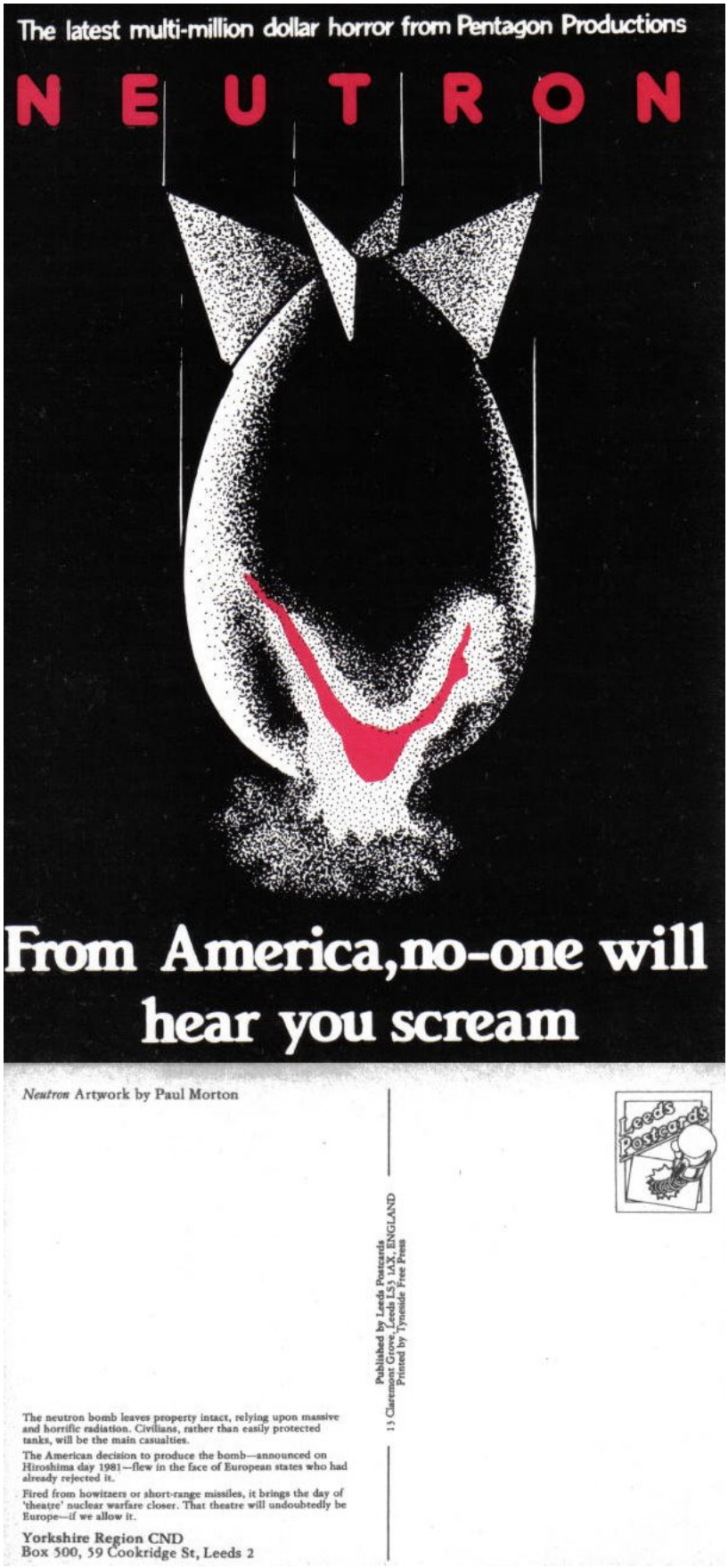
On pages 91-2, Cohen explains: 'A discriminate tactical nuclear weapon is one whose effects can be confined mainly to the military target, minimizing damage to non-combatants and their property. So neutron bombs, which are intended to kill enemy soldiers but spare civilians and their towns, are, by this definition, discriminate weapons. For example, had they been available in the Korean War [which Cohen saw first hand] for use against enemy soldiers fighting in the city of Seoul, their application would have represented a highly discriminate attack - far more so than was the attack that actually took place using conventional weapons, and which pretty well levelled the city.'

He was inspired to invent and promote the neutron bomb by the vast civilian casualties from collateral damage due to the conventional weapons he saw in Korea, and by the NATO 'Carte Blanche' exercise of 23-28 June 1955, which predicted that the 268 nuclear explosions over 3 days in Germany which would be needed to defend Western Europe from Warsaw Pact forces would kill 1,500,000 civilians, and injure a further 3,500,000. By using neutron bomb air bursts (500-1,000 m altitude for 1-10 kt yields), all of these civilian casualties could be avoided. There would be no significant fallout, and the small area of neutron induced activity at ground zero decays very rapidly, as in Hiroshima and Nagasaki. The uselessness of conventional defences to stop massed tank invasions was clearly demonstrated by the French anti-tank Maginot Line, which failed in World War II when Nazi tanks bypassed it and went through the Ardennes Forest to invade France.



On 12 July 1977, President Jimmy Carter publically announced the development of a neutron bomb to deter massed Soviet tank invasions of Western Europe because the Warsaw Pact had 25,000 tanks in Eastern Europe, ready for an invasion. Cohen on page 109 points out that President Reagan in 1981 stated that the Soviet Union responded by pumping over $100,000,000 into an anti-neutron bomb 'peace' propaganda campaign. Premier Leonid Brezhnev offered to refrain from building the neutron bomb if America agreed to do likewise! President Carter responded (Cohen, p. 111):

'The Soviets know and President Brezhnev knows that the neutron weapon is designed to be used against massive and perhaps overwhelming tank forces. ... The neutron weapons are designed to equalize that inequality. ... The Soviets have no use for a neutron weapon, so the offer by Brezhnev to refrain from building the neutron weapon has no significance in the European theatre and he knows this.'



But Carter chickened out when the Soviet anti-neutron bomb propaganda assault on the media commenced. Moscow radio was followed by 28 different European communist parties statements denouncing the neutron bomb as an immoral weapon, and the Soviet funded 'World Peace Council' (similar to Hitler's '25-year-peace plan' propaganda spin before World War II) called a week of international anti-neutron bomb action in August 1977, lying that the neutron bomb was designed to kill *civilians* and leave cities intact for American invasions and plunder. The pro-communist left-wing media of the West, plus the anti-nuclear biased groups, lapped it all up. Grigori Gokshin, Secretary of the 'Soviet Peace Committee' from 1973-91, conducted war on the neutron bomb through the media to protect the Soviet tank advantage in Europe!

'What's fair? You don't develop weapons to ruin our tanks; we don't build weapons to ruin our tanks'

The media pressure, including continuing bias from the BBC, which still falsely claims that *horrific fallout and collateral damage was a good thing because it allegedly increased deterrence* (in fact, collateral damage potential reduced deterrence by making the threat totally non-credible: as proved by the fact that the Soviets were so fearful of the neutron bomb but were *undeterred* by nuclear weapons which would produce collateral damage and amassed a tank superiority in the Warsaw Pact for a possible invasion of Western Europe precisely *because they knew that indiscriminate American weapons could not be used without millions of casualties, so that such indiscriminate threats had zero, nil, nada, zip credibility as a deterrent to war or aggression*), forced President Carter on 7 April 1978 to delay his decision to produce neutron warheads, and although he ordered the production of the *fusion capsules* for neutron bombs in October 1978, he continued to delay making a decision on the production of the *rest of the bomb!* (Cohen, page 115.) The next month, Premier Brezhnev responded to Carter's half-hearted decision by telling a group of U.S. senators visiting Moscow that 'many years ago, we tested but we never started production of that weapon'. They didn't want or need low yield anti-tank tactical weapons, because they were the ones with the 4-to-1 tank superiority in Europe! They didn't want or need low yield collateral-avoilding neutron bombs, because they didn't give a damn about civilian casualties and collateral damage. But Premier Brezhnev pretended that the reason they did not have neutron bombs was because they were morally superior!

Carter continued to postpone his decision on the neutron bomb. Undeterred, the Soviet Union in 1979 invaded Afghanistan with tanks in what many considered a forerunner to an invasion of Western Europe and the rest of the free world. *President Ronald Reagan was elected, and he ordered the production of 700 neutron bombs (350 nuclear 20-cm diameter shells for howitzers, and 350 W70 warheads for tactical Lance missiles) on 8 August 1981 to help to deter an invasion from the 19,500 Warsaw Pact tanks.* Responding on 8 March 1983 to the Soviet 'peace morality' propaganda, Reagan pleaded: 'I urge you to beware the temptation to label both sides "equally at fault", to ignore the facts of history and the aggressive impulses of an evil empire, to simply call the arms race a "giant misunderstanding", and thereby remove yourself from the struggle between right and wrong, and good and evil.'

The neutron bomb is efficient against massed tank invasions, thus an aggressor would be forced to disperse tanks; making them easy for troops to destroy or halt individually using simple hand-launched anti-tank rockets.

Dr Edward Teller and Dr Albert L. Latter were the first to suggest this solution on page 171 of their book *Our Nuclear Future: Facts, Dangers and Opportunities,* Criterion Books, New York, 1958:

'In a nuclear war it will not make sense to use massed manpower. Any such concentration will provide too good a target for atomic weapons. ...

'Any fighting unit in a nuclear war will have to be small, mobile, inconspicuous and capable of independent action. ...

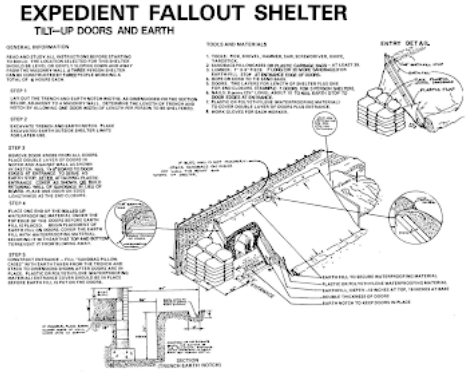
'If an invader adopts extreme dispersion, it will become impossible to defeat him with atomic weapons. But a very highly dispersed army can be defeated by a determined local population [with hand-held anti-tank rockets, etc.]. Therefore the main role of nuclear weapons might well be to disperse any striking force so that the resistance of people defending their homes can become decisive. Nuclear weapons may well become the answer to massed armies and may put back the power into the hands where we believe it belongs: the hands of the people.'

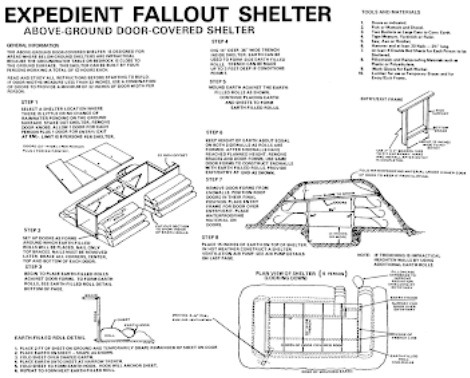
On page 135 of ***The Truth About the Neutron Bomb,* 1983,** Cohen stated that the neutron bomb is inefficient against cities with civilians because: 'All they have to do is **construct very simple radiation shelters and, as the eemy approaches, get into them. ... Because there is no blast to contend with ... all that is called for is piling several feet of earth over the shelter. And dirt is cheap.'** Earth slows down neutrons efficiently (removing neutron energy) because it contains a lot of light elements, but the heavy iron nuclei in steel tanks don't absorb much energy when they scatter neutrons around, so tanks only have a protective factor of about 2 against neutron radiation (tanks have a protection factor of 10 against initial high energy gamma rays, which are better attenuated by scattering the many electrons in iron atoms).

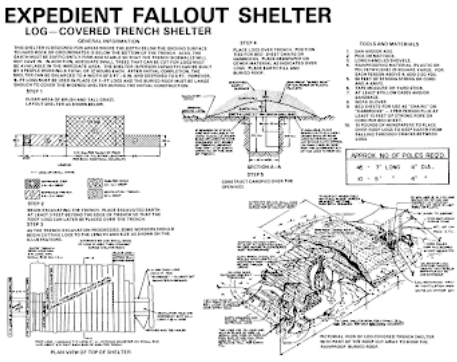
DOSE TRANSMISSION FACTORS FOR VARIOUS STRUCTURES

Structure	Initial Gamma Rays	Neutrons	Early fallout Gamma Rays
Three feet underground	0.002–0.004	0.002–0.01	0.0002
Frame House	0.8–1.0	0.3–0.8	0.3–0.6
Basement	0.1–0.6	0.1–0.8	0.05–0.1
Multistory building (apartment type):			
Upper stories	0.8–0.9	0.9–1.0	0.01
Lower stories	0.3–0.6	0.3–0.8	0.1
Concrete blockhouse shelter:			
9-in. walls	0.1–0.2	0.3–0.5	0.007–0.09
12-in. walls	0.05–0.1	0.2–0.4	0.001–0.03
24-in. walls	0.007–0.02	0.1–0.2	0.0001–0.002
Shelter, partly above grade:			
With 2 ft earth cover	0.03–0.07	0.02–0.08	0.005–0.02
With 3 ft earth cover	0.007–0.02	0.01–0.05	0.001–0.005

Effects of Nuclear Weapons, 3rd ed., 1977, pp. 349 and 441.







This is simple physics, but **chemist George Kistiakowsky** falsely claimed in MIT's *Technology Review* that 'A 10-cm (about 4 inches) layer of a suitable hydrogenous material, say water in plastic bags over the crew compartment, followed by a thin sheet of cadmium metal, would reduce neutron radiation intensity by about a factor of 5.' A factor of 5 reduction only reduces the neutron range by 15-20% because the dose drops off sharply with distance. But the factor of 5 calculation is false anyway, as Cohen explains on page 142, because the majority of the neutron dose is not coming straight down, but is coming from all directions due to the scatter of neutrons by the air, the ground around the tank, and the remainder of the tank itself! Kistiakowsky's stupidity is like trying to shield gamma radiation from fallout by wearing lead-soled shoes, in the mistaken belief that the hazard is due to fallout under your feet:

'Shielding a tank crew against neutrons is an enormously complicated problem. It is not solved by simply placing the shield over the crew compartment. By the time the neutrons reach the tank, they are bouncing around in all directions, and to protect the crew properly, the shielding will have to be placed around the sides of the crew compartment as well. As a consequence, the shielding weight begins to pile up: to a much greater level than Kistiakowsky realizes. ... The tank's mobility would be cut appreciably, as would the ability to swing the turret around to fire at acquired targets. In fact, were the tank to be shielded to a degree where the radiation was no longer the primary threat ... the added weight would cripple the tank's combat effectiveness.'

Another wild claim against the neutron bomb, made by Dr Herbert Scoville, Jr., which Cohen debunks (page 140), is that tank crews who are lethally irradiated will fight a 'Kamikaze' attack *even more efficiently that they were fighting before,* despite having radiation sickness. Cohen points out that they will not know exactly what their neutron dose is in a combat situation, and in any case the symptoms of radiation sickness will prevent their efficient execution of military functions.

Cancer and genetic effects are another hoax which was levelled against the neutron bomb: lethally irradiated people don't get cancer (as we shall see, Cohen shows that the effects of radiation sickness are no worse than other lethal combat injuries in modern conventional warfare due to organ damage, burns effects, and so on). In any case, no excess of genetic effects occurred in Hiroshima and Nagasaki as compared to a matched non-exposed control group. For all types of cancers, radiation has only contributed a small fraction of the cancer in survivors, most of which is natural cancer, as shown by comparison with the matched non-exposed control group. Claims that neutron bomb radiation is 'inhumane' ignore the comparison with the organ damage consequences by conventional nuclear weapons (as well as with conventional weapons, which rip organs to pieces, burn, crush and so on), and they ignore the primary purpose of the neutron bomb is to *deter* an aggressor.

Cohen further points out (pages 153-5) that two radiation accident victims who *survived* 400-600 cGy air doses (300-450 bone marrow doses): 'were back to normal some number of weeks [discharge from hospital at 2 and 6 weeks, respectively, and full recovery of strength at 10 weeks postexposure] after their accidents. They bore no scars from their mishaps (apparently not even emotional scars) and were able to pick up where they left off when they were irradiated. As to how these aftermaths compare with those resulting from being wounded by conventional weapons, if one so desires you can find out by visiting the nearest Veterans Administration hospital.'

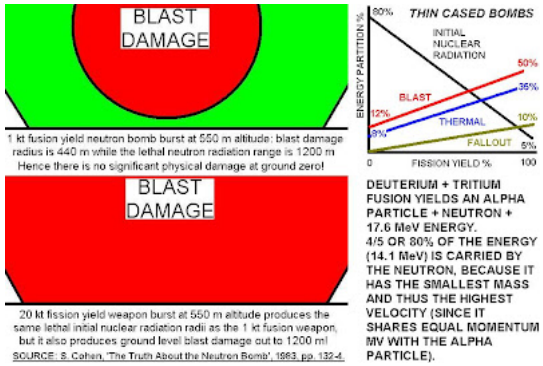
On 11 November 1981, the *Los Angeles Times* printed an article called 'Neutron Weapons: an Agonising Death (I've seen it)', by Professor J. Garrott Allen at Stanford University Medical School, falsely claiming that the death of Dr Louis Slotin 9 days after a criticality accident in May 1946 indicates the radiation effects of a neutron bomb: 'The production of neutron weapons is probably as immoral a concept as human minds have yet devised.' Cohen debunks Allen on pages 156-7: Dr Slotin was *touching a plutonium bomb core with his bare hands when he made it supercritical, so he got terrible localized exposures to his hands and arms, which were way higher than the doses you can get from a neutron bomb.* This is why Dr Slotin had the painful radiation burns which Allen observed in treating him. Allen was dishonest

in claiming that those radiation burns were analogous to neutron bomb exposures. In any case: 'Allen never mentioned the terrible burns that can result from ... the heat from fission battlefield nuclear weapons.'

On 10 September 1981, two months before Allen's notoriously inaccurate article was published, Cohen had written to the Secretary of Energy James B. Edwards, asking:

'Why is it, Mr Secretary, that after more than four years of intense, often acrimonious and almost always highly emotional, debate over the neutron bomb, the government has never put out an official statement to dispel the distorted technical charges which have been made about the weapon's effectiveness and alleged immorality? It seems to me that had this been done at the start, today we would not have the same anti-nuclear scientists making the same distorted charges; leaving the American people as confused as ever - and probably the Europeans as well.

'I would strongly suggest that DOE and DOD get together (as they did some 30 years ago, when they first issued *The Effects of Nuclear Weapons* to responsibly inform the American people what nuclear weapons were all about) and provide an official document spelling out the true facts of the issue.' (As we shall see, the declassification of *Capabilities of Nuclear Weapons* is a step in that direction.)



Samuel Glasstone was well aware of the facts on the neutron bomb, for he had taught classified nuclear weapons design at Los Alamos until he retired and moved to Oak Ridge (Glasstone was **co-author with Leslie M. Redman of the originally Secret - Restricted Data June 1972 report WASH-1038, *An Introduction to Nuclear Weapons***):

'When I arrived at the [Los Alamos] Lab 36+ years ago ... though I was a lowly postdoc, we took a course on nuclear physics (as did every new employee) and then a class on elements of bomb design both taught by Samuel Glasstone. This was required training. ... After that approximately 3 weeks of training, I understand what the Lab was about and why it was important to the nation. I'm certain it contributed to my wanting to stay on after my postdoc and has helped me in my work over the years. This was part of the "openness" despite the secrecy associated with the Lab. I believe we have lost this over the years ...' - **Dr David Forslund**

'During the Manhattan Project, classification was easy: everything in the project was classified. Then and later, information on nuclear weapons was "born classified" in the Restricted Data category. During the [Los Alamos National] Lab's orientation for new hires in the mid-1960s, Sam Glasstone, who had been a chemist in the Manhattan Project, drew one circle on the blackboard and another inside it. "Drawing concentric circles used to be classified," he joked. Fission bombs are designed in concentric circles.' - **Dr Cheryl Rofer, *Los Alamos National Laboratory, Part I - Historical Perspectives* ['Cheryl Rofer is a chemist who worked for the Los Alamos National Laboratory for 35 years. ...'], *Word Worth*, September 2004, volume IV, No. 9.**

In December 1977, the 653 pages long revision of *The Effects of Nuclear Weapons,*, compiled and edited by Samuel Glasstone and Philip J. Dolan, was published by the U.S. Department of Defense, and was a brief summary of some of the material from extensive data in the secret *Capabilities of Nuclear Weapons*.

America had not conducted any atmospheric nuclear tests since the previous revision in February 1964, but new computer simulations of the effects of nuclear weapons had resulted in a better analysis of the 1945-62 nuclear test data (especially high-altitude electromagnetic pulse, and all radiation prediction techniques), and research had been done into the biological effects of radiation. (Chapter 12, Principles of Protection, an excellent summary of data for civil defence in the earlier editions, was removed in 1977.) The 1977 edition crater scaling ‘law’, stating that crater radii depend on the 0.3 power of yield, was soon discredited because of the case-shock energy absorption with absolute (not scaled) distance by the ground, and because the energy needed to eject masses against gravity reduces the true scaling dimensions law from the 1/3 power of yield at low yields to 1/4 power scaling at very high yields. Blast reduction due to irreversible energy loss by the cumulative ground-level work done in damaging houses is ignored at best or falsely dismissed at worst (in discussion of blast scattering, instead of energy loss), but Penney’s 1970 paper is cited in the blast bibliography.

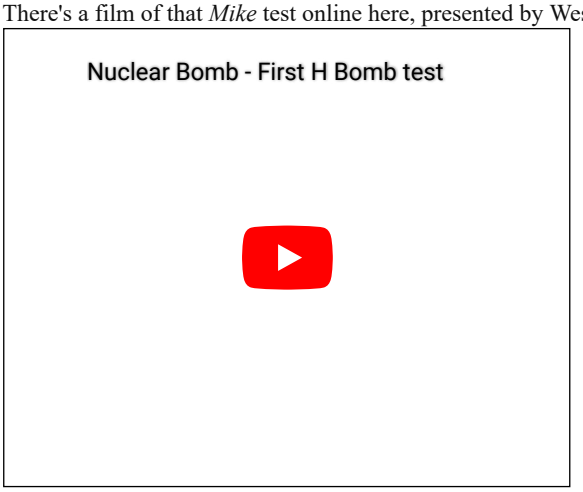
In an interview with Glasstone at Oak Ridge (where Glasstone moved after retirement from Los Alamos, New Mexico) on 25 September 1978, Howard Morland asked him about the deletion of the section in *The Effects of Nuclear Weapons* 1977 on radiological warfare, which had been in previous editions: 'In 1978, I asked Samuel Glasstone why that section had been removed. "Lack of interest," he said. Had the fission percentage of the U.S. nuclear stockpile been significantly reduced? "Oh no, the weapons haven't changed, but people aren't interested in talking about radiological warfare anymore."'

Morland ignored the actual science of fallout effects for clean weapons, discussed in another post. Wordy definitions of the term 'radiological warfare' don't reflect the fact that radiation is the best investigated effect of nuclear explosions. Certainly more research has been sponsored on fallout than blast and heat flash, and this will be discussed in a later post. Glasstone was of course 81 in 1978, and although he continued to publish major books into the 1980s (for example, the *Energy Deskbook* of 1983), Dolan had done most of the revisions of the 1977 edition of *Effects*.

(While Glasstone happily helped Kearny with civil defense for free, he used a clever tactic when asked for interviews by investigative journalists with an anti-nuclear bias, as documented by anti-nuclear campaigner Howard Morland in his 1981 book, *The Secret that Exploded,* Random House, New York, page 100: "That afternoon [25 September 1978, in Oak Ridge] I visited Samuel Glasstone, the author of several textbooks on nuclear matters, including *The Effects of Nuclear Weapons.* He had been reluctant to see me; he was a professional writer, he said, and time taken from his writing was money taken from his pocket. ... He was cautious with me, and told very little." On page 20, Morland states that he: "asked Samuel Glasstone ... about **Lapp's diagrams**, and he had remarked that they showed how active people's imaginations could get when they thought about H-bombs.")

Improvements to data in the *Effects of Nuclear Weapons* editions, **1957** to 1977, resulted for instance in a halving of the predicted ignition range for shredded dry newspaper on a clear day due to a 10-Mt air burst (**56 km in 1957**; 28 km in 1977). This reduced Glasstone's areas for ignition of fires by a factor of four (the errors were a flawed heat flash transmission theory and flawed laboratory ignition tests).

The absurdity of the **1957** claim that newspaper can be ignited at 56 km from a 10 Mt burst is demonstrated by the fact that the observers of the 10.4 Mt *Mike* test observed the shot from the deck of the *U.S.S. Estes,* 57 km away, without any heating than normal sunshine. Admittedly that was a surface burst and not an air burst, but when you look at the difference, it still illustrates a gross exaggeration. There's a film of that *Mike* test online here, presented by Western actor **Reed Hadley** aboard the control ship *U.S.S. Estes:*



Dr Carl F. Miller, who worked for the U.S. Naval Radiological Defense Laboratory at later nuclear tests to measure fallout on ships with washdown safeguards that were sailing under the expanding mushroom clouds, stated in the February 1966 *Scientist and Citizen* (this journal was titled *Nuclear Information* August 1964 when it became *Scientist and Citizen;* it has since been renamed *Environment magazine*):

'Reliance on the ***Effects of Nuclear Weapons*** has its shortcomings... I was twenty miles from a detonation ... near ten megatons. The thermal flash did not produce the second-degree burn on the back of my neck, nor indeed any discomfort at all.'

The online ***NATO HANDBOOK ON THE MEDICAL ASPECTS OF NBC DEFENSIVE OPERATIONS,* FM 8-9, 1996, calculates in Table 4-VI** that second-degree skin burns even from 10 Mt air bursts (where the range is greater than from surface bursts) would only extend to a range of 14.5 km (9 miles) in a typical city with atmospheric visibility of 10 km.

Dr Carl F. Miller's **major fallout reports are now declassified** and he was able to elaborate further on his work at the Naval Radiological Defense Laboratory in **his speech accepting an award for decontamination research at the U.S. National Council on Radiological Protection (NCRP) symposium on 27-29 April 1981 in Virginia, published in *The Control of Exposure of the Public to Ionising Radiation in the Event of Accident or Attack,* pp. 99-100:**

'Someone talked a little about risks. ... In 1954 ... we were about 20 miles away when a 10-megaton shot was detonated ... **The ship [YAG 39] sailed on a pathway that led to an area directly underneath the expanding cloud, so as to be exposed to a maximum amount of fallout ... Fallout arrived about 20 minutes after detonation, at which time I collected the first few drops of "hot" washdown water** ... In 1957, at the Nevada Test Site, personnel from the Naval Radiological Defense Laboratory and the Atomic Energy Commission sat in an underground shelter a mile away when shot *Diablo* was detonated. Some of us collected fallout particles ... after about a half-hour or so, one could hardly get a reading [from a single fallout particle] ... because of the rapid decay rate. ... With most of the local fallout that we're talking about, a lot of the larger particles are fused or melted to form little glassy marbles. The tower shots had iron in them so they were magnetic and we could separate hot fallout particles from tower shots with magnetism. The radioactive atoms that could be absorbed into, or by, body organs were the few that are plated out on the surface of the fallout particles during the later stages of condensation in the fireball. That's why the elements iodine, strontium, ruthenium and a few other isotopes of that nature have been found in organs of animals and humans.'

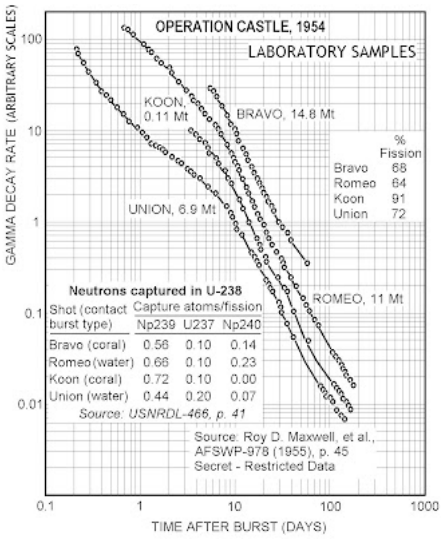
So don't get the idea that fallout effects are less exaggerated than second degree burns:

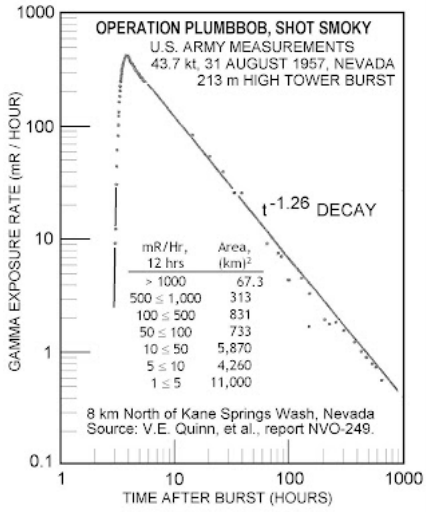
'A number of factors make large-scale decontamination useful in urban areas. Much of the area between buildings is paved and, thus, readily cleaned using motorized flushers and sweepers, which are usually available. If, in addition, the roofs are decontaminated by high-pressure hosing, it may be possible to make entire buildings habitable fairly soon, even if the fallout has been very heavy.'

– Dr Frederick P. Cowan and Charles B. Meinhold, *Decontamination,* Chapter 10 (pp. 225-240) of Dr **Eugene P. Wigner**, editor, ***Survival and the Bomb,*** Indiana University Press, Bloomington, 1969.

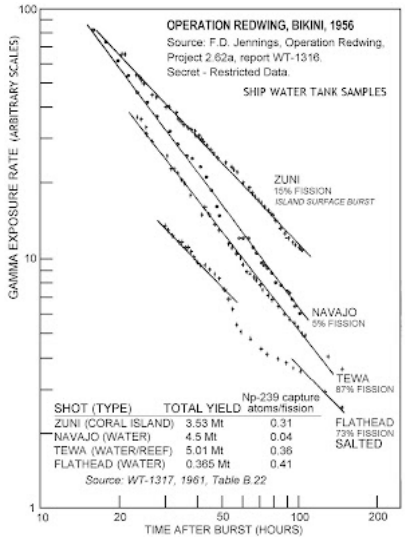
'The casualty rate will depend to a considerable extent on the awareness by the civilian population of the danger facing it. If the **phenomenon of fall-out** is not understood or if there are no preparations to deal with it, the casualty rate from fall-out will approach that produced by the heat and blast of the explosion. ... As soon as radiation has dropped to a relatively safe level ... decontamination can be

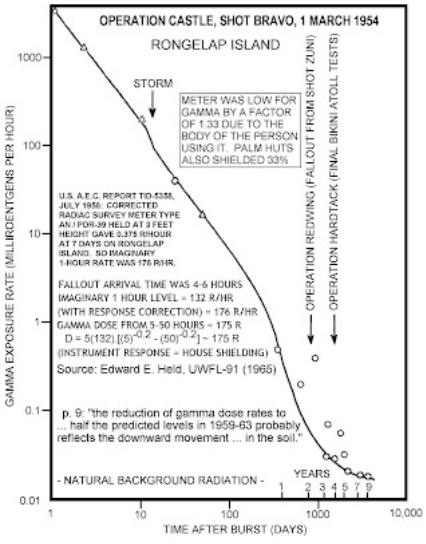
started by sweeping **radioactive ash** from rooftops and streets, flushing them with water, or even raking the earth [to cover the fallout with earth, therebyattenuating the radiation hazard above ground]. ... During the **Symington** [February 1955 U.S. Congressional nuclear weapons effects] hearings **General LeMay** testified that a person covered by three feet of dirt would be relatively safe.' - Dr **Henry A. Kissinger**, ***Nuclear Weapons and Foreign Policy***, Harper and Brothers, New York, 1957, page 77.

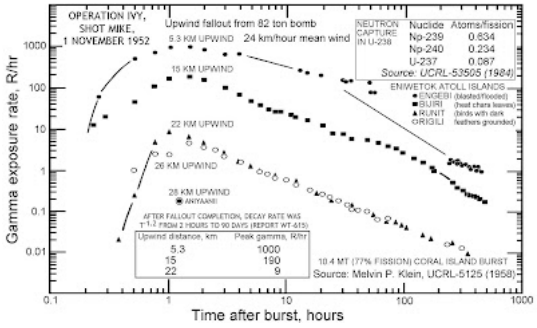




Above: the table of fallout areas for measured dose rate contours in PLUMBBOB-SMOKY, 31 August 1957, Nevada, is taken from page 808 of the *Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, 86th Congress, The Biological and Environmental Effects of Nuclear War, June 22, 23, 24, 25, and 26, 1959, Part 1,* U.S. Covernment Printing Office, Washington, 1959, 966 pages.







As with the 1945 Smyth unclassified report on the Manhattan Project (which had accidentally included in the first version some details of the reactor poisoning by fission products with large neutron capture cross-sections, like xenon-135 and samarium-149), secrets were also accidentally included in Glasstone's books, such as the following account of fireball and shock wave physics in the 1962/4 editions which was deleted from the 1977 edition, apparently since it gives thermonuclear principles:

'As a result of numerous inelastic collisions part of the kinetic energy ... is converted into internal and radiation energy... most ... in the soft X-ray region. The ... surrounding medium... is heated and the resulting fireball re-radiates part of its energy ... The remainder of the energy contributes to the shock wave ... After a few microseconds nearly all of the debris is contained in a moderately thin shell of high density called the 'hydrodynamic front' ... it acts like a fast-moving piston.'

– S. Glasstone, *The Effects of Nuclear Weapons,* U.S. Department of Defense, 2nd ed., 1962, pp. 68-9.

'We shall discuss in the sequel the hoped-for [fusion material] compressions.

'The arrangement might be called heterocatalytic, involving as it does a setting off of a reaction in one system by a reaction started in another material - the 'auxiliary' arrangement is located at a considerable distance (from the purely nuclear point of view), like 50 cm to 5 metres. This is in distinction to hitherto-considered autocatalytic schemes based essentially on self-implosions of a mixture of nuclear substances.'

- Edward Teller and Stanislaw Ulam, *On Heterocatalytic Detonations I: Hydrodynamic Lenses and Radiation Mirrors,* Los Alamos Scientific Laboratory report LAMS-1225, 9 March 1951, page 4 (originally Secret - Restricted Data).

'The following ... are basic features of the design or operation of the U.S. type thermonuclear weapon and are classified as Secret – Restricted Data:

'(a) Separate stages – a physically separate fission explosive (stage) and a capsule (stage) of thermonuclear fuel, centred at separate points;

'(b) Radiation coupling – channelling (ducting) ... from the first stage to ignite the second stage;

'(c) Compression – implosion of the thermonuclear fuel capsule prior to ignition to achieve maximum yield.'

– U.S. Departments of Justice and Energy, 15 June 1979, U.S. Court of Appeal for the Seventh Circuit, Case No. 79-1428, pp. 19-20.

This material about the physics of energy transfer for thermonuclear weapons was finally declassified in 1979. Harold L. Brode gives this data and more on his 1968 'Review of Nuclear Weapons Effects' in the *Annual Review of Nuclear Science. Nuclear* proliferation needs to be stopped by stopping the production of nuclear materials in dangerous countries, not by trying to retrospectively make people ignorant of simple physical principles about how x-rays affect matter. Everything is connected to everything else in science, so secrecy on nuclear effects, besides inducing wishful thinking and the dangerous complacency of loud 'scientific' crackpots in the media and in politics (secrecy didn't stop Russia detonating a bomb in 1949, despite wishful thinking on the part of America), also hinders scientific

developments.

Since the first nuclear explosion on 16 July 1945, all reliable information on the effects of nuclear weapons was classified Secret-Restricted Data by the United States, and only filtered reports edited by Dr Samuel Glasstone were released.

For example, the nuclear implosion bomb principle, that you get an inward force as well as an outward force in an explosion (by Newton's 3rd law) is the cause of **gravity (unification of cosmology, general relativity and the Standard Model of particle physics)** in the big bang, but is being pathetically censored by sneering dunces because the full evidence is secret data.

Take 9/11 terrorism. Nobody seems to conclude that such disasters can be prevented simply by classifying pilots manuals top secret to hinder terrorists. Physics information is not unique to nuclear weapons and can't be safely guarded, because the basic laws of physics and data are universa. You will create a false sense of security and not help one bit if you stamp some pilot manuals and aerodynamics textbooks 'top secret', but you can do something useful physically: airport security can be stepped up. Similarly, the focus should be on stopping proliferation physically, and not burying your head in the sand and imagining that by making physics secret all will be well.

Perhaps the most important modification in the April 1962 edition of *The Effects of Nuclear Weapons* was the disclosure that the radioactive fallout from nuclear weapons contains substantial amounts of radioactive nuclides from neutron capture in U-238. This had been pointed out by **scientist George Stanbury (who worked with data from nuclear tests, and had attended British nuclear tests to study the effects) of the British Home Office Scientific Advisory Branch** in report A12/SA/RM 75, ***The Contribution of U239 and Np239 to the Radiation from Fallout,*** November 1959, Confidential (declassified only in June 1988). Both Mr Stanbury and The Effects of Nuclear Weapons 1962 found 40% of the gamma radiation dose rate from fallout is the typical peak contribution due to Neptunium-239 and other capture nuclides (e.g., U-237, which is formed by an important reaction whereby 1 neutron capture in U-238 is followed by 2 neutrons being released), which all emit very low energy gamma radiation, and are important between a few hours and a few weeks after burst, i.e., in the critical period for fallout sheltering. Because of the low energy of the gamma rays from such neutron-capture elements, which are present in large quantities in both Trinity-type fission bombs (with U-238 tampers) and thermonuclear bombs like Mike and Bravo, the fallout is much easier to protect against than pure fission products (average gamma energy 0.7 MeV). However, *The Effects of Nuclear Weapons,* while admitting that up to 40% of the gamma radiation is from such nuclides, did not point out the effect on the gamma energy and radiation shielding issue, unlike Stanbury's Confidential civil defence report.

This discovery greatly stimulated the **'Protect and Survive' civil defence advice given out in Britain for many years**, although it was kept secret because the exact abundances of these bomb nuclides in fallout were dependent on the precise bomb designs, which were Top Secret for decades.

In 1958, W. J. Heiman of the U.S. Naval Radiological Defense Laboratory released data on the sodium-24 activity induced in sea water after an underwater nuclear explosion in which 50 % of the gamma radiation at 4 days after burst is due to Np-239 (which makes a peak contribution at 4 days). He found that Na-24 contributed a peak contribution of 7.11 % to the total gamma radiation, at about 24 hours after burst (*Journal of Colloid Science,* Vol. 13, 1958, pp. 329-36; based on the secret November 1952 report by W. J. Heiman, *Contribution of Different Chemical Elements to the Rate of Gamma Radiation at Various Times After an Underwater Atomic Burst,* U. S. Naval Radiological Defense Laboratory, report USNRDL-387, Secret - Restricted Data). Hence Np-239 is far more more important than Na-24.

In 1993 I contacted the Atomic Weapons Establishment library at Aldermaston about some of the references in declassified Home Office civil defence scientific advisory branch reports at the UK Public Record Office (now the UK National Archives). This was before the UK Freedom of Information Act, but the Library of the Atomic Weapons Establishment was reasonably helpful, sending me the declassified fallout pattern from Operation Hurricane, and explaining to me that the civil defence reference I had found to the Confidential November 1957 *Capabilities of Atomic Weapons* TM 23-200 was outdated because a declassified version of the later Dolan manual EM-1 had been available since 1989. The Dolan EM-1 is in the British Library at Boston Spa on microfilm. When I received printouts in 1994, I wondered whether it would be feasible to publish the declassified information for civil defence purposes.

We're not concerned with military nuclear effects on submarines and missile silos, just with the data which pertains to personnel survival and recovery from the civil defence stand point. The data in Glasstone and Dolan's 1977 *Effects of Nuclear Weapons* besides being obsolete for just about all effects now, is deplorably unconvincing because the graphs and charts have no data points, so it is unclear whether any particular chart comes from real nuclear test experience or speculative computer simulation. *Capabilities of Nuclear Weapons,* EM-1, is far more candid on where the data comes from, and it also contains a great deal more useful data. For example, EM-1 contains far more useful data on ignition of forests by thermal radiation than Glasstone does (for example, allowing for shielding of the dry kindering on the forest floor by the green leaf canopy for different angles of fireball elevation). Initial nuclear radiation is also dealt with according to weapon design

History of the precursor

Above: the discovery of the precursor at the fourth test of Operation Tumbler is documented in this film, 'Military Participation on Tumbler/Snapper', produced by the U.S. Air Force Lookout Mountain Laboratory, Hollywood, California for the U.S. Armed Forces Special Weapons Project. Narrated by Reed Radley:

'It was [Mach wave] amplification which extended the area of damage at Hiroshima and Nagasaki. The Mach-Y stem worked over every kind of structure: masonry, steel-frame buildings, and reinforced frame buildings. From a military standpoint, the atomic detonations on Japan seemed to be pretty effective, so Hiroshima and Nagasaki became the norm, the basis for curves on blast effects and damage. During Bikini in 1946, damage to ships in the lagoon agreed with blast damage curves developed in Japan. Theoretical height of burst curves were developed from effects observed at Hiroshima and Nagasaki, the *Able* shot at Bikini, and were backed up by high explosive experiments.

'During *Operation Greenhouse* at Eniwetok in 1951, men from each of the services got their heads together and dreamed up the most extensive blast study program up to that date. It involved every principal kind of structure: many above and some below the ground, in a variety of orientations to the burst. It involved airplanes in the sky, parts of airplane structures on the ground, tanks and other types of military equipment. The pre-blast estimates of damage were based on composite blast curves developed on studies from Japan and theoretical calculations. The pressures resulting from the tower shots of *Greenhouse* were less in some cases by a factor of as much as two-thirds, than the original predictions.

'On the bursts of *Buster-Jangle* even more severe differences showed up between the predicted blast effect estimates and the actual results produced by nuclear weapons. For unknown reasons, nuclear weapons were producing in some cases only about one-third of the blast pressure that we had expected.

'This raised some very sobering questions in the minds of military planners. We knew the energy was there, but something somewhere along the line was happening to lessen or cushion the full effect of the blast. Where and why are there such discrepancies in our blast curves? Getting the answers was the priority objective on *Tumbler.* Several things could be happening ... the thermal radiation may ... heat up the ground and the air layer close to the ground to such an extent that it would alter or soften the full effect of the blast or the development of the total potential force of the reflected pressure wave. ...

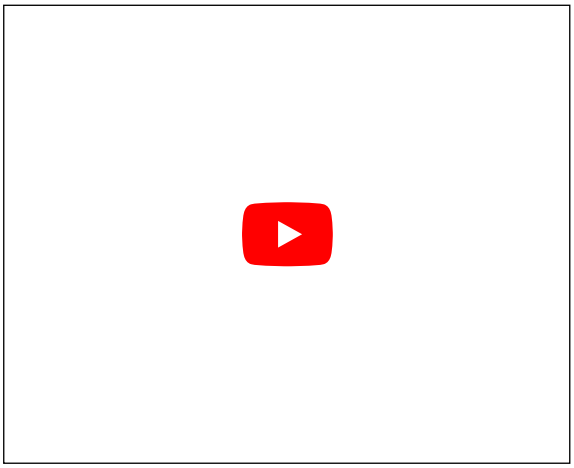
'So nuclear weapons were used for the purpose of establishing new blast curves at the Nevada proving Ground in the spring of 1952. The first weapon [*1 kt, 800 feet height of burst*] will be detonated over Frenchman Flats, the scene of *Operation Ranger* in 1951. This is a dry lake bed with moderately stable soil and generally high thermal reflecting characteristics. The blast measurement line stretches 4000 feet West from ground zero. Fifty-foot poles were placed every 250 feet along the blast line, with instrument running from ground level to the very top ...

'With the first shot of the *Tumbler* phase completed, we're taking the rest of the weapons north, some 10 miles across a ridge of mountains into the next valley, Yucca Flats, site of the Buster operation, to try different heights of burst over a completely different type of target. ... By comparison with the lake bed in Frenchman Flats, the surface in this area is rough and dusty.

2nd Tumbler shot: 1 kt, 1100 feet height of burst
3rd Tumbler shot: 30 kt, 3500 feet height of burst (the same-scaled height as shot 2)
4th Tumbler shot [DOG]: 20 kt, 1050 feet height of burst

'A new phenomenon which may account for the low pressures measured on previous tests, was observed for the first time on the fourth shot of Tumbler: a so-called precursor pressure wave, moving out from ground zero in advance of the incident shock wave from the bomb. This precursor wave may be caused by the intense thermal radiation released at detonation.'

Above: the 1 November 1952 10.4 megaton surface burst Mike film, 'Operation Ivy', produced by the U.S. Air Force Lookout Mountain Laboratory, Hollywood, California for the U.S. Armed Forces Special Weapons Project, presented by Reed Radley: 'You have a grand stand seat here to one of the most momentous events in the history of science. In less than a minute you will see the most powerful explosion ever witnessed by human eyes. The blast will come up on the horizon just about there, and this is the significance of the moment: this is the first full-scale test of a hydrogen device. If the reaction goes, we're in the thermonuclear era. For the sake of all of us, and for the sake of our country, I know you'll join me in wishing this expedition well.'



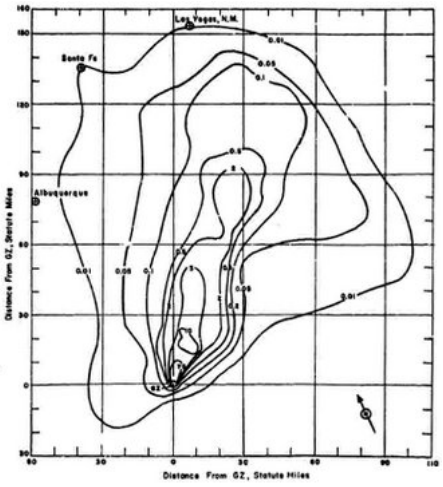


Figure 1. Operation TRINITY off-site dose rate contours in r/hr at H+1 hour.

ABOVE: This is the fallout pattern from the first ever nuclear test, *Trinity,* 16 July 1945. One of the gross errors in Glasstone's 1950 *Effects of Nuclear Weapons* was a total omission of this fallout pattern, compounded by a statement of the 'trinitite' (glassy fused sand) crater residual radiation levels near and upwind of ground zero. Glasstone's 1950 book records that at ground zero the dose rate at 1 hour was 8,000 R/hr of gamma, and gives upwind radii for other dose rates, but omits the *downwind fallout pattern.* This probably contributed to speculation of a cover-up when Marshallese received beta burns from fallout in 1954.

The *Trinity* test was about 19 kilotons on a 30 metres high tower. The effective (altitude averaged) wind speed for the fallout was 27 km/hour. The gamma dose rate contour values on the pattern above are scaled back to 1 hour after burst using the t^-1.2 decay rate law (which was discovered from the *Trinity* fallout analysis), a time before actually fallout arrived in many of the locations shown, from measurements taken after fallout was complete. The contour values from ground zero outward are consecutively labelled: 75, 10, 5, 2, 0.5,

0.1, 0.05, and 0.01 R/hour. Just to emphasise: these dose rates didn't actually occur at 1 hour except within 10 miles of ground zero. (The habit of referring all fallout dose rates to a time of 1-hour after detonation creates a lot of confusion when people look at such patterns.) **Source: DASA-1251-1-EX** (secret 1963 report, declassified and released in 1979).

I've already said in the first post on this blog where I'm coming from. I'll add a few more comments on Glasstone and Dolan here quickly. Around 1983 I saw a lot of political arguments on the effects of nuclear weapons in the media. My father was an instructor in the British Civil Defence Corps in Colchester and knew that certain facts do exist in the data from Hiroshima and Nagasaki as well as nuclear tests. It simply is not correct to claim that 'nobody knows what a nuclear explosion could do, because after all it has yet to happen.'

Back in 1945 after Japan surrendered, Home Office scientists like F. H. Pavey went to Hiroshima and Nagasaki, and during the 1950s they measured effects and the effectiveness of civil defence countermeasures against heat flash, blast and radiation at surface and air bursts over the desert at Maralinga in Australia, and Home Office physicists like George R. Stanbury measured the heat, blast, and radiation including residual fallout from Australian-British nuclear weapons trials at Monte Bello. Stanbury and others reviewed American test reports and lectured on the scientific facts to civil defence personnel around Britain from about 1952-65.

They had seen the survivors of nuclear air burst attacks, had felt the blast and had seen the fallout from surface bursts. More important, they had done the quantitative scientific measurements needed. **Here is a taste of how Stanbury, who attended the October 1952 *Hurricane* 25 kt British test to measure the effects, reacted to senile physicists' propaganda:**

‘We have often been accused of underestimating the fire situation ... we are unrepentant in spite of the television utterances of renowned academic scientists ... Air cannot get into a pile of rubble 80% of which is incombustible anyway. This ... is the result of a very complete study of some 1,600 flying bomb incidents ... Secondly, there is a considerable degree of shielding of one building by another ... Thirdly, even when the windows of a building can "see" the fireball, and something inside is ignited ... even with the incendiary bomb the chance of a continuing fire developing in a small room is only 1 in 5 ...’

– George R. Stanbury, ‘The Fire Hazard from Nuclear Weapons’, *Fission Fragments,* Scientific Civil Defence Magazine, No. 3, August 1962, pp. 22-6, British Home Office, Scientific Adviser’s Branch, originally classified 'Restricted'.

I tracked this journal down at the Public Records Office (now the National Archives) in Kew. See also Glasstone and Dolan's admission that thermal radiation doesn't vaporise more than a surface layer of material in 1977:

‘Dense smoke, and even jets of flame, may be emitted, but the material does not sustain ignition... smoke formed in the early stages will partially shield the underlying material from subsequent radiation. This behaviour is illustrated in the photographs taken of one of the wood-frame houses exposed in the 1953 Nevada tests... the house front became covered with a thick black smoke... within less than 2 seconds from the explosion, the smoke ceased... Ignition of the wood did not occur... The thermal energy incident upon the material was apparently dissipated in the kinetic energy of the "exploding" surface molecules before the radiation could penetrate into the depth of the material.’

– Dr Samuel Glasstone and Philip J. Dolan, editors, *The Effects of Nuclear Weapons,* U.S. Department of Defence, 1977, pp. 285-6.

‘Persons exposed to nuclear explosions of low or intermediate yield may sustain very severe burns on their faces and hands or other exposed areas of the body as a result of the short pulse of directly absorbed thermal radiation. **These burns may cause severe superficial damage similar to a third-degree burn, but the deeper layers of the skin may be uninjured. Such burns would heal rapidly** [emphasis added; this is true unless the person also receives a concurrent massive nuclear radiation dose], like mild second-degree burns.’

– Dr Samuel Glasstone and Philip J. Dolan, editors, *The Effects of Nuclear Weapons,* U.S. Department of Defence, 1977, p. 561.

Around 1990, when I was 18, some 10 year old kids pestered me in Woking Library to borrow the book I was photocopying from. It was Glasstone's 1962 *Effects of Nuclear Weapons*, the one with the title in large capitals on the cover. I explained it was a book I'd bought secondhand, not a library book, and that the library had other books on the same subject, suitable for kids. One of them made it clear that he didn't want a political book 'about' nuclear weapons, they didn't have any information in them at all: political facts summarising how many casualties someone claims to calculate and photographs of what look like burned out victims who could be from any fire, Tokyo or Hamburg, are not real information, just propaganda. Any deeply charred bodies after Hiroshima resulted from subsequent fire, so you do really need to understand the thermal flash mechanism, the physics which shows the poverty of propaganda.

The thermal exposure on the ground under the Hiroshima and Nagasaki detonations briefly induced high temperatures in the surfaces of tiles, ground, wood and skin, which could cause relatively deep flash burns and later the surface charring of skin. But this did not instantly kill anybody, let alone vaporise anyone or char more than a matter of millimetres, because the energy delivered was not high enough: to heat anything you need high temperatures to be maintained for sufficient time for the material to heat up. This didn't happen: only the outer surface has time to heat. The initial nuclear radiation was lethal at ground zero below those air bursts, but even in combination with thermal flash charring of the skin facing the fireball it would not kill immediately. People resist the direct effects of much higher blast pressures than occurred at ground zero in either detonation. Obviously, there is no wind drag or missile problem at ground zero, since the blast winds are vertically directed, not horizontal.

Nobody was vaporised painlessly, although doubtless some people were knocked unconscious by debris in areas which later were engulfed by the firestorm. You don't know anything about a possible future attack so you cannot assume the type or scale of attack, or even the atmospheric visibility and wind pattern. Civil defence is not a complete fraud, but what is a complete fraud is all the extensively published mainstream pseudo-scientific lying literature on nuclear weapons which deliberately misrepresents the evidence and obfuscates on the ease of mitigating the wide range of nuclear effects for reasons of political spin.

It seems that such repeated political propaganda overkill of public understanding on nuclear weapons hasn't been 100% lethal to the facts, so publishers continue to defend the mainstream by pretending only false-orthodoxy on nuclear effects exaggeration should be published, and sales will continue therefore to drop because the same lying old message is well known, except to politically-correct librarians who

feel they have a moral duty to support the publication of lies that sound fashionable.

(Related: Since the **rise of string 'theory', which honestly has absolutely no scientific connection to reality**, A-level uptake of physics has dropped annually. My objection to stringy Texas professor Jacques Distler's dictatorial attitude is **deleted from his blog discussion** on string theory trackback censorship! Jacques **replies to me brusquely with a false reason for deleting my comment**, then has nothing further to say. Same old story of dictatorship. No mechanism for progress to occur, but lots of censors out to stop it! Nobody can do anything to stop a dictator without being shot. Simply **exposing the corruption** is no use in the sort of pseudo-democratic society we have, because everyone with any credibility fears losing credibility by making enemies of **big mouthed stringers.)**

NUCLEAR PROPAGANDA FALSEHOODS:

'Radioactive mud fell out, followed by heavy rain ... The [*MIKE*] explosion vaporised and lifted into the air some eighty million tons of solid material ... [*BRAVO* fallout] was calcium precipitated from vaporised coral.' – Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb*, Simon and Schuster, 1995, pp. 509-42.

> *Actually (see posts **here** and **here**) the MIKE fallout consisted of coral (calcium carbonate in the aragonite form) that had been reduced to calcium oxide by the fireball temperature; atmospheric water vapour then slaked the calcium hydroxide surface of each particle to give a layer of calcium hydroxide which in turn absorbed carbon dioxide from the air during fallout, forming a surface shell of calcium carbonate of the calcite (not aragonite) form. Calcium burns in water and oxidises rapidly in air, so there can be no calcium fallout even if the energy is sufficient to dissociate 80 million tons of debris, which it was not. MIKE shot fallout was dry material (not rain) and was similar to the ZUNI and TEWA coral land and reef shots which produced 136 and 210 metric tons of fallout per total yield kiloton, respectively; so that MIKE produced about 2 million tons of fallout, not the 80 million tons (which may be the crater ejecta mass) figure quoted by Rhodes! The mass of radioactive fallout produced is obtained by measuring the activity per gram of fallout; since you know from the yield the total amount of activity produced in the detonation, this measures the total mass of fallout produced, which is only a small fraction of the mass displaced from the crater (which is mostly non-contaminated ejecta which forms the crater lip and ejecta zone). The MIKE test report by **W. B. Heidt, Jr., et al., 'Nature, Intensity and Distribution of Fall-out from MIKE Shot, Operation IVY', WT-615, April 1953, Secret – Restricted Data, p. 43**, shows the actual mass of deposited fallout throughout Eniwetok Atoll, at locations for which the 1-hour dose rates were known. This allows the number of grams per unit area to be related to the 1-hour reference dose rate. Since the fission yield of Mike is known, and the 1-hour dose rate from a kiloton of bomb debris per square metre, the mass of fallout is 2 million tons for MIKE, not 80 million. Hence Rhodes exaggerated by a factor of 40.*

'A crater was torn [by *MIKE*] in the ocean bed a mile wide and two miles deep.' – Norman Moss, *Men Who Play God: The Story of the Hydrogen Bomb,* Penguin Books, 1970, p. 61.

> *This exaggerated the 10.4-megaton MIKE crater depth by 64 times (it was 50 m deep). The correct depth was not secret and had been disclosed and widely reported in the media on 17 February 1954, by Sterling Cole, the Chairman of the U.S. Congressional Joint Committee on Atomic Energy. Yet Moss's false exaggeration was published 16 years later!*

'... a crater 1/2 mile deep and 2 miles wide had been torn [by *MIKE* shot] in the reef.' – Inaccurate source quoted without criticism by Richard Rhodes, *The Making of the Atomic Bomb,* Penguin Books, 1988, p. 778.

> *This exaggerated the depth of the MIKE crater by 16 times, and exaggerated the diameter by a factor of 2, but book still won a 'literary' prize! As usual, with science being abused by exaggeration, the judges are compelled award prizes for 'journalism' as a political statement. (The book also falsely presents Bohr's anti-Einstein Copenhagen Interpretation dogma of wave-particle duality as being factual physics, when it is not science - it is not even wrong - because it makes no checkable predictions that differ from other interpretations: science is about checkable facts, and so is not remotely concerned with opinions or prejudiced dogmas or religious consensus/fashion/groupthink/politics.)*

'After the test of a 15 Mt bomb on Bikini Atoll, in the South Pacific, in March of 1954, small animals were found to have suffered retinal burns at a distance of 345 miles.' – Jonathan Schell, article for the *New Yorker,* later published as a book, *The Fate of the Earth.*

> *This is totally and shamefully false propaganda/hype in every respect, even down to the location of Bikini Atoll, which is in the North Pacific not the South Pacific! In particular, ground bursts fireballs cannot even be seen directly to cause retinal burns beyond the horizon, so Schell is advocating the long obsolete 'flat earth' theory! In particular, the Japanese fisherman who saw the flash North of Rongelap, as well as some of the 64 unprotected native people just 115 miles away on Rongelap Atoll, only saw a diffuse, non-damaging flash. It is a load of total garbage, but many publishers and journalists believe this sort of trash. (Herman Kahn identified other gross errors, distortions and exaggerations in his review of Jonathan Schell's book in Fortune, 28 June 1982, pp. 113-6.)*

'A soldier on picket duty at Nagasaki was vaporised by the explosion even though he was 3.5 km from the centre of the blast.' – Professors Tony Hey and Patrick Walters, *The Quantum Universe,* Cambridge University Press, 1989, p. 69.

'Evidence' is photo of shadows on wood. The soldier was only subject to skin reddening because of the brief pulse, which even a leaf or a sheet of paper stopped. The wooden panel behind the person was slightly scorched where shielded by the person. Hey and Walters' are unaware that it takes more energy to evaporate water (people are 70% water) than to burn dry wood! If the flash had been sufficient to 'vaporise' anyone, the wooden panel would have burned first. Totally ignorant and shameful abuse of 'scientific authority' from two physics professors. Shameful to the publishers' physics editor at Cambridge University Press, too.

A single burned patient in 1947 with 40% body area burns required 42 oxygen tanks, 36 pints of plasma, 40 pints of whole blood, 104 pints of fluids, 4,300 m of gauze, 3 nurses and 2 doctors. - Dr Herman E. Pearse and Dr J. Thomas Payne in 'Mechanical and Thermal Injury from the Atomic Bomb' published by the *New England Journal of Medicine,* volume 241 (1949), pp. 647-53. This is the first example of a kind of medical 'overkill' statement which became widespread during the Cold War, often accompanied by a lament that the fatally injured casualty died at the end anyway (despite using up such incredible medical resources), and is a frequent and typical argument made for the futility of civil defence and medicine in general for widespread nuclear weapons effects.

Firstly, data from flash burns at Hiroshima, Nagasaki and nuclear tests show that people would have to be completely unclothed, outdoors and in an unobstructed line of sight to the fireball in order to receive 40% body area burns from a nuclear explosion! (G. V. LeRoy had already published, two years earlier, in J.A.M.A., volume 134, 1947, pp. 1143-8, that less than 5% of burns in Hiroshima and Nagasaki were caused by building and debris fires!) Secondly, duck and cover shield skin and prevents burns. Thirdly, even the bad facial and hand burn areas of people in Hiroshima and Nagasaki who took no evasive action were smaller as they wore clothes which gave some protection against the thermal flash. Fourthly, trying to discredit civil defence, by saying that it would require far more resources than are available to treat the fatally injured, is like saying that the peacetime emergency services should be abolished because they would not cope if everyone by some remote chance had a fatal accident at the same time! In other words, it misses the whole point. The number of flash burns casualties would be tiny at night when people are indoors, or especially in cold weather. It would be tiny if atmospheric visibility was low. It would be tiny if buildings shadowed most people from the line of sight of the fireball. It would be tiny if people had any warning to duck and cover or get out of a direct line of sight. There are many possible uses of nuclear weapons which do not involve such effects at all, e.g. high altitude bursts, earth penetrators or surface bursts where the elevation angle is so low there is little chance of a line-of-sight for the thermal radiation before the blast arrival time, or ***underwater bursts which create radioactive base surges like the HURRICANE test in 1952****. The probability that an air burst will be used on a clear day, that many people would be outdoors, not wearing any clothes, and have a direct view of the fireball is low unless the detonation was above a tropical beach! Even if there were such detonations, the effects would not be as bad as in Hiroshima and Nagasaki, where malnutrition already existing due to wartime rationing before the attacks led to the formation of keloid scars in burned survivors, and also excessively severe infections and mortality after nuclear radiation exposure where the health of the person before exposure is paramount (radiation sickness includes nausea and reduced immune system response due to bone marrow damage and thus reduced numbers of white blood cells).*

DECEPTION OVER OZONE LAYER DAMAGE

One of several errors in the 1977 3rd edition of the U.S. Department of Defense book *The Effects of Nuclear Weapons* is the false claim on page 78 that air bursts like those over Hiroshima and Nagasaki damage the ozone (O_3) layer which exists at altitudes of 15-30 km:

'... nuclear explosions are accompanied by the formation [in the blast wave at high overpressures] of oxides of nitrogen [causing the red-brown colour to the rising fireball before condensing water vapor turns it white]. An air burst, for example, is estimated to produce about 10^{32} molecules of nitrogen oxides per megaton of TNT equivalent ... hence, the nitrogen oxides from such explosions would be expected to enhance mechanisms which tend to decrease the ozone concentration.'

This is false because:

(1) the initial gamma radiation from both surface and air bursts produce a large ozone layer around the early fireball, shielding the early thermal radiation from the fireball after nuclear explosions, and this *ozone production* is not mentioned in the book. The mechanism for the production of ozone naturally is the absorption by oxygen molecules (O_2) of short-wavelength ultraviolet light, bordering the soft X-ray spectrum. In addition to ozone formation by gamma radiation, nuclear weapons release typically 70-80% of their energy as such soft X-rays in a blackbody distribution Glasstone and Dolan, 1977, pp. 23-59) which is soon degraded by air scatter into ultraviolet radiation which forms ozone. The reaction is: $3O_2$ + energy -> $2O_3$. The heat released by the natural ozone-forming process is the reason for the increase in the temperature of the stratosphere with altitude. The natural chemical reaction produces about 4,500 tons of ozone per second in the stratosphere, which maintains equilibrium by being broken down at a similar rate by other natural chemical reactions.

(2) the nitrogen oxides, largely nitrogen dioxide, in the fireball soon reacts with moisture in the white mushroom cloud to produce nitric acid, which is later precipitated in rainfall along with naturally produced nitric acid from lightning storms, and has no effect on the ozone layer. A lightning storm is qualitatively like a nuclear explosion in that it produces *both* ozone (from the electrical discharge air ionization) and nitrogen oxides (from the shock waves formed around the extremely hot lightning bolts, which are later heard as thunder). Nitric acid (HNO_3) production from the mixing with nitrogen dioxide and water vapour in the fireball is described by the reaction:

$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$

then the nitrogen oxide, NO, itself gets oxidized into nitric acid by the reaction:

$4NO + 3O_2 + 2H_2O \rightarrow 4HNO_3$

It was a bigger hoax than Piltdown Man to suggest that nitrogen oxides from nuclear bomb tests could break down ozone; they instead get oxidised into nitric acid by atmospheric moisture and oxygen *before they can reach the ozone layer.* For a published discussion of the nitric acid production in the air around the fireball from an atmospheric nuclear explosion, see Murray Scheibe, *The Increased Attachment Due to Ionization-Induced Smog in EMP Environments,* Mission Research Corporation, California, MRC-R-532, DNA5077F, ADA087850, 1979: 'The increased electron attachment due to HNO_3 production in the EMP source region is investigated. The HNO_3 produced is found to be roughly linear with the total ionization up to an ionization value of about 2 x 10 to the 16th power ion pairs. Above this, the HNO_3 production is less than linear.'

P. Goldsmith, A. F. Tuck, J. S. Foot, E. L. Simmons and R. L. Newson, reported in their paper, 'Nitrogen oxides, nuclear weapon testing, Concorde and stratospheric ozone' published in *Nature,* vol. 244 (1973), issue 5418, pp. 545-551:

'Although amounts of nitrogen oxides equivalent to the output from many concordes were released into the atmosphere when nuclear testing was at its peak, the amount of ozone in the atmosphere was not affected.'

In total, the U.S.A, U.S.S.R., U.K., France and China detonated 545.4 megatons in the atmosphere, the peak rate of testing occurring in 1962, see page 295 of Merril Eisenbud and Thomas F. Gesell, *Environmental Radioactivity,* Academic Press, 4th ed., 1997 (the ten biggest atmospheric tests are listed on another **post, here**).

Finally, for high altitude explosions, there is no high pressure air blast wave, thus no production of nitrogen oxides whatsoever, but the gamma radiation striking the atmosphere still produces ozone! Therefore, such explosions have the exact opposite effect on the ozone layer to the claims being made. This has some importance to the issue of holes in the ozone layer by CFCs, and the way to repair such damage.

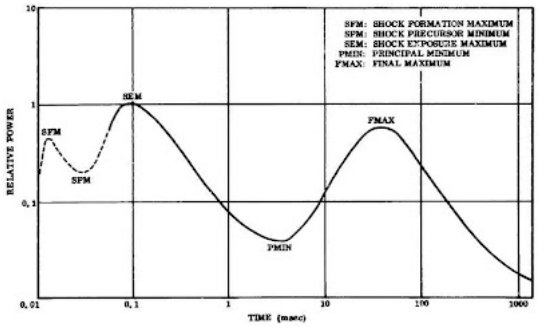
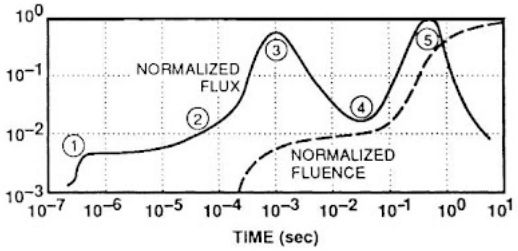


FIG. 2-1 THERMAL POWER RADIATED FROM ONE KILOTON AT SEA LEVEL

Harold L. Brode, Richard W. Hillendahl, and Rolf K. Landshoff, "Thermal Radiation Phenomena, Vol. 5, Radiation Hydrodynamics of High Temperature Air", Lockheed Missiles & Space Co., report DASA-1917-5, 1967



(1) Fireball shielded by ionised air and ozone from the air ionization due to X-ray and gamma radiation
(2) Shock wave forms, expanding past ozone shell
(3) Shock wave thermal radiation peaks
(4) Nitrogen dioxide formed in compressed hot air behind shock front absorbs radiation from core
(5) Shock wave decays: expanding fireball radiates

Above: effect of ozone on early thermal radiation emission from a nuclear explosion. The first graph above shows the thermal radiation calculated by computer when ozone is ignored, while the second shows how it reduces the (mainly ultraviolet) radiation emission from the very hot fireball at early times, before the shock wave has formed and penetrated through the 'veil' or shell of ozone caused by the intense high energy X-ray and gamma radiation interacting with the air just around the fireball. (*Thermal Radiation From Nuclear Weapons,* Defense Nuclear Agency, February 1991.)

The fact that nuclear explosions *produce* ozone was first published in paragraph 6.26 on page 190 of the 1950 U.S. Department of Defense book, *The Effects of Atomic Weapons:* 'there may be some absorption of ultraviolet radiation by ozone which is produced by interaction of gamma rays from the atomic explosion with atmospheric oxygen.' **Herman Hoerlin states on page 43 of his 1976 Los Alamos report LA-6405 *United States High Altitude Test Experiences:* 'significant amounts of ozone are produced in sea-level explosions.'** (Hoerlin cites as reference: **H. E. DeWitt, *A Compilation of Spectroscopic Observations of Air Around Atomic Bomb Explosions,* Los Alamos Scientific Laboratory report LAMS-1935, June 1955**.) However, since the time that was written, full calculations have been performed which show that high altitude nuclear detonations (above 100 km altitude) produce large excess amounts of ozone, strengthening rather than depleting the ozone layer. Finally, sampling of the cloud of a 1976 atmospheric Chinese megaton range test showed confirmed that there was no ozone depleting nitrogen dioxide: it reacts with water vapour to form nitric acid, instead of destroying ozone! Anyway, nitrogen dioxide is only formed in high pressure shock waves from low altitude detonations, not from high altitude bursts, which produce an excess of ozone.

The ozone destruction lie

The U.S. Department of Defense book *The Effects of Atomic Weapons* reported in 1950 on page 183 that 20 kt nuclear air bursts near sea level produce 100 tons of nitrogen dioxide (NO_2) or 5 tons per kiloton, causing the flame-like red-brown colour of the fireball. The pressure and temperature of the shock front converts about 1% of the air it contains into nitrogen dioxide when it cools to 2000 K, below which no further nitrogen dioxide is formed. The shock waves around bolts of lightning in thunderstorms also produce nitrogen dioxide, and it is quickly transformed into nitric acid, causing the natural acidity (pH 4.5) of thunderstorm rain. Thunderstorms produce 100,000 tons of nitric acid daily.

Ozone (O_3) is created in the stratosphere in part by the action of ultraviolet light with wavelengths less than 0.24 microns upon molecular oxygen (O_2):

$3O_2$ + ultraviolet -> $2O_3$

Nitrogen oxide (NO) acts as a catalyst to break down ozone in the atmosphere. The reaction requires the energy of sunlight:

$2O_3 + NO + O$ + sunlight -> $3O_2 + NO + O$.

This is the principal cause of destruction of stratospheric ozone. Nitrogen oxide (NO) is naturally produced in the upper atmosphere (the thermosphere at 90-120 km altitude) by sunlight at the mean rate of 73,000 metric tons per hour!

In the troposphere (below the stratosphere), ozone is also destroyed by the reaction with sunlight:

$O_3 + H_2O$ + sunlight -> O_2 + 2OH,

Where OH is the hydroxyl radical (negatively charged) which is a vital catalyst in other reactions. A catalyst is defined as a vital component of a chemical reaction that is nevertheless returned to its original state at the end of a reaction, so that it is able to endlessly function without being permanently modified. (Therefore, chemical reaction formulae containing catalysts should never have the catalyst deleted from both sides of the reaction to 'simplify' the equation, because that will produce a false reaction that will not work!) Nitrogen oxide, NO, is also an essential catalyst in the creation of ozone in the troposphere from carbon monoxide (CO) and methane (CH_4), both of which exist in the troposphere in concentrations of several parts per million of air. The CO reaction creating ozone requires the energy of sunlight and is given by:

$CO + 2O_2 + OH + NO$ + sunlight -> $CO_2 + O_3 + OH + NO$.

If there is an insufficient concentration of the NO catalyst present, ozone is actually *destroyed* by CO, since the following reaction is then favoured:

$CO + O_3 + OH + O_2$ -> $CO_2 + OH + 2O_2$.

This reaction predominates in the atmosphere today, since the concentration of NO is less than 0.025% of the concentration of ozone. If the concentration of NO were raised above 0.025% of the ozone concentration, then this rate of destruction of ozone would be overtaken by the rate of creation of ozone using the NO catalytic effect.

With CH_4, the ozone creation reaction, which again requires sunlight, is represented by:

$CH_4 + 4O_2 + OH + 2NO$ -> $CO + H_2 + H_2O + 2O_3 + OH + 2NO$.

Finally, ethane (C_2H_6) in the troposphere racts with sunlight to produce ozone if NO is present:

$C_2H_6 + 10(O_2) + 2OH + 5NO$ + sunlight -> $2\ H_2O + H_2 + CO_2 + CO + 5(O_3) + 2OH + 5NO$.

The CO produced in this reaction is then available for other ozone reactions, already listed.

As a result of all these reactions, NO injections to the atmosphere at altitudes below 20 km actually *increase* the ozone layer concentration! For the mushroom cloud heights from the yields of stockpiled nuclear weapons today, the effect of a nuclear war would be to strengthen the ozone layer rather than to destroy it. High altitude bursts don't produce nitrogen oxides because they don't produce high-pressure air blast waves, although they too do produce ozone by the action of gamma radiation on oxygen! So the entire ozone destruction myth is a complete and utter fraud, both in theory and in extensive observed nuclear test evidence on the ozone layer.

Quite frequently during testing, an 'excuse' was made for the theoretical lies, that the ozone layer is naturally highly variable, masking any effect from the hundreds of megatons of atmospheric tests. Duh! Even if it were true (which it is not) that the ozone layer is slightly damaged by a nuclear war of hundreds of megatons (as known from testing data), what is the significance of such slight damage when the concentration is so naturally variable that it masks the effect anyway?

In a slightly different context, but to give some feel for what the nuclear effects exaggeration hype is about, see what Dr John Maddox, editor of *Nature,* wrote in his editorial in 1983 (vol. 312, p. 593) about the 'nuclear winter' scandal ('hype' was Maddox's own word for it!) from the TAPPS (the 'nuclear winter' pseudo-scientific propaganda group consisting of Richard Turco, Carl Sagan, et al.): they got publicity by means of handing over $50,000 to a public relations company (the funding came from the Kendall Foundation). This is how political pseudo-science is marketed. Caveat emptor!

Professor Brian Martin (then a physicist at the Department of Mathematics, Faculty of Science, Australian National University, Canberra, but now he is Professor of Social Sciences in the School of Social Sciences, Media and Communication at the University of Wollongong), **'Critique of Nuclear Extinction', published in *Journal of Peace Research,* Vol. 19, No. 4, pp. 287-300 (1982):**

'The idea that global nuclear war could kill most or all of the world's population is critically examined and found to have little or no scientific basis. A number of possible reasons for beliefs about nuclear extinction are presented, including exaggeration to justify inaction, fear of death, exaggeration to stimulate action, the idea that planning is defeatist, exaggeration to justify concern, white western orientation, the pattern of day-to-day life, and reformist political analysis. Some of the ways in which these factors inhibit a full political analysis and practice by the peace movement are indicated. Prevalent ideas about the irrationality and short duration of nuclear war and of the unlikelihood of limited nuclear war are also briefly examined.'

The U.S. Arms Control and Disarmament Agency report in 1975, *Worldwide Effects of Nuclear War,* incorrectly asserted that:

'It has been estimated that a 10,000-megaton war with half the weapons exploding at ground level would tear up some 25 billion cubic meters of rock and soil, injecting a substantial amount of fine dust and particles into the stratosphere. This is roughly twice the volume of material blasted loose by the Indonesian volcano, Krakatoa, whose explosion in 1883 was the most powerful terrestrial event ever recorded. Sunsets around the world were noticeably reddened for several years after the Krakatoa eruption, indicating that large amounts of volcanic dust had entered the stratosphere.'

This is false because 25,000,000,000 cubic metres of rock and soil per 10,000 megatons, with an average density of 2 tons per cubic metre, implies 5,000 tons of lofted fallout material per kiloton. **As we saw in a previous post, the specific activity of fallout (fraction of bomb per kg of fallout debris) was extensively measured (although all this kind of vital fallout results were kept secret for some crazy reason). The 3.53 Mt *ZUNI* coral land surface burst and 5.01 Mt *TEWA* coral reef shots produced 136 and 210 metric tons of fallout per total yield kiloton**, respectively (Rhodes in his book on the H-bomb confused the entire crater ejecta mass for the fallout mass, as exposed above). **For the Nevada desert, Dr Carl F. Miller's 1963 Stanford Research Institute report *Fallout and Radiological Countermeasures, vol. 1,* estimated similar amounts of fallout mass per kiloton, around 200 tons per kiloton of yield**. Hence, the U.S. Arms Control and Disarmament Agency exaggerated the mass of lofted fallout debris by at least a factor of 25. (In fact, a lot of the heavier particles reside in the stem of the mushroom and never make it into the stratosphere, so the exaggeration is even bigger than a factor of 25.)

‘During World War II many large cities in England, Germany, and Japan were subjected to terrific attacks by high-explosive and incendiary bombs. Yet, when proper steps had been taken for the protection of the civilian population and for the restoration of services after the bombing, there was little, if any, evidence of panic. It is the purpose of this book to state the facts concerning the atomic bomb, and to make an objective, scientific analysis of these facts. It is hoped that as a result, although it may not be feasible completely to allay fear, it will at least be possible to avoid panic.’

– **Dr George Gamow (the big bang cosmologist)**, Dr Samuel Glasstone, DSc (Executive Editor of the book), and **Professor Joseph O. Hirschfelder**, ***The Effects of Atomic Weapons,* Chapter 1, p. 1, Paragraph 1.3, U.S. Department of Defense, September 1950.**

‘The consequences of a multiweapon nuclear attack would certainly be grave ... Nevertheless, recovery should be possible if plans exist and are carried out to restore social order and to mitigate the economic disruption.’

- Philip J. Dolan, editor of ***Nuclear Weapons Employment* FM 101-31** (1963), *Capabilities of Nuclear Weapons* DNA-EM-1 (1972), and *The Effects of Nuclear Weapons* (1977), Stanford Research Institute, Appendix A of the **U.S. National Council on Radiological protection (NCRP) symposium *The Control of Exposure to the Public of Ionising Radiation in the Event of Accident or Attack,* 1981.**

‘Suppose the bomb dropped on Hiroshima had been 1,000 times as powerful ... It could not have killed 1,000 times as many people, but at most the entire population of Hiroshima ... [regarding the hype about various nuclear "overkill" exaggerations] there is enough water in the oceans to drown everyone ten times.’

- Professor Brian Martin, PhD (physics), 'The global health effects of nuclear war', *Current Affairs Bulletin,* Vol. 59, No. 7, December 1982, pp. 14-26.

‘The purpose of a book is to save people [the] time and effort of digging things out for themselves. ... we have tried to leave the reader with something tangible – what a certain number of calories, roentgens, etc., means in terms of an effect on the human being. ... we must think of the people we are writing for.’

– Dr **Samuel Glasstone**, DSc, **letter dated 1 February 1957 to Colonel Dent L. Lay, Chief, Weapons Effects Division, U.S. Armed Forces Special Weapons Project, Washington, D.C., pages 2 and 4, concerning the preparation of *The Effects of Nuclear Weapons*.**

From Dr Glasstone's *Effects of Nuclear Weapons* (1962/64 ed., page 631): ‘At distances between 0.3 and 0.4 mile from ground zero in Hiroshima the average survival rate, for at least 20 days after the nuclear explosion, was less than 20 percent. Yet in two reinforced concrete office buildings, at these distances, almost 90 percent of the nearly 800 occupants survived more than 20 days, although some died later of radiation injury. Furthermore, of approximately 3,000 school students who were in the open and unshielded within a mile of ground zero at Hiroshima, about 90 percent were dead or missing after the explosion. But of nearly 5,000 students in the same zone who were shielded in one way or another, only 26 percent were fatalities. ... survival in Hiroshima was possible in buildings at such distances

that the overpressure in the open was 15 to 20 pounds per square inch. ... it is evident ... that the area over which protection could be effective in saving lives is roughly eight to ten times as great as that in which the chances of survival are small.'

'It is true that the Soviets have tested nuclear weapons of a yield higher than that which we thought necessary, but the 100-megaton bomb of which they spoke two years ago does not and will not change the balance of strategic power. The United States has chosen, deliberately, to concentrate on more mobile and more efficient weapons, with lower but entirely sufficient yield ...' - President John F. Kennedy in his television broadcast to the American public, 26 July 1963.

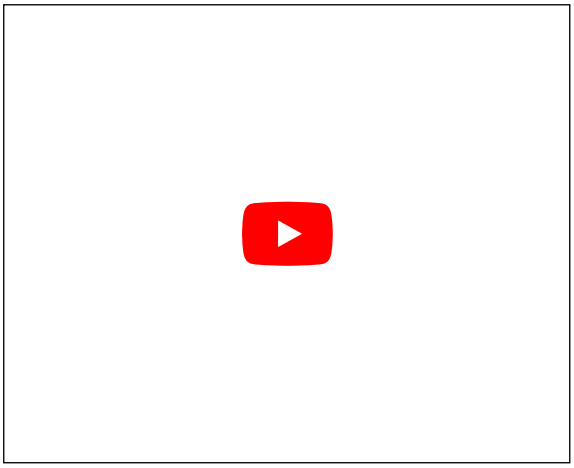
'The expression of dissenting views may not seem like much of a threat to a powerful organization, yet sometimes it triggers an amazingly hostile response. The reason is that a single dissenter can puncture an illusion of unanimity. ...

'Suppression of intellectual dissent can inflict large costs on society. Among those suppressed have been the engineers who tried to point out problems with the Challenger space shuttle that caused it to blow up. More fundamentally, suppression is a denial of the open dialogue and debate that are the foundation of a free society. Even worse than the silencing of dissidents is the chilling effect such practices have on others. For every individual who speaks out, numerous others decide to play it safe and keep quiet. More serious than external censorship is the problem of self-censorship.'

— Professor Brian Martin, University of Wollongong, 'Stamping Out Dissent', Newsweek, 26 April 1993, pp. 49-50

This problem leads to the publication of inaccurate, nuclear effects hyping papers, which are are of course totally *non-threatening to the mainstream lying dogma,* which is why so many of them get through peer-review politics and are published by lying publications.

Above: the 1.2 kt 1955 *Teapot-Ess* shallow underground nuclear test effects, such as would occur with an earth-penetrator warhead. There is total suppression of thermal radiation (the cratered dirt ejecta which is thrown out first shields and then cools the fireball, as well as absorbing most of the initial nuclear radiation). Using low fission yield weapons for this could avoid collateral damage.



Above: basic principles of nuclear weapons and their safety systems against nuclear accidents.

'The evidence from Hiroshima indicates that blast survivors, both injured and uninjured, in buildings later consumed by fire [caused by the blast overturning charcoal braziers used for breakfast in inflammable wooden houses filled with easily ignitable bamboo furnishings and paper screens] were generally able to move to safe areas following the explosion. Of 130 major buildings studied by the U.S. Strategic Bombing Survey ... 107 were ultimately burned out ... Of those suffering fire, about 20 percent were burning after the first half hour. The remainder were consumed by fire spread, some as late as 15 hours after the blast. This situation is not unlike the one our computer-based fire spread model described for Detroit.'

- Defense Civil Preparedness Agency, U.S. Department of Defense, *DCPA Attack Environment Manual, Chapter 3: What the Planner Needs to Know About Fire Ignition and Spread,* report CPG 2-1A3, June 1973, Panel 27.

Update on 19 October 2009: PhD research student Melissa Smith of the Centre for the History of Science, Technology and Medicine at University of Manchester, has just had published a vital new scholarly paper on the role of the **British Home Office Scientific Advisory Branch nuclear test research programme in shaping the 'Protect and Survive' advice** (one fragment of which was actually published as a paper in the little read **1965 U.S. National Academy of Sciences civil defense compendium, *Proceedings of the symposium on protective structures for civilian populations,*** *giving experimental data on the 1.25 MeV mean gamma Co-60 radiation protection factors for emergency 'core shelters' inside typical British homes)*:

Melissa Smith, 'Architects of Armageddon: the Home Office Scientific Advisers' Branch and civil defence in Britain, 1945–68', *British Journal for the History of Science* (published by Cambridge University Press), 8 October 2009.

Abstract:

'In 1948, in response to the perceived threat of atomic war, the British government embarked on a new civil defence programme. By the mid-1950s, secret government reports were already warning that this programme would be completely inadequate to deal with a nuclear attack. The government responded to these warnings by cutting civil defence spending, while issuing apparently absurd pamphlets advising the public on how they could protect themselves from nuclear attack. Historians have thus far sought to explain this response with reference to high-level decisions taken by policymakers, and have tended to dismiss civil defence advice as mere propaganda. This paper challenges this interpretation by considering the little-known role of the Home Office Scientific Advisers' Branch, a group of experts whose scientific and technical knowledge informed both civil defence policy and advice to the public. It explores both their advisory and research work, demonstrating their role in shaping civil defence policy and showing that detailed research programmes lay behind the much-mocked government civil defence pamphlets of the 1950s and 1960s.'

This paper is an expanded version of the essay **awarded the Singer Prize of the British Society for the History of Science for 2008:**

> **Ms Melissa Smith wins 2008 Singer Prize**
>
> **The BSHS Singer Prize judging panel has selected the essay entitled "Architects of Armageddon: Scientific advisers and**

civil defence in Britain, 1945-68" by Ms Melissa Smith (CHSTM, University of Manchester), as the winner of the 2008 Singer Prize. The judges were impressed by the flair and ambition of the essay, by its critical engagement with the existing literature on post-war British science and government, and by its extensive use of primary archival sources. They found the essay original, well written, engaging and informative.

We have **also blogged about this research**. As **previously explained,** the government should have published **nuclear weapons effects research based on nuclear test data in order to substantiate the scientific basis for civil defense.** Hiding the *factual scientific evidence for public civil defense advice behind a solid wall of secrecy* is a guaranteed way to allow the advice to be falsely ridiculed and ignored by ignorant 'scientists' with a political agenda, thereby maximising the scale of tragedy in the event that civil defense is needed in a disaster. Allowing the popular media to wrongly discredit civil defence also increases the risk of war by encouraging dictators and terrorists to spend money trying to get hold of weapons of mass destruction in the belief that there is no effective defense against such weapons. It's vital to publish the facts!

DCPA Attack Environment Manual -

Capabilities of Nuclear Weapons_Part I -

Capabilities of Nuclear Weapons_Part II -

Update (12 November 2009):

Since the 1977 update by **Glasstone and Dolan, extensive new updates to EM-1 for a further revised edition** of *The Effects of Nuclear Weapons* have not actually been published with unlimited public distribution, due to President Carter's 1979 executive order which transferred responsibility for civil defense from the jurisdiction of the U.S. Department of Defense's Defense Civil Preparedness Agency to the new agency (which is not an Agency of the U.S. Department of Defense, and is not concerned with the analysis of nuclear weapons test effects data), the Federal Emergency Management Agency. However, the **February 1997 U.S. Department of Defense's Defense Special Weapons Agency 0602715H RDT&E Budget Item Justification Sheet (R-2 Exhibit) states that a revision of Glasstone and Dolan's unclassified *Effects of Nuclear Weapons* was budgeted for 1997-9:**

"FY 1997 Plans: ... Provide text to update Glasstone's book, *The Effects of Nuclear Weapons,* the standard reference for nuclear weapons effects. ... Update the unclassified textbook entitled, *The Effects of Nuclear Weapons.* ... Continue revision of Glasstone's book, *The Effects of Nuclear Weapons,* the standard reference for nuclear weapons effects. ... FY1999 Plans ... Disseminate updated *The Effects of Nuclear Weapons.*"

The new publications are either classified or unclassified with limited distribution restrictions (e.g., **Bridgman's *Introduction to the Physics of Nuclear Weapons Effects,* which includes several chapters on nuclear weapons design to enable initial radiation outputs to be calculated precisely**) which prevents up-to-date basic nuclear effects information to justify civil defense against the latest nuclear threats from being widely disseminated; the books are printed for use only by government agencies. The problem with this approach is that widespread public understanding of the best information for civil defense countermeasures is prevented.

The key pages from the U.S. Government's 456 pages long September 1950 edition of *The Effects of Atomic Weapons* are linked here (82.7 MB PDF file download). Notice that it contains extensive data on the underwater *BAKER* test base surge and also rainout radiation patterns not to mention detailed predictions of shore innundations by the water waves created, pertinent to the effects of radiation and water waves from a terrorist shallow underwater nuclear detonation below the waterline inside a ship in a harbor or off the coast of city, which is excluded from all further editions, and it also contains *two* chapters dealing with civil defense countermeasures: Chapter X, *Decontamination,* and Chapter XII, *Protection of Personnel.* The next edition was the **June 1957 *Effects of Nuclear Weapons,* key pages of which are linked here (90.8 MB download),** which only contains one civil defense chapter: Chapter XII, *Protective Measures* (although it also contains good civil defense countermeasures in some other chapters, for example pages 318-322 which describe the 1953 Nevada nuclear tests on ignition and the conclusions for civil defense). The problem with reducing the association of nuclear weapon test effects data and civil defense countermeasures is that the latter will not be taken seriously by the public (in fact they will be ridiculed by the media and ignored by the public) without proper justification, i.e., proof that nuclear weapons tests have been done to validate the civil defense countermeasures.

Weinberger's endorsement for the Star Wars SDI 'Nuclear Explosion Pumped X-Ray Laser', which was tested underground in Nevada as *CABRA* shot on March 26, 1983, resulted in marginally positive readings but the later research on the weapon was highly successful in leading to **'a superior mammographic technique for early detection of breast cancer.' Quoted in: *Legacy of the X-Ray Laser Program,* published in the Lawrence Livermore National Laboratory magazine, *Energy and Technology Review (E&TR),* November 1994, page 14, linked here.** See also Joseph Nilsen, *Legacy of the X-Ray Laser Program,* Lawrence Livermore National Laboratory, report UCRL-LR-114552, 1993.

Before 9/11, Weinberger was quizzed by skeptical critics on BBC News Talking Point on Friday, 4 May, 2001, *Caspar Weinberger quizzed on new US Star Wars ABM plans:*

> 'The [ABM] treaty was in 1972 ... The theory ... supporting the ABM treaty ... that it will prevent an arms race ... is perfect nonsense because we have had an arms race all the time we have had the ABM treaty, and we have seen the greatest increase in proliferation of nuclear weapons that we have ever had. We are up to 7,000 plus, the Russians are up to 6,900 plus. On intercontinental missiles the Russians have 23,000 nuclear warheads. So the ABM treaty preventing an arms race is total nonsense. ... I don't know how any networking is going to prevent North Korea from doing everything it can to get more nuclear weapons than they have now particularly when China and Russia are perfectly willing to sell them all of the technology required. Intelligence sources aren't going to prevent a country from doing it.
>
> 'You have to understand that without any defences whatever you are very vulnerable. **It is like saying we don't like chemical warfare - we don't like gas attacks - so we are going to give up and promise not to have any defences ever against them and that of course would mean then we are perfectly safe. ...**
>
> 'The Patriot was not a failure in the Gulf War - the Patriot was one of the things which defeated the Scud and in effect helped us win the Gulf War. One of two of the shots went astray but that is true of every weapon system that has ever been invented. ...
>
> **'The fact that a missile defence system wouldn't necessarily block a suitcase bomb is certainly not an argument for not proceeding with a missile defence when a missile that hits can wipe out hundreds of thousands of lives in a second**. ...
>
> 'The **curious thing about it is that missile defence is not an offensive weapon system - missile defence cannot kill anybody. Missile defence can help preserve and protect your people and our allies, and the idea that you are somehow endangering people by having a defence strikes me almost as absurd as saying you endanger people by having a gas mask in a gas attack.** ...
>
> 'My worry is when we have Russia and China being the most vociferous opponents of the plan to abandon the ABM treaty and go to a defensive system. Why are they so vociferous about their hatred of the idea of having a defensive system? **The answer, I am afraid is rather clear - it is because they have offensive plans that they think would be thwarted by a defensive system and so they are doing everything they can to try to block it.** ...
>
> ***'Tensions are on the rise because very aggressive powers know that the one system that will never be defended against if we follow the ABM treaty ... are these nuclear and chemical warhead carrying missiles. Now if you tell an aggressive nation that is the one system weapons that is never going to be defending against - what are they going to do? They are going to make every effort to get that kind of system of weapons. That is what is happening and that is why there is an increased tension. The greatest force for proliferation is the ABM treaty.***
>
> 'So that is why it seems to me that it is vital that we get rid of the ABM treaty concept as soon as possible and proceed with the construction of an effective defence to protect ourselves and our allies. ...
>
> 'President Bush said that we were going ahead with the defensive system but we would make sure that nobody felt we had offensive intentions because we would accompany it by a unilateral reduction of our nuclear arsenal. It seems to me to be a rather clear statement that proceeding with the missile defence system would mean fewer arms of this kind.
>
> 'You have had your arms race all the time ABM treaty was in effect and now you have an enormous accumulation and increase of nuclear weapons and that was your arms race promoted by the ABM treaty. Now if you abolish the ABM treaty you are not going to get another arms race - *you have got the arms already there* - and if you accompany the missile defence construction with the unilateral reduction of our own nuclear arsenal then it seems to me you are finally getting some kind of inducement to reduce these weapons.'

How Britain's bungling Foreign Minister of 1914, Lord Grey, helped to diplomatically cause World War I, and then sowed the seed for World War II with his lying excuse that a gun shot during an arms race caused World War I

"... small matters are only the symptoms of the dangerous disease, and are only important for that reason. ... long antagonisms express themselves in trifles."

- Winston S. Churchill, *The World Crisis, 1911-1914,* Charles Scribner's Sons, vol. I, 1923, p. 52.

Quite often, World War I is alleged to have been the result of a war escalating from one bullet shot during an arms race between European powers, not as the result of political stupidity and agreements on pieces of paper like World War II. Actually, World War I was not started by either weapons or the arms race in Europe, but by politicians and treaties. In the **First Balkan War of 1912-3**, the **Ottoman Empire** was driven out of the Balkans by Bulgaria, Serbia and Greece. Serbia then fought the other Balkan states, doubling its territory in the **Second Balkan War**. The Serbians (whose ally was Russia) then threatened Bosnia (whose ally was Austria). In response to the Serbian-Russian threat to Bosnia, the Austrians decided to help defend Bosnia by holding military manoeuvres there. The Austrian Archduke

Ferdinand was inspecting those troops in Sarajevo, Bosnia when a Serbian (Gavrilo Princip) assassinated him and his wife on June 28, 1914. So it was a dispute between Bosnia and Serbia, but the heir to the Austrian throne was assassinated.

In response, on July 23, Austria sent an unacceptable ultimatum to Serbia and then broke off diplomatic relations with it on July 25. In order to protect its ally Serbia from Austria, Russia mobilized some of its soldiers the next day, and on July 31 both Russia and Austria had fully mobilized. Germany sided with Austria against the Russian mobilization. Germany declared war on Russia on August 1, which was the first declaration of war. In December 1912 the Chiefs of Staff of the German Kaiser had argued that Germany needed a war with Russia *before* Russia had completed its military modernisation programme, which would have made it an unacceptable threat. So Germany had, since 1912, been looking for an excuse to declare war on Russia, not because it was in an arms race with Russia, but because it *preferred the idea of having a war with Russia to having an arms race to maintain the peace*. This is similar to the aggressive role of Germany in World War II, and also to the role of Japan in attacking Pearl Harbor in 1941 to start a war with America before further expansion of the American Navy. **The reason for the surprise attack was a simple calculation by the Imperial Japanese navy, which predicted that at the end of 1941 Japan would have 70 percent of the warship strength of America, but this strength: 'would fall to 65 percent in 1942, to 50 percent in 1943, and to a disastrous 30 percent in 1944.' (Source: H. P. Willmott, Empires in the Balance, Annapolis, 1982, p. 62.)**

Barbara W. Tuchman's 1962 Pulitzer Prize-winner, *The Guns of August - August 1914,* begins by explaining the roots of World War I: how Germany had become war obsessed by 1914, while Britain had become complacent that a European war was impossible because of the interdependence of trade, peace treaties, mutual defence agreements, etc., so no nation would risk economic ruin by starting a war. In Germany, General Friedrich von Bernhardi wrote the 1914 best-seller *Germany and the Next War*. Tuchman says on pages 24-25 (1964 Four Square edition) that von Bernhardi's 1914 book was the forerunner to Hitler's *Mein Kampf,* in gluing together the military philosophy of Karl von Clausewitz (that war is the extension of politics) to the evolutionary biology of Charles Darwin (that the evolution of improved forms of life on this planet is due to the "struggle for existence and the survival of the fittest") to "prove" that war "is a biological necessity": "Three of its chapter titles, *The Right to Make War, The Duty to Make War,* and *World Power or Downfall,* sum up its thesis. ... Nations, he said, must progress or decay; 'there can be no standing still,' and Germany must choose 'world power or downfall'."

But at the other extreme, British author Normal Angell had published a diametrically opposite thesis on war in his bestselling book *The Great Illusion: A Study of the Relation of Military Power to National Advantage* (Putnam's, New York, 1913, 4th ed.). Tuchman says on page 24: "A new book, *The Great Illusion* by Normal Angell, had just been published, which proved that war was impossible. By impressive examples and incontrovertible argument Angell showed that in the present financial and economic interdependence of nations, the victor would suffer equally with the vanquished; therefore war had become unprofitable; therefore no nation would be so foolish as to start one. Already translated into eleven languages, *The Great Illusion* had become a cult."

On August 3, 1914, after Belgium refused passage to the German army (which wanted to outflank its old enemy, France), France declared war on Germany to protect Belgium. When Germany invaded Belgium on August 4, Britain was forced to declare war on Germany under the terms of a protection treaty made between Britain and Belgium in 1839. *So it wasn't an arms race or a bullet that caused World War I, it was a domino effect of old political treaties and mutual defence agreements between countries on pieces of paper, which were supposed to preserve the peace but instead caused the countries to be sucked into war.*

The stupid political agreements to deter war simply failed and trapped other countries into declaring war; it was not the failure of deterrence in an arms race (contrary to modern propaganda). As Kennedy, the future U.S. President wrote (when he was working in the American Embassy in London in the late 1930s and witnessed the manipulation of World War I propaganda for disarmament), the causes of war *go deeper than armaments:*

“The [excuse] statement of Lord Grey, British Foreign Minister [responsible for getting Britain into World War I], made in 1914, that, ‘The enormous growth of armaments in Europe, the sense of insecurity, and fear caused by them; it was these that made war inevitable,’ had a tremendous effect on post-war British opinion. Armaments were looked upon as something horrible, as being the cause of war, not a means of defense. ... but England’s failure to rearm has not prevented her from becoming engaged in a war; in fact, it may cost her one. The causes of war go deeper than armaments.”

- John F. Kennedy (1917-63), *While England Slept,* Wilfred Funk, Inc., New York, 1940, reprinted by Greenwood, 1981, pp. 6-7.

This is a very important point. In his personal political history of World War I, ***War Memoirs* (1933),** David **Lloyd George** does not mince words in his extensive blame of **Grey (1862-1933)** for the bungling political incompetence which caused World War I. Grey's famous claim that Kennedy quotes,

"The enormous growth of armaments in Europe, the sense of insecurity, and fear caused by them; it was these that made war inevitable",

was *in fact just an excuse for his own blunders*. Grey's complete political incompetence as British Foreign Minister helped cause World War I; moreover, his excuse (blaming weapons instead of his own incompetence) sowed the lie that led to World War II. Wikipedia explains briefly what Lloyd George's 1933 *War Memoirs* document at length:

"In 1914, Grey played a key role in the July Crisis leading to the outbreak of World War I. His attempts to mediate the dispute between Austria-Hungary and Serbia by a "Stop in Belgrade" came to nothing, owing to the tepid German response. He also failed to clearly communicate to Germany that a breach of the treaty not merely to respect but to protect the neutrality of Belgium — of which both Britain and Germany were signatories — would cause Britain to declare war against Germany. When he finally did make such communication German forces were already massed at the Belgian border and Helmuth von Moltke convinced Kaiser Wilhelm II it was too late to change the plan of attack. Thus when Germany declared war on France (3 August) and broke the treaty by invading Belgium (4 August), the British Cabinet voted almost unanimously to declare war on August 4, 1914."

Barbara W. Tuchman’s Pulitzer Prize-winning 1962 book, *The Guns of August,* **which reportedly influenced Kennedy’s handling of the Cuban Missiles Crisis that year,** records that Lord Grey on 3 August 1914 obscenely begged Parliament for war to preserve imperialistic “self-respect” and “financial security” as follows (page 141 of the Four Square edition, London, 1964):

“I ask the House from the point of view of British interests to consider what may be at stake. ... if, in a crisis like this, we run away ... we should, I believe, sacrifice our respect and good name and reputation before the world and should not escape the most serious and grave economic consequences.”

This shows clearly that not weapons but politicians cause wars, and that war is a political act. Karl von Clausewitz stated in *On War* in 1832:

"The War of a Community - of whole Nations, and particularly of civilised Nations - always starts from a political condition, and is called forth by a political motive. It is, therefore, a political act."

Both the Nazis and Soviet Union understood Clausewitz, although democracies have often been embarrassed by him and have usually tried to pretend that wars are caused purely by naughty weapons, not by politicians (the patronising and sneering attack of lawyer James Newman against Herman Kahn's *On Thermonuclear War* in a notorious *Scientific American* book review is a typical example of the pseudo-moralistic, elitist and unethical attitude). General von Blomberg's foreword to the 1936 edition of Clausewitz endorsed his view, as did Lenin when he wrote "politics is the reason, and war is only the tool" (quoted by Marshal V. D. Sokolovsky, et al., *Military Strategy: Soviet Doctrine and Concepts,* Praeger, London, 1963).

Having thus engaged in World War I in order to somehow preserve Britain's "respect", "reputation" and "economy", Lord Grey wrote on page 285 of vol. II of his 1925 book *Twenty-Five Years* that the lesson to be learned from World War I is that nations must try:

“to find at least one common ground on which they should come together in confident understanding: an agreement that, in the disputes between them, war must be ruled out as a means of settlement that entails ruin.”

Grey's pontificating is the backdrop to the appeasement of fascist states terrorising the Jews and others in the 1930s. Here you find the reason why Hitler was able to do what he pleased for six years. Here you see the reason why weapons effects were exaggerated to “justify” appeasement, without opposition for fear of wanting war. Here you see why a critic of Hitler in pre-war Britain would be visited by a leading member of the British government and accused point-blank of being a threat to national security. *Here you see why collaboration with evil was widely praised.*

However, this does not mean that Grey's critic Lloyd George was more competent than Grey; Lloyd George believed falsely that diplomacy can avert war and that Grey had simply bungled the diplomacy. Later, Hitler taught him *hot air cannot prevent war.*

Above: colour film of former World War I British Prime Minister David Lloyd George cavorting with Adolf Hitler in 1936, and seeing Hitler's **autobahn (the world's first motorways).** Lloyd George (who was a cabinet minister in 1914 when World War I started and Prime Minister later in the war), condemned British Foreign Minister Lord Grey in his 1933 *War Memoirs* for causing World War I by fumbling incompetence in 1914. In August 1936, Lloyd George tried to be less incompetent at averting war himself when he met Hitler at Berchtesgaden and tried to resolve the political differences between Britain and the Nazis diplomatically. **As he did with everybody else who met him, Hitler completely and utterly brainwashed Lloyd George with lies, irrelevant (but impressive) Nazi achievements in civil engineering and overcoming poverty, and sheer personality (Hitler greeted Lloyd George with enthusiastic flattery: "Here is the man who won the war!").**

Lloyd George wrote in the November 17, 1936 issue of the London *Daily Express* newspaper that Hitler:

"is a born leader of men. A magnetic, dynamic personality with a single-minded purpose, a resolute will and a dauntless heart. He is not merely in name but in fact the national Leader. He has made them safe against potential enemies by whom they were surrounded. He is also securing them against that constant dread of starvation, which is one of the poignant memories of the last years of the War and the first years of the Peace. Over 700,000 died of sheer hunger in those dark years. You can still see the effect in the physique of those who were born into that bleak world. The fact that Hitler has rescued his country from the fear of a repetition of that period of despair, penury and humiliation has given him unchallenged authority in modern Germany. As to his popularity, especially among the youth of Germany, there can be no manner of doubt. The old trust him; the young idolise him. It is not the admiration accorded to a popular Leader. It is the worship of a national hero who has saved his country from utter despondency and degradation. It is true that public criticism of the Government is forbidden in every form. That does not mean that criticism is absent. I have heard the speeches of prominent Nazi orators freely condemned. But not a word of criticism or of disapproval have I heard of Hitler. He is as immune from criticism as a king in a monarchical country. He is something more. He is the George Washington of Germany - the man who won for his country independence from all her oppressors. To those who have not actually seen and sensed the way Hitler reigns over the heart and mind of Germany this description may appear extravagant. All the same, it is the bare truth. ... What Hitler said at Nuremberg is true. The Germans will resist to

the death every invader at their own country, but they have no longer the desire themselves to invade any other land."

Lloyd George of course had his first-hand impression of the Nazis revised. In 1938 he wrote another book, *The Truth About Peace Treaties* in which he blamed the Nazi aggression upon the French for effectively trying to starve the defeated Germans by the draconian terms of the Versailles Treaty (which Lloyd George himself helped to formulate) of June 29, 1918 which ended World War I six months later. The point here is that diplomacy and paper agreements were not a failure for want of trying; there were endless efforts to talk to Hitler and to get "peace treaties" signed by people. Trying to stop genocide by getting people to talk and agree to peace is like trying to stop crime by the same tactics: it misses the whole point. If you want to stop crime, you are just flattering yourself if you think you can get somewhere by talking to criminals or getting them to sign treaties (flattery is of course something politicians are very susceptible to).

Key earlier blog posts on this subject are linked **here**, **here**, **here**, **here**, **here**, and **here**.

Laws and agreements to prevent crime all suffer from the fundamental problem that *criminals ignore them,* or if pushed by fear of the consequences of violating the laws, then pretend to abide them, while breaking them secretly, so that *even in principle* crime can't be stopped or prevented by an "innocent until proved guilty" system of law. In the real world, no system of arms control and no disarmament agreements work perfectly, because terrorists seek to overcome them. This goes too for dictatorships, as shown by the examples of Hitler, the organization behind 9/11, the secret acquisition of nuclear weapons by South Africa in the 1980s, etc. Historically, **groupthink** on peaceful agreements, disarmament pacts, and laws has led to complacency and allowed problems to escalate ever further, as demonstrated by the **Munich Pact in 1938 and the events which led up to it from 1933. Chamberlain later claimed that by 1938 it was too late to avoid a serious war, and Britain was unprepared at that time anyway, so appeasement by then was possibly the best of all options, buying time for British rearmament and civil defence activities like gas masks to successfully deter a gas attack;** Hitler **should have been stopped much earlier than Munich, say in 1933-4, which would have averted a major war (as Herman Kahn argued in *On Thermonuclear War*).**

However, a close study of the facts discredit Chamberlain's assertion. First, despite the resources acquired by invasions, Nazi Germany only had a 6-weeks supply of munitions in September 1938, and the position of France was actually deteriorating relative to Germany: in other words, France should have acted rather than delayed since German armament was occurring faster than French armament. Furthermore, the combined naval power of France and Britain in September 1938 still outweighed that of Germany; *their relative weakness to Germany then was only in air power.* France had 1,454 aircraft, Britain 1,550, but the German Luftwaffe had 3,356, although these were mainly tactical, short-range aircraft incapable of reaching Britain from Germany, and Britain's Thames Estuary was already protected by a revolutionary, secret radar-guided air defense system. The figures from Appendix B of Stephen Roskill's *Hankey, Man of Secrets,* 1931-1963, Vol. III (Collins, London, 1974) such as 3,356 German aircraft is the *actual number,* contrasted to the A. I. Sitrep British intelligence report for 31 August 1938 which estimated a threat of only 2,650 German aircraft. *Hence, the information Chamberlain actually had available was even more favorable to the suggestion that Hitler could have been resisted at that time.* Germany had acquired many resources from its invasions, but in September 1938 it was still short of vital military resources such as oil and rubber. It was militarily prepared with only a 6-week munitions supply for a series of invasions, not to fight a World War. In August 1939, just before warfare started, Germany, Italy, France and Britain actually had 4,210, 1,531, 1,234, and 1,750 aircraft, respectively (ref.: Anthony P. Adamthwaite, *The Making of the Second World War,* George Allen and Unwin, London, 2nd ed., 1979, pp. 227-8). Hence, the appeasement at Munich in delaying the war gave a bigger advantage to the Nazis than to anyone else.

"At no time did Hitler threaten to initiate war against France and England. He simply threatened to 'retaliate' if they attacked him. The Munich crisis had an incredible sequel in March 1939. ... Hitler occupied the rest of Czechslovakia. The technique he used is such an obvious prototype for a future aggressor armed with H-bombs that it is of extreme value to all who are concerned with the problem of maintaining a peaceful and secure world ..."

- Herman Kahn, On Thermonuclear War, Princeton University Press, 1960, p. 403.

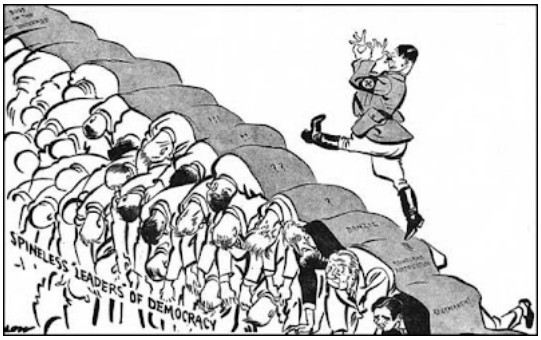
"I asked Hitler about one in the morning while we were waiting for the draftsmen whether he would care to see me for another talk ... I had a very friendly and pleasant talk, on Spain (where he too said he had never had any territorial ambitions), economic relations with S. E. Europe, and disarmament. I did not mention colonies, nor did he. At the end I pulled out the declaration which I had prepared beforehand and asked if he would sign it. As the interpreter translated the words into German Hitler said Yes I will certainly sign it. When shall we do it? I said 'now', and we went at once to the writing table and put our signatures to the two copies which I had brought with me."

- British Prime Minister Chamberlain, letter to his sister Hilda, on 2 October 1938.

"This morning I had another talk with the German Chancellor, Herr Hitler, and here is the paper which bears his name upon it as well as mine [*waves the piece of paper to the crowd - receiving loud cheers*]. Some of you, perhaps, have already heard what it contains ... My good friends, for the second time in our history a British Prime Minister has returned from Germany bringing peace with honour. I believe it is peace for our time."

- Neville Chamberlain on arriving at Heston Aerodrome, announcing the Munich deal with Hitler, conceding the Sudetenland region of Czechoslovakia to Nazi Germany.

Above: David Low's cartoon of Munich, published on 30 September 1938. It shows (from left) Hitler, appeaser British Prime Minister Chamberlain, appeaser French Prime Minister Edouard Daladier, Italian fascist dictator Benito Mussolini, and Soviet dictator Joseph Stalin standing in the doorway, captioned: "What, no chair for me?"



Above: **David Low's earlier illustration for the London *Evening Standard* newspaper of July 8, 1936, showing Hitler free to walk over the 'spineless leaders of democracy' (the steps of Hitler are labelled 'Rearmament', 'Rhineland fortified', 'Dantzig' ... 'Boss of the Universe').** The pathetic truth is that David Low was pretty much alone in attacking Hitler with cartoons, and the Nazis actually persuaded the British government to put pressure on Low's newspaper editors to make him tone down his cartoon attacks on the Nazis, for fear of upsetting Hitler *(what a complete travesty of the supposed "democratic freedom of the press" in Britain!):*

> **In 1936 during the Berlin Olympic Games Low received his first request to tone down his depiction of Hitler in the interests of "good relations between all countries".**
>
> **In 1937 the British Foreign Secretary Lord Halifax visited Germany and met with the Propaganda Minister Goebbels, who told him that Hitler was very sensitive to criticism in the British press, and he singled out Low for attention.**
>
> **Lord Halifax contacted the manager of the Evening Standard to see if Low could be toned down. He said:**
>
> **"You cannot imagine the frenzy that these cartoons cause. As soon as a copy of the Evening Standard arrives, it is pounced on for Low's cartoon, and if it is of Hitler, as it generally is, telephones buzz, tempers rise, fevers mount, and the whole governmental system of Germany is in uproar. It has hardly subsided before the next one arrives. We in England can't understand the violence of the reaction."**
>
> **His attempt to influence newspaper management was unsuccessful, so the Foreign Secretary then decided to speak with Low directly. At their meeting, this is how David Low described Lord Halifax's explanation.**
>
> **"Once a week Hitler had my cartoons brought out and laid on his desk in front of him, and he finished always with an explosion. That he was extremely sore; his vanity was badly touched... So the Foreign Secretary asked me to modify my criticism, as I say, in order that a better chance could be had for making friendly relations... The Foreign Secretary explained to me that I was a factor that was going against peace.' 'Do I understand you to say that you would find it easier to promote peace if my cartoons did not irritate the Nazi leaders personally?' 'Yes,' he replied. '...I said, "Well, I'm sorry." Of course he was the Foreign Secretary what else could I say? So I said, "Very well, I don't want to be responsible for a world war. But, I said "It's my duty as a journalist to report matters faithfully and in my own medium I have to speak the truth. And I think this man is awful. But I'll slow down a bit." So I did."**
>
> **Meanwhile Hitler within a month invaded Austria. Low felt vindicated and went back to his old ways. Low said:**
>
> **"...I was good for about three weeks. Then Hitler bounced in and invaded Austria, showing that he had given our Foreign Secretary a run-around, had taken him for a ride. I considered that let me out, so I resumed criticism."**
>
> **It was no surprise when after the war it was revealed that Low was high on the Nazi's death list.**
>
> **It wasn't only Hitler complaining about Low. In 1938 Prime Minister Neville Chamberlain singled out Low while appealing to newspapers to temper their critical commentary of Germany. Chamberlain said:**
>
> **"Such criticism might do a great deal to embitter relations when we on our side are trying to improve them. German Nazis have been particularly annoyed by criticisms in the British press, and especially by cartoons. The bitter cartoons of Low of the Evening Standard have been a frequent source of complaint."**

- http://hmmh.blogspot.com/2006/02/cartoonist-fought-hitler.html

Winston Churchill, who had been warning of the need to halt the "secret" Nazi armament programme since Hitler came to power, was similarly opposed as a "war-monger" by pacifist politicians in Parliament, backed by most of the mainstream media:

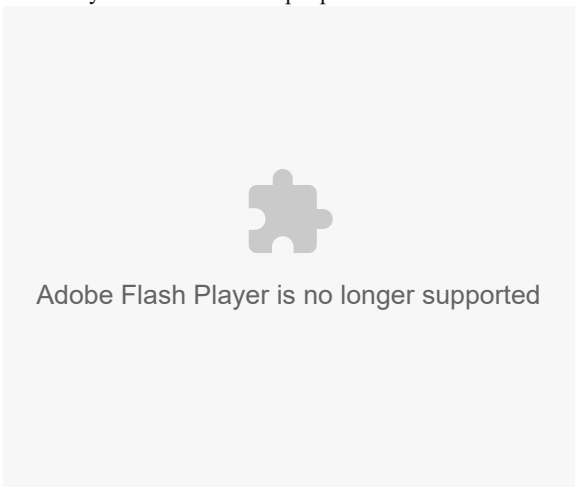
"The new appeasement was a mood of fear, Hobbesian in its insistence upon swallowing the bad in order to preserve some remnant of the good, pessimistic in its belief that Nazism was there to stay and, however horrible it might be, should be accepted as a way of life with which Britain ought to deal."

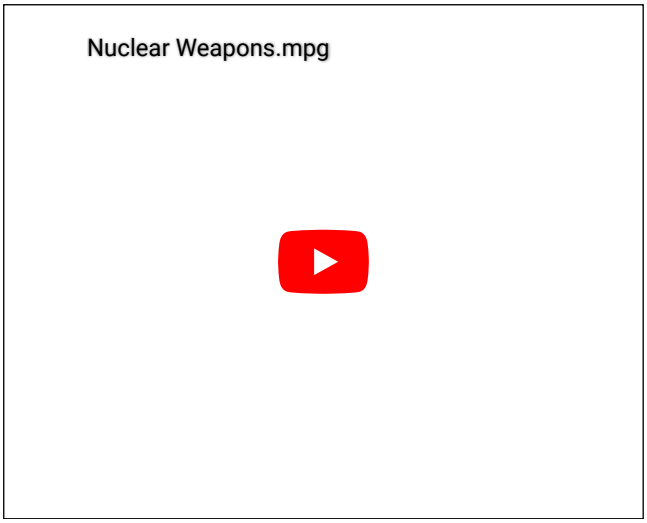
- Sir Martin Gilbert, *The Roots of Appeasement,* 1968.

War after the Cold War

After the Cold War, Harvard politican scientist Samuel Huntington addressed the problem of the next battleground in an article in *Foreign Affairs* and in an interview in the 28 June 1993 issue of *Time*. In ancient times, most wars were made between kings or tribes. Both twentieth century World Wars and the Cold War were between ideologies such as imperialism versus democracy or democracy versus dictatorships of fascism or communism. Since the fall of the Soviet Union, the nature of war has continued its evolution and wars have predominantly been between rival religious "civilizations" (as termed by Huntington). E.g., the Croatian versus Serbian Civil War which started in the former Yugoslavia after the Soviet Union collapsed (sparked when Croatia declared itself independent on 29 May 1991), was a war between people who spoke the same language but followed different religions or forms of "civilization". In the 1993 *Time* interview, Huntington argued:

"The conflicts among civilizations will be increasingly central: the West and Islam, Islam and Hindu civilizations in India, Islam vs. the slavic Orthodox Russian civilization, China and Japan as civilizations. ... Islam is the most strict religion in the world outside of Christianity. There is no separation between religion and politics. ... The most significant dividing line in Europe now is the line where Western Christianity ends and Orthodox Christianity and Islam begin. That is a line which hasn't changed much in several hundred years. Its significance was suppressed during the cold war. ... In Asia there is the Hindu-Muslim conflict in India, which could involve Pakistan. ... the Asian and virtually all the Middle Eastern Islamic states are increasing their military strength. There is this Confucian-Islamic connection between China and North Korea on one hand and Middle Eastern states like Iran, Iraq, Syria and Libya on the other. ... The cold war was relatively simple. The Russians certainly had no **martyr complex**. They were rational in ways we tend to think of as rationality. It is not clear that people in these other civilizations think in the same way."





posted by Nuclear Weapons Effects 12:18 am

28 COMMENTS:

At 1:09 pm, Anonymous said...

More on the neutron bomb which Glasstone mentions:

Samuel Cohen
From Wikipedia

Samuel T. Cohen is a physicist who is known for inventing the W70 warhead, the "enhanced neutron weapon" or neutron bomb, the blueprints of which were allegedly stolen by the Chinese [1]. He got his physics PhD from UCLA. In 1944 he worked on the Manhattan project with calculating how neutrons behaved in Fat Man. At RAND Corporation in 1950, his calculations of the intensity of radiation from fallout were included as a special appendix in Samuel Glasstone's book The Effects of Atomic Weapons. In the Vietnam War, Cohen argued that using small neutron bombs would end the war quickly and save many American lives, but politicians were not amenable to his ideas. He was a member of the Los Alamos Tactical Nuclear Weapons Panel in the early 1970s. President Carter delayed the neutron bomb in 1978 [2], but during Reagan's presidency, Cohen claims to have convinced Reagan to make 700 neutron bombs, 350 shells to go into the 8 inch (200-millimetre) howitzer and 350 W70 warheads for the Lance missile [3]. Cohen's backing of investigations into these controversial ideas won him some media attention after many years of being ignored [4]. In 1992 he was featured on the award-winning BBC TV series Pandora's Box episode, To the Brink of Eternity, discussing his battles with officialdom and colleagues at the RAND Corporation.

'Clean' nuclear tests and Cohen's revolutionary invention
In 1956, President Eisenhower announced the testing of a 95% 'clean' (2-stage) fusion weapon, later identified to have been the 11 July Navajo test at Bikini Atoll during Operation Redwing. This weapon had a 4.5 megatons yield. Previous 'dirty' weapons had fission proportions of 50-77%, due to the use of uranium-238 as a 'pusher' around the lithium deuteride (secondary) stage. (The fusion neutrons have energies of up to 14.1 MeV, well exceeding the 1.1 MeV 'fission threshold' for U-238.) The 1956 'clean' tests used a lead pusher, while in 1958 a tungsten carbide pusher was employed. Hans A. Bethe supported clean nuclear weapons in 1958 as Chairman of a Presidential science advisory group on nuclear testing [5]:

"... certain hard targets require ground bursts, such as airfield runways if it is desired to make a crater, railroad yards if severe destruction of tracks is to be accomplished... The use of clean weapons in strategic situations may be indicated in order to protect the local population." (Dr Hans Bethe, 27 March 1958 Top Secret - Restricted Data Report to the NSC Ad Hoc Working Group on the Technical Feasibility of a Cessation of Nuclear Testing (Bethe was the Working Group Chairman, page 9).

In consequence of Bethe's recommendations, on 12 July 1958, the Hardtack-Poplar shot on a barge in the lagoon yielded 9.3 megatons, of which only 4.8% was fission. It was 95.2% clean. It was the clean Mk-41C warhead.

Cohen in 1958 investigated a low-yield 'clean' nuclear weapon and discovered that the 'clean' bomb case thickness scales as the cube-root of yield. So a larger percentage of neutrons escapes from a small detonation, due to the thinner case required to reflect back X-rays during the secondard stage (fusion) ignition. For example, a 1-kiloton bomb would need to have a case only 1/10th the thickness of that for 1-megaton [6].

This means that although most of the neutrons are absorbed by the outer casing in a 1-megaton bomb, in a 1-kiloton bomb they would mostly escape. A neutron bomb is only feasible if the yield is sufficiently high that efficient fusion stage ignition is possible, and if the yield is low enough that the case thickness will not absorb too many neutrons. This means that neutron bombs have a yield range of 1-10 kilotons, with fission proportion varying from 50% at 1-kiloton to 25% at 10-kilotons (all of which comes from the primary stage). The neutron output per kiloton is then approximately 10-15 times greater than for a pure fission implosion weapon or a standard (high yield) strategic warhead like a W87 or W88 [7].

Official U.S. Department of Defense manual on the neutron bomb
Cohen's neutron bomb is not mentioned in the unclassified manual by Glasstone and Dolan, The Effects of Nuclear Weapons 1957-77, but is included as an 'enhanced neutron weapon' in chapter 5 of the declassified (formerly secret) manual edited by Philip J. Dolan, Capabilities of Nuclear Weapons, U.S. Department of Defense, effects manual DNA-EM-1, updated 1981 (U.S. Freedom of Information Act).

Provided that the weapon was not used in a thunderstorm, no fallout effects would occur from the use of a neutron bomb according to that manual, as the combination of 500 m burst altitude and low yield prevents fallout in addition to significant thermal and blast effects. The reduction in damage outside the target area is a major advantage of such a weapon to deter massed tank invasions. An aggressor would thus be forced to disperse tanks, which would make them easier to destroy by simple hand-held anti-tank missile launchers.

Cohen stated that he "worked in France on low-yield, highly discriminate tactical nuclear weapons in 1979-1980".

"In 1979, Pope John Paul II conferred on one of the authors (Sam Cohen) a peace medal for his invention, the neutron bomb. This was a small nuclear weapon designed to do its work, killing enemy military forces, without destroying a country’s infrastructure." (Cohen, March 11, 2003)

The Pope, John Paul II, was from Poland and knew that Warsaw Pact forces had a massive tank superiority (though NATO maintained a technical superiority) in Europe and that a deterrent which was designed to minimise civilian casualties was a step away from indiscriminate warfare. Though the neutron bomb's killing by radiation is no different than chemical warfare.

The speed of modern warfare meant that the civilian population would be unlikely to withdraw from combat zones and would suffer a

large number of deaths from even low yield nuclear weapons. The very deployment of the neutron bomb threatened an escalation to full scale nuclear retaliation, thus canceling out the supposed benefit of the neutron bomb. Advances in precision anti-tank weapons ultimately made the neutron bomb redundant.

In 1981, the Christian Science Monitor reported that there "are 19,500 tanks in the Soviet-controlled forces of the Warsaw Pact aimed at Western Europe. Of these, 12,500 are Soviet tanks in Soviet units. NATO has 7,000 tanks on its side facing the 19,500." (Joseph C. Harsch, "Neutron Bomb: Why It Worries The Russians," Christian Science Monitor, August 14, 1981, p. 1.) [8]

[edit]
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Review of Shame published on Amazon: [9]

*At **3:18 pm**, **nige** said...*

From: Jack Reed
To: Nigel B. Cook
Sent: Monday, June 26, 2006 6:08 PM
Subject: Blogs and memories

Hi Nigel, I was amazed last night when I got around to visiting your blog site. Obviously, you're no beginner at studying nuclear weapons and technology. Much of the stuff there I was not particularly familiar with, but several items brought back old memories and faces. Thanks. Is your intent to put together a book?

Your collection of info on the Japanese and Rongelap radiation survivors was interesting to me, having had some accidental exposures totalling around 64 R, with only 4 R on an official film badge. A few years ago United States support for the Japanese survivor studies was cut off, to my chagrin. Later I inferred the reason. One of their reports claimed that of 47,000 being tracked after 40-100 R exposures, they were now dying - at one-quarter the rate of their unexposed controls. My conclusion: politically unacceptable to the American anti-nukes. Now, later figures show 3/4 of my veteran colleagues of WW-II are dead, so we (40-100 R) have been "vaccinated". Neat!

The other stong recollection was about that Teak cloud. Some twenty minutes after the shot, I spotted a white "smoke ring" in the NW sky, from the deck of the carrier USS Boxer. Back to my home office, I did the calculation of the closest point where it could be in the sun (01:00 Johnston Island time). I haven't easy access to my old files and forget the exact numbers, but that required a SE wind of around 1500 knots. My colleague, Hugh Church, then did the calculations for the hydrostatic winds around the hot, low pressure area under the direct sun, and came up with nearly the same wind direction and speed. We submitted these two reports to the J. Geophysical Research, and received prompt rejection because "everyone knew that the circulation at those ionospheric altitudes was dictated by the electric field." Some twenty years later, your Sir James Lighthill published a report based on neutral particle flow at such altitudes, because only a tiny fraction of the air was ionized and of no consequence. Hugh and I never got around to re-submitting our articles, but I did get to meet Lighthill at an Oxford meeting in 1985, and told him that chuckler. And finally, in 2003, I got to face a 93-year-old James Peoples, later-long-time-editor of Science Magazine and previously editor of the JGR. His response was "I am a chemist, and I had to rely on my advisors for such problems". More chuckles.

Straight Ahead, Jack W. Reed
And reed that boweth down to euery blaste. Chaucer, 1385

I believe in getting into hot water. I think it keeps you clean. G.K.Chesterton

----- Original Message -----
From: Nigel B. Cook
To: Jack Reed
Sent: Sunday, June 25, 2006 3:29 AM
Subject: Blast yield estimates controversy QQQQ

Hi Jack,

Many thanks for these comments on using the EMP to give the time of detonation in 1955 Teapot tests. I've been reading the sanitized report ITR-1660-(SAN), "Operation Hardtack: Preliminary Report, Technical Summary of Military Effects Programs 1-9", DASA, Sandia Base, Albuquerque, New Mexico, 23 September 1959, sanitized version 23 February 1999.

It contains a lot of blast data including a plot of all the Pacific data for very low overpressure blast, in Fig 6.13 on page 287, and also seems to refer to a report of yours concerning thermal radiation effects on page 453:

J. W. Reed and others, "Thermal Radiation from Low-Yield Bursts", Project 8.8, Operation Hardtack, ITR-1675, January 1959, Air Force Cambridge Research Centre, Laurence G. Hanscom Field, Bedford, Massachusetts, Secret Restricted Data.

One issue with thermal radiation is that some reports say it varies with yield. Did you find any evidence of this? Glasstone 1962/64 suggests that the thermal yield fraction for a surface burst varies from 1/7 or 14% for Nevada tests to 1/4 or 25% for Pacific tests. Brode's 1968 RAND Corp report on computer simulations indicates that the thermal yield fraction theoretically increases with bomb yield.

The fireball radius at second thermal brightness, when most radiation is emitted, scales up more rapidly (radius proportional to W^0.4) with yield than the blast pressure that greates nitrogen dioxide that shields some of the thermal radiation (radius proportional to W^1/3). Therefore, you would expect nitrogen dioxide in the shock wave to filter out more of the thermal radiation in a low yield burst than a high yield burst. This accounts for the rise in predicted thermal yield with yield in air bursts.

In a surface burst, the cratering action does much the same thing, throwing up a dirt over a radius that scales as the cube-root of yield, so it should have a greater shielding effect on the fireball radiation at maximum brightness at low yields than high ones. So the thermal fraction again should increase with increasing yield.

It is very hard to see how energy is really used in a nuclear explosion. Glasstone 1950 claimed that only about 1% is used in cratering and ground shock, but that was based on a theory that air blast caused both effects. Brode's 1960 RAND computer simulation showed the figure was 15% because the case shock of the bomb is denser than the air shock and couples far better to the ground. C. E. Adams of USNRDL in a 1958 report calculated that 3% of the energy in the Redwing-Inca tower shot was used for melting the observed mass of fallout. Report DNA 5159F-1 (1979) on simulations of mushroom cloud rise (for the main U.S. Department of Defense DELFIC fallout computer) states on page 12:

"On the basis of considerable experience with the cloud rise model we take the fraction of explosion energy used to heat air, soil and water to their initial temperatures to be 45% of the joule equivalent of the total yield, W."

This is a massive amount of energy, essentially the entire blast yield. Hence about 15% of the energy of the surface burst nuclear explosion is used in ground shock and cratering, 45% in mushroom cloud rise, and over 3% in melting fallout. This accounts for 63% of the explosion energy without mentioning nuclear radiation, blast or thermal!

But if you look at chapter 1 of Glasstone and Dolan, it says 50% is blast, 35% is thermal, 15% nuclear.

So there is really a total lack of accounting for the energy, and I think Glasstone and Dolan is severely misleading. The blast wave at high overpressures is losing energy very rapidly by heating up the air it engulfs. Therefore, it is a complete fiction to quote 50% blast yield. They get it by subtracting the thermal and nuclear yield from 100%, but clearly the blast wave is continuously leaving warm air behind and thus losing wave energy.

My calculations at http://glasstone.blogspot.com/2006/03/physical-understanding-of-blast-wave.html indicate that the blast wave begins with all the available fireball energy, 85% of the explosion energy, and then loses energy as the overpressure falls until it has only about 1.09% of the explosion energy when it has become basically a sonic wave at great distances. Therefore, the idea that the blast contains 50% of the energy is entirely misleading. It starts with 85% or so, and then loses energy by thermal radiation from the surface and from leaving behind hot air which rises to form the cloud, etc., until the energy is dow to 1.09% of the total.

On page 347 of ITR-1660-(SAN), the first American measurement of high altitude EMP was at the 2 kt Yucca test in 1958. The Teak shot EMP measurements failed because the shot went off directly overhead instead of 20 miles downrange due to a missile guidance error. They only measured the beta ionisation which affects radio/radar transmissions for hours, but it is the brief high frequency EMP which causes physical damage to equipment: "Shot Yucca ... [EMP] field strength at Kusaie indicated that deflection at Wotho would have been some five times the scope limits... The wave form was radically different from that expected. The initial pulse was positive, instead of the usual negative. The signal consisted mostly of high frequencies of the order of 4 Mc, instead of the primary lower-frequency component normally received ..."

Best wishes,
Nigel

----- Original Message -----
From: Jack Reed
To: Nigel Cook
Sent: Sunday, June 25, 2006 4:51 AM
Subject: Re: Electrical effects at the Nevada Control Point? QQQQ

Hi Nigel,

>I cannot understand how the EMP effect was kept secret until 1961.<
I didn't ever realize that it was, particularly after the high altitude Teak shot in 1958 disrupted communications over most of the Pacific. I was somewhat familiar with it and used the pulse in 1955 to give our distant (200 km) microbarograph operators a shot time on their paper recordings. We simply hung a hundred meters or so of copper wire to catch it, for the vast Nevada areas didn't have very reliable telephone contacts and we hadn't gotten an off-site radio system yet. Before that, in 1953 when I read in Scientific American about ham operators

getting radio whistlers from lightning, I suggested in a report (that was classified at the time) that USSR nuclear tests could be easily detected at the southern conjugate in the Indian Ocean. I never got a response from the report, but 3-4 years later a navy man told me they were doing such monitoring with a pair of ships on site rotation from Western Australia. Again, I should have applied for a patent. That leads to another story.

Also, ca 1953-4, a Scientific American article described extremely bright flashes in laboratory shock tubes filled with argon. As a long-time member of the 188th Fighter Squadron, New Mexico Air National Guard, I published another classified report, "An Aircraft Psychological Defense Device", proposing flare-sized clear plastic shock tubes filled with argon to pop out when an enemy fighter got on your tail. The flash should stun him long enough to make an escape maneuver. The Air Force had different ideas, however, as such dog-fights became obsolete, and used argon shock devices to light up Viet Nam in night-time surveillance.

Anyway, I wasn't involved in general instrument maintenance in the immediate test areas and didn't pay much attention to their problems nor read all the various reports that came out. My concern was weather dependences - distant airblast and fallout - and I never was much interested in electricity.

Straight Ahead, Jack W. Reed
And reed that boweth down to euery blaste. Chaucer, 1385

I believe in getting into hot water. I think it keeps you clean. G.K.Chesterton

----- Original Message -----
From: Nigel Cook
To: Jack Reed
Sent: Wednesday, June 21, 2006 4:04 AM
Subject: Electrical effects at the Nevada Control Point? QQQQ

Hi Jack,

Thank you very much for setting the facts straight on the sound being associated with the first peak, taking a few milliseconds. All of the film tracks of blast waves sound more like hurricane winds, than bangs.

Since you were at the control point if - assuming it is not secret - you recollect EMP effects. I cannot understand how the EMP effect was kept secret until 1961. ...

*At **12:57 pm**, **nige** said...*

Just an update about the origins of "Effects of Atomic Weapons" and the origins of DASIAC (now renamed DTRIAC; Defense Threat Reduction Information Analysis Centre).

Book source used below: "Defense's Nuclear Agency 1947-1997", DTRA (Defense Threat Reduction Agency, USA) History Series, U.S. Department of Defense, Washington, D.C., 2002. This document is unclassified and online as a 36 MB PDF file download at http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A412977&Location=U2&doc=GetTRDoc.pdf see also http://stinet.dtic.mil/stinet/jsp/docread.jsp?K2DocKey=http%3A%2F%2Fstinet.dtic.mil%2Fstinet%2FXSLTServlet%3Fad%3DADA412977%40trA-search&Format=1F&Custom=&querytext=%28defense+nuclear+agency%29+%3Cand%3E+%28ftloc+%3Ccontains%3E+pdf%29&AD=ADA+1997&RD=January+01%2C+2002&DC=%26nbsp%3B+%26nbsp%3B+%26nbsp%3B+%26nbsp%3B+%26nbsp%3B+01+-+APPROVED+FOR+PUBLIC+RELEASE&XPC=&PAG=466+Pages%28s%29&MC=&PE=

"Effects of Atomic Weapons" origins:

"Jan. 1949. JCS [Joint Chiefs of Staff, USA] assigns responsibility to AFSWP [Armed Forces Special Weapons Project] for collecting, reviewing, and disseminating data on atomic weapons effects; this research results in *The Effects of Atomic Weapons* (1950), prepared jointly with the AEC [Atomic Energy Commission, USA]."

- page 369.

DASIAC origins:

"Dec. 15, 1960. DASA supports the Joint Strategic Target Planning Staff (JSTPS), established at SAC, by providing computer models for nuclear weapons blast effects; DASA sponsors formation of the Defense Atomic Support Information and Analysis Center (DASIAC) in Santa Barbara, California."

- page 377.

*At **9:04 pm**, **Anonymous** said...*

Hey - this is cool. I'm Philip Dolan's grandson (I have the same name). Thanks for blogging this...

- PD3

*At **12:53 pm**, **nige** said...*

The document hyperlink in this blog posts and other posts on this blog,

http://worf.eh.doe.gov/data/ihp1d/78192e.pdf

no longer works. It is unclear whether the file has been removed from that server or has merely been corrupted in such a way (file-name corruption, for instance) that it cannot be found.

The report is

Dr Carl F. Miller, A THEORY OF DECONTAMINATION OF FALLOUT FROM NUCLEAR DETONATIONS; PART II METHODS FOR ESTIMATING THE COMPOSITION OF CONTAMINATED SYSTEMS (DELETED), U. S. Naval Radiological Defense Laboratory, report number USNRDL-466, 29 September 1961, originally classified Secret - Restricted Data.

One interesting feature of the declassification was that the table of neutron induced activities produced in Nevada and Pacific nuclear tests was deleted, but a second table (calculated from that first deleted table) showing the contributions to gamma dose rates for each nuclide in each test, as well as the gamma dose rate which 1 atom/fission of neutron induced activity would produce for a kiloton of fission products deposited over a square mile, was not deleted.

The first table can obviously be calculated from the second table, which tells you the neutron induced activity in atoms per fission produced by the Nevada and pacific nuclear tests.

For example, if test X produces 100 (R/hr)/(fission kt per square mile) at 1 hour from nuclide Y, and if 1 atom of Y per fission produces 200 (R/hr)/(fission kt per square mile), then obviously the neutron induced activity for nuclide Y from test X is 100/200 = 0.5 atoms/fission.

All high-fission yield thermounclear weapons (i.e., all thermonuclear weapons except "clean" tests) as well as older fission bomb designs with massive U-238 tampers around the fissile core, produced a lot of U/Np-239 due to neutron capture in the U-238. Typically the figure is 0.5 atoms/fission. Hydrogen bombs, due to the higher neutron energy and flux resulting from fusion reactions in the bomb secondary stage, additionally produce substantial quantities of U/Np-240 and particularly U-237 which results from an emission of two neutrons when U-238 is hit by single high energy neutron, and is increasingly likely to occur as neutron energy is increased (i.e., the reaction cross-section increases as a function of neutron energy).

The exception is the modern lightweight fission bomb with a beryllium reflector instead of U-238. This design produces only trivial quantities of induced activities resulting from neutron capture in U-238, because the latter exists only as a trace impurity in the composite highly enriched uranium-235/plutonium core. However, such fission weapons are generally reserved for low yield nuclear device applications (tactical weapons) and the major fallout hazards result from hydrogen bombs with large fission yields.

It is a shame that there is such secrecy still surrounding vital data of concern to the evaluation of the gamma ray energy of fallout for shielding and related civil defence applications, and for decontamination data.

*At **4:03 pm**, **nige** said...*

In this blog post, I quited Dr Miller as follows:

*Dr Carl F. Miller, who worked for the U.S. Naval Radiological Defense Laboratory at later nuclear tests to measure fallout on ships with washdown safeguards that were sailing under the expanding mushroom clouds, hit out in the February 1966 **Scientist and Citizen**:*

'Reliance on the Effects of Nuclear Weapons has its shortcomings... I was twenty miles from a detonation ... near ten megatons. The thermal flash did not produce the second-degree burn on the back of my neck, nor indeed any discomfort at all.'

I need to here add a bit about why Dr Miller was writing to *Scientist and Citizen*. I requested the issue from Weybridge Public Library nearly a decade ago, and the highly competent and helpful LASER (intercounty loan) request librarian there was able to get me a photocopy. (It was not stocked at the local university libraries, or in the British Library.)

Dr Miller was objecting to the anti-civil defence stance of *Scientist and Citizen* in previous issues, where they exaggerated the effects of nuclear weapons to score political points in some kind of immoral game they were playing against life-saving civil defence.

I've just found a discussion of some of this in a chapter endnote by the Nobel Laureate Eugene P. Wigner on page 22 of Wigner's book "Survival and the Bomb: Methods of Civil Defense" (Indiana University Press, Bloomington, London 1969:

"This point [pseudo-physics propaganda being thrown hard against civil defense] is well illustrated by the discussion about the effect of fires on shelters in connection with the Harbor Report (Publication 1237; Washington, D.C., National Research Council, National Academy of Sciences, 1964) conducted in *Scientist and Citizen* for May and August 1965, and February 1966. *Scientist and Citizen* is a publication of the St. Louis Citizens' Committee for Nuclear Information, an organization strongly opposed to civil defense. There are eight physicists on *Scientist and Citizen*'s Advisory Board who should be able to make calculations on heat conductivity. However, similarly erroneous views on technical questions, made in authoritative tone by nontechnical people, are too numerous to quote."

Wigner also provides on page 18 the following quotation dated 1 March 1955:

"The need for an effective system of civil defence is surely beyond dispute. No city, no family, nor any honorable man or woman can repudiate this duty."

- Winston Churchill, 1 March 1955.

*At **2:57 pm**, **nige** said...*

Notes about a few important U.K. Home Office Scientific Advisory Branch research reports on nuclear weapons tests effects and fallout decontamination research:

HO 225/42 (National Archives reference): “Estimates, for exercise purposes, of the radio-active contamination of land areas from an adjacent underwater explosion”, 1953. Original Home Office Scientific Advisory Branch reference: CD/SA 42. This contains a stylised low-classification (restricted) version of the top secret British “Operation Hurricane” fallout pattern from 1952, redrawn in the form of simplified elliptical contours for use in civil defence planning. George R. Stanbury who prepared it had attended the “Operation Hurricane” nuclear test at Monte Bello to measure civil defence effects of the detonation, including blast, heat and nuclear radiation. The text accompanying the fallout pattern tries to justify the fact that the dose rates are much higher than those shown in the 1950 U.S. Atomic Energy Commission book “The Effects of Atomic Weapons” Figure 8.101 (Radiation dosage rate countours at 1 hour after explosion due to fission products from underwater burst) by stating that the American data is for contamination on ships and most of the rainout on the ships immediately ran off the decks and straight back into the sea water (where it was diluted and shielded by the relatively deep water). The British data is for “Operation Hurricane” fallout on islands in the Monte Bello group, Australia, and does not suffer from the problem of the American studies. However, it should also be noted that the British underwater test was 10 miles per hour effective wind (not 5 miles per hour in the case of fallout from the cloud head of the American Crossroads-Baker test), in much shallower depth in much shallower water than the American test, and was actually inside the hull of a ship (below the waterline). Hence, the British “Operation Hurricane” test data is for a situation more that is like a hybrid between a surface burst over mud and a shallow underground burst. “Operation Hurricane” was 25 kt, detonated 2.7 metres below the water line inside a 1,370 ton River class frigate (HMS Plym) anchored in 12 metres deep water, 350 metres off shore from Trimouille Island. Anderson shelters (World War II style outdoor civilian shelters) survived with just a few sandbags displaced on the island, and there are photos showing the ship in the background from the Anderson shelters before the test. The objective of this test was to evaluate the effect of a bomb smuggled near a city on the coast, hidden aboard a ship. The American “Crossroads-Baker” test of 1946 was a 23.5 kt bomb suspended by cable 90 feet below the water surface inside Bikini Lagoon, and hence detonated at mid-depth in 180 feet of water. Baker produced a base surge, Hurricane didn’t because the Hurricane depth of burst (2.7 metres under water) was simply too shallow for base surge formation. To make a base surge, a large bubble of steam must be formed under water. The escaping hot steam condenses into small radioactive droplets which under bulk subsidence, causing the base surge. A burst which is too shallow doesn’t produce a dense-enough cloud of small particles to subside and form a base surge.

HO 225/87 (National Archives reference): “Some recent information from USA about fallout from groundburst megaton weapons”, 1957. Original Home Office Scientific Advisory Branch reference: CD/SA 87. This report is in turn based on data from a September 1957 report by Dr Frank H. Shelton called “Physical Aspects of Fall-Out”, summarising the effects of the American “Operation Redwing” nuclear tests of 1956 at Bikini Atoll. Of particular significance are reproductions of the fallout distribution pattern from the “Redwing-Tewa” surface burst test, and a map of the toroidal shaped radioactivity distribution within the actual mushroom cloud, based on data from rockets sent through the mushroom cloud containing radiation meters and radio transmitters. In addition, the report notes that fallout begins to arrive on the ground near ground zero about 15-20 minutes after a 1 megaton land surface burst or 30-40 minutes after a 1 megaton water surface burst.

HO 225/100 “The hazards from direct exposure to fallout in a damaged area”, 1960. Original Home Office Scientific Advisory Branch reference: CD/SA 100. This report is a summary of beta burn risks to skin, involving studies of the concentration of fallout on skin relative to the ground, and estimates of the beta dosage to the skin and the risk of delayed beta radiation burns resulting from that exposure.

HO 225/117, “Experimental determination of protective factors in a semi-detached house with or without core shelters”, 1964. Original Home Office Scientific Advisory Branch reference: CD/SA 117. This report led to the “Protect and Survive” advice because it proved that adequate fallout radiation protection can be assembled in an inner core within a typical British brick-built house (American wood frame houses offer less protection).

*At **5:00 pm**, **nige** said...*

A rare, non-detailed background survey of the social reasons for nuclear weapons effects data censorship is the paper:

Professor Brian Martin (then a physicist at the Department of Mathematics, Faculty of Science, Australian National University, Canberra, but now he is Professor of Social Sciences in the School of Social Sciences, Media and Communication at the University of Wollongong), "Critique of Nuclear Extinction", published in *Journal of Peace Research,* Vol. 19, No. 4, pp. 287-300 (1982):

"The idea that global nuclear war could kill most or all of the world's population is critically examined and found to have little or no scientific basis. A number of possible reasons for beliefs about nuclear extinction are presented, including exaggeration to justify inaction, fear of death, exaggeration to stimulate action, the idea that planning is defeatist, exaggeration to justify concern, white western orientation, the pattern of day-to-day life, and reformist political analysis. Some of the ways in which these factors inhibit a full political analysis and practice by the peace movement are indicated. Prevalent ideas about the irrationality and short duration of nuclear war and of the unlikelihood of limited nuclear war are also briefly examined."

For his article debunking the "nuclear winter" hoax of Sagan et al., see Brian Martin's article, "Nuclear winter: science and politics", *Science and Public Policy,* Vol. 15, No. 5, October 1988, pp. 321-334, **http://www.uow.edu.au/arts/sts/bmartin/pubs/88spp.html**.

Notice that Brian Martin is an immensely important figure in censorship studies:
http://www.uow.edu.au/arts/sts/bmartin/pubs/controversy.html#nuclearwar.

Of particular interest on the Brian Martin site are the following pages:

http://www.uow.edu.au/arts/sts/bmartin/dissent/intro/

and

http://www.uow.edu.au/arts/sts/bmartin/pubs/controversy.html

*At **6:59 pm**, **nige** said...*

Also see the informative article on line in PDF:

"Nitrogen oxides, nuclear weapon testing, Concorde and stratospheric ozone" P. Goldsmith, A. F. Tuck, J. S. Foot, E. L. Simmons & R. L. Newson, published in *Nature*, v. 244, issue 5418, pp. 545-551, 31 August 1973:

"ALTHOUGH AMOUNTS OF NITROGEN OXIDES EQUIVALENT TO THE OUTPUT FROM MANY CONCORDES WERE RELEASED INTO THE ATMOSPHERE WHEN NUCLEAR TESTING WAS AT ITS PEAK, THE AMOUNT OF OZONE IN THE ATMOSPHERE WAS NOT AFFECTED."

What happens when nitrogen oxides are released in a nuclear explosion is partly that they combine with moisture in the mushroom cloud to form very dilute nitric acid which eventually (after being blown around the world in small particles) gets precipitated.

More important, although the shock wave of a nuclear explosion creates nitrogen oxides, especially nitrogen dioxide, THE PROMPT X-RAYS AND GAMMA RADIATION CREATE OZONE!

It's the ozone around the early fireball that shields most of the the early-time thermal radiation, which is mainly in the ultraviolet.

Hence, nuclear explosions in the atmosphere don't just release oxone-destroying nitrogen oxides, THEY ALSO RELEASE OZONE! Depending on the yield and the altitude of the detonation, in some cases the Earth's ozone layer can actually be INCREASED not reduced.

A high altitude nuclear explosion does NOT produce a strong blast wave, and all nitrogen oxides production requires a high overpressure shock wave! Hence, in a high altitude nuclear explosion, the production of ozone from gamma radiation EXCEEDS the production of nitrogen oxides by many times. It is quite conceivable that suitable high altitude nuclear explosions over the South Pole would have the effect of repairing the hole in the ozone layer there. Of course, it won't happen, because as Feynman said when discussing nuclear testing hysteria in the 1960s, we really still live in a pseudo-scientific age.

See also:

J. Strzelczyk, W. Potter, & Z. Zdrojewicz, "Rad-By-Rad (Bit-By-Bit): Triumph of Evidence Over Activities Fostering Fear of Radiogenic Cancers at Low Doses", *Dose Response*, v. 5 (2007), issue 4, pp. 275-283:

"Large segments of Western populations hold sciences in low esteem. This trend became particularly pervasive in the field of radiation sciences in recent decades. The resulting lack of knowledge, easily filled with fear that feeds on itself, makes people susceptible to prevailing dogmas. Decades-long moratorium on nuclear power in the US, resentment of "anything nuclear", and delay/refusal to obtain medical radiation procedures are some of the societal consequences. The problem has been exacerbated by promulgation of the linear-no-threshold (LNT) dose response model by advisory bodies such as the ICRP, NCRP and others. This model assumes no safe level of radiation and implies that response is the same per unit dose regardless of the total dose. The most recent (June 2005) report from the National Research Council, BEIR VII (Biological Effects of Ionizing Radiation) continues this approach and quantifies potential cancer risks at low doses by linear extrapolation of risk values obtained from epidemiological observations of populations exposed to high doses, 0.2 Sv to 3 Sv. It minimizes the significance of a lack of evidence for adverse effects in populations exposed to low doses, and discounts documented beneficial effects of low dose exposures on the human immune system. The LNT doctrine is in direct conflict with current findings of radiobiology and important features of modern radiation oncology. Fortunately, these aspects are addressed in-depth in another major report—issued jointly in March 2005 by two French Academies, of Sciences and of Medicine. The latter report is much less publicized, and thus it is a responsibility of radiation professionals, physicists, nuclear engineers, and physicians to become familiar with its content and relevant studies, and to widely disseminate this information. To counteract biased media, we need to be creative in developing means of sharing good news about radiation with co-workers, patients, and the general public."

Here's a quotation from Feynman (not his specific objection to low-level radiation hysteria which he rejected elsewhere by saying that if Pauling et al were so worried about such levels of radiation, they'd campaign first and foremost to make everyone evacuate cities at high altitudes where cosmic radiation is highest, they'd ban air travel, they'd evacuate cities built on bedrock like granite that contains substantial quantities of naturally radioactive uranium-238, etc., and THEN move on to the far smaller dangers of fallout from weapons tests which only increased lifetime background radiation dosage by typically a mere 1%, see Feynman's book called "The Meaning of It All"):

"What is Science?" by R.P. Feynman, presented at the fifteenth annual meeting of the National Science Teachers Association, 1966 in New York City, and reprinted from The Physics Teacher Vol. 7, issue 6, 1968, pp. 313-320:

"... great religions are dissipated by following form without remembering the direct content of the teaching of the great leaders. In the same way, it is possible to follow form and call it science, but that is pseudo-science. In this way, we all suffer from the kind of tyranny we have today in the many institutions that have come under the influence of pseudoscientific advisers.

"We have many studies in teaching, for example, in which people make observations, make lists, do statistics, and so on, but these do not thereby become established science, established knowledge. They are merely an imitative form of science analogous to the South Sea Islanders' airfields--radio towers, etc., made out of wood. The islanders expect a great airplane to arrive. They even build wooden airplanes of the same shape as they see in the foreigners' airfields around them, but strangely enough, their wood planes do not fly. The result of this pseudoscientific imitation is to produce experts, which many of you are. ... you teachers, who are really teaching children at the bottom of the heap, can maybe doubt the experts. As a matter of fact, I can also define science another way: Science is the belief in the ignorance of experts.

"When someone says, "Science teaches such and such," he is using the word incorrectly. Science doesn't teach anything; experience

teaches it. If they say to you, "Science has shown such and such," you might ask, "How does science show it? How did the scientists find out? How? What? Where?"

"It should not be "science has shown" but "this experiment, this effect, has shown." And you have as much right as anyone else, upon hearing about the experiments--but be patient and listen to all the evidence--to judge whether a sensible conclusion has been arrived at.

"In a field which is so complicated ... that true science is not yet able to get anywhere, we have to rely on a kind of old-fashioned wisdom, a kind of definite straightforwardness. I am trying to inspire the teacher at the bottom to have some hope and some self-confidence in common sense and natural intelligence. The experts who are leading you may be wrong.

"I have probably ruined the system, and the students that are coming into Caltech no longer will be any good. I think we live in an unscientific age in which almost all the buffeting of communications and television--words, books, and so on--are unscientific. As a result, there is a considerable amount of intellectual tyranny in the name of science.

"Finally, with regard to this time-binding, a man cannot live beyond the grave. Each generation that discovers something from its experience must pass that on, but it must pass that on with a delicate balance of respect and disrespect, so that the race--now that it is aware of the disease to which it is liable--does not inflict its errors too rigidly on its youth, but it does pass on the accumulated wisdom, plus the wisdom that it may not be wisdom.

"It is necessary to teach both to accept and to reject the past with a kind of balance that takes considerable skill. Science alone of all the subjects contains within itself the lesson of the danger of belief in the infallibility of the greatest teachers of the preceding generation."

*At **10:14 pm**, **nige** said...*

According to Alexander Sesonske, the co-author with Samuel Glasstone of "Nuclear Reactor Engineering, Reactor Systems Engineering, Vol. 2", 4th edition, March 1994, page xv:

"Dr Samuel Glasstone, the senior author of the previous editions of this book, was anxious to live until his ninetieth birthday, but passed away in 1986, a few months short of this milestone."

Presumably for this reason the U.S. Government revisions of the "Effects of Nuclear Weapons" which continue to be prepared are no longer openly published but have fallen back out of public view in secret handbooks which combine the "Capabilities of Nuclear Weapons" with the Glasstone and Dolan open publication. This situation is basically a reversal to that of 1949, before the "Effects of Atomic Weapons" was published for aiding civil defense (to use American spelling of "defence") countermeasures in response to the hysteria unleashed by the first Russian nuclear bomb test. (Maybe if or when a new nuclear threat becomes of overwhelming importance, the U.S. Government will again be candid and openly publish further updates on nuclear effects research of relevance for civil defense.)

*At **7:38 pm**, **nige** said...*

It's interesting that some of Glasstone's articles in the Microsoft Encarta encyclopedia are now online (the contributor's name is at the end of most Encarta articles), e.g. Glasstone's particularly excellent article on "Albert Einstein":

http://encarta.msn.com/encyclopedia_761562147_2/Albert_Einstein.html

"Einstein's efforts in behalf of social causes have sometimes been viewed as unrealistic. In fact, his proposals were always carefully thought out. Like his scientific theories, they were motivated by sound intuition based on a shrewd and careful assessment of evidence and observation. Although Einstein gave much of himself to political and social causes, science always came first, because, he often said, only the discovery of the nature of the universe would have lasting meaning."

and also of course Glasstone's article in Encarta on the topic of "Nuclear Weapons" which includes a section on nuclear winter controversy up to 1985, which was presumably when Glasstone's last revision of the article was done:

http://encarta.msn.com/encyclopedia_761570062_4/Nuclear_Weapons.html

"... The nuclear winter theory has since become the subject of enormous controversy. It found support in a study released in December 1984 by the U.S. National Research Council, and other groups have undertaken similar research. In 1985, however, the U.S. Department of Defense released a report acknowledging the validity of the concept but saying that it would not affect defense policies.

"(E) Clean H Bombs

"On the average, about 50 percent of the power of an H-bomb results from thermonuclear-fusion reactions and the other 50 percent from fission that occurs in the A-bomb trigger and in the uranium jacket. A clean H-bomb is defined as one in which a significantly smaller proportion than 50 percent of the energy arises from fission. Because fusion does not produce any radioactive products directly, the fallout from a clean weapon is less than that from a normal or average H-bomb of the same total power. If an H-bomb were made with no uranium jacket but with a fission trigger, it would be relatively clean. Perhaps as little as 5 percent of the total explosive force might result from fission; the weapon would thus be 95 percent clean. The enhanced-radiation fusion bomb, also called the neutron bomb, which has been tested by the United States and other nuclear powers, does not release long-lasting radioactive fission products. However, the large number of neutrons released in thermonuclear reactions is known to induce radioactivity in materials, especially earth and water, within a relatively small area around the explosion. Thus the [1 kt, 500 metres altitude air burst] neutron bomb is considered a tactical weapon because it can do serious damage on the battlefield, penetrating tanks and other armored vehicles and causing death or serious injury to exposed individuals, without producing the radioactive fallout that endangers people or structures miles away."

Notice that this is a strong support of Samuel Cohen's position on the neutron bomb and clean nuclear weapons.

http://glasstone.blogspot.com/2006/05/revised-edition-of-sam-cohens-shame-is.html

Chuck Hansen, the late author of "U.S. Nuclear Weapons", calls the clean bomb a "fraud" in the final version of his U.S. nuclear weapons history DVD, the relevant extract of which is online in PDF format at:

http://www.nuclearweaponhistory.com/CLEANFRAUD.pdf

The Great "Clean" Weapons Fraud

Excerpt from SWORDS OF ARMAGEDDON, Second Edition
The Development of Nuclear Weapons,
Volume IV, pp. IV-387 - IV-391
©2003 by Chuck Hansen

Hansen quoted a statement made in June 1958 in connection with the planned UN test of "Piñon" during Operation Hardtack (a publicity stunt demonstrating a 96% clean warhead to UN observers, scientifically backed up by open - non-secret - local fallout measurements) by Morse Salisbury:

"... the Piñon device, in either case, would be so large that it clearly would not illustrate the cleanliness of the small tactical defensive weapons that have been stressed in public references to HARDTACK and in other statements of policy on testing. *To the contrary, such detonations in Piñon would disclose that we have made essentially no progress in our attempts to reduce substantially the size of feasible clean weapons.* (Emphasis as per Hansen.)"

This, Hansen held to be evidence that clean weapons were a failure. However, it is simply a lie. All nuclear weapons are expensive and clean ones are slightly more expensive. In an all-out, supposedly civilisation-annihilating "wargasm" type war(Herman Kahn's quaint term) then clean weapons would be no advantage to anyone. But in the majority of possible realistic scenarios for nuclear war, such as limited nuclear conflicts, then using small clean weapons rather than dirty local fallout weapons with high fission yield, would be as morally defensible as choosing not to use napalm, mustard gas, nerve gas, etc., when dropping conventional high explosive weapons on military targets near populated areas where there is a risk of collateral damage.

I've documented some evidence on the subject here:

http://glasstone.blogspot.com/2006/03/clean-nuclear-weapon-tests-navajo-and.html

I emailed Chuck Hansen about his declassified information on fallout shortly before he died, and he replied stating that he had *not* read the declassified scientific evidence in weapon test report WT-1317 which contains the main comparison of fallout dangers from clean weapons like "Zuni" and "Navajo" in particular, and dirty weapons like "Tewa" and "Flathead" at Bikini Atoll, Operation Redwing, in summer 1956.

As regards the overall size of the relatively clean weapons, as long ago as July 1962 the 104 kt total yield 30 kt fission yield cratering test "Sedan", under 30% fission. Increasing the ratio of fusion to fission means that the radioactivity is more diluted in the big mushroom cloud and the dose rates from deposits on the ground get reduced in almost direct proportion to the reduction in fission %. This has massive consequences for the feasibility of civilian survival in a collaterally damaged, fallout area. The neutron induced activity from fusion neutrons hitting the lead or tungsten carbide ablative pusher around the fusion charge does add slight radioactivity to the weapon, particularly at long times after burst when radioactivity levels are near background and relatively safe anyway, but as the data in WT-1317 (extensive tables of measurements of neutron induced activities in the fallout for several different types of weapon tested) shows, this is trivial. Fission product activity is the main threat and the main source of the problem, and by making the bomb mainly a fusion weapon, the fallout hazard is killed off.

See also my blog posts:

http://glasstone.blogspot.com/2006/05/clean-nuclear-weapons-tests-worked.html

and

http://glasstone.blogspot.com/2006/03/clean-nuclear-weapon-tests-navajo-and.html

Presumably Glasstone's articles in Encarta were originally in the print based Encyclopedia from the mid 1980s which Microsoft bought electronic rights to in 1993:

"Following the first multimedia Academic American Encyclopedia, Microsoft initiated Encarta by purchasing non-exclusive rights to the Funk & Wagnalls Encyclopedia, incorporating it into its first edition in 1993. (Funk & Wagnalls continued to publish revised editions for several years independently of Encarta, but then ceased printing in the late 1990s.)"

- http://en.wikipedia.org/wiki/Encarta

***At 7:44 pm*, nige said...**

To clarify, my email to Chuck Hansen was focussed on what declassified fallout information he had about neutron induced activities in fallout debris, like U-237, Np-239, U-239, U-240, etc.

He replied he had seen no declassified data on this. All this is covered in detail in report WT-1317. Hence, Hansen had not read that report on fallout. His main interest was in the historical development of the weapons and the physics of the first microsecond of detonation. he had no interest in nuclear weapons effects, and the whole basis of clean weapons is to be found in subtle aspects of nuclear weapons

effects. It's not essentially a qualitative weapon design problem. You reduce lethal fallout by a combination of the way the weapon is detonated (e.g., 500 metres altitude for 1 kt total yield) and by the design. It's not purely a weapons design matter.

*At **12:20 pm**, **nige** said...*

Regarding the clean neutron bomb controversy, the 1988 book by the late Chuck Hansen, *U.S. Nuclear Weapons* (Orion Books), gives some relevant information on pages 175-201:

"W-79 [this is the nuclear warhead of a rocket-propelled 8-inch diameter, 43-inch long, 215 pounds mass, artillery shell; this artillery shell includes a rocket motor to double the usual 8-inch shell's range to 18 miles, and has a target sensor and programmable height of burst as well as Category D PAL built into it to prevent unauthorised use]

"... Development engineering of the W-79 started at Livermore in January 1975. By 1976, the Army was developing a warhead for an eight-inch atomic artillery shell that would be the first U.S. weapon specially designed to reduce collateral damage from blast and radioactivity.

[Because 80% of the energy in tritium-deuterium fusion is released as 14.1 MeV (highly penetrating) neutrons, the blast and thermal output of the bomb is reduced and will be negligible for a 1kt neutron bomb burst at say 500 metres over the target, where only neutron radiation will be a hazard.]

"In January 1977, President Gerald Ford approved a Stockpile Memorandum that featured the W-79 as an 'enhanced radiation' weapon (the so-called 'neutron bomb which is really not much more than a boosted fission device). Production engineering began in March; this phase was suspended (for political reasons) at the end of September and not resumed until the beginning of November 1978.

[Actually, as Cohen has pointed out, the mechanism of the neutron bomb is that a standard Teller-Ulam design when reduced to very low yields automatically has a high neutron output. The case thickness, needed to reflect X-rays from the fission primary to the physically separate fusion charge within the weapon, is proportional to the cube-root of the total required yield of the weapon. So the case thickness required for a Teller-Ulam device of 1 kt is only 10% of that required for a total yield of 1 Mt. It is this massive, order-of-magnitude reduction of case thickness for a low-yield Teller-Ulam bomb, which makes the neutron bomb effect occur: the thin casing of a 1 kt Teller-Ulam allows over 90% of the neutrons to escape without being scattered and degraded to low energy, whereas the thick casing needed for a 1 Mt Teller-Ulam bomb results in something like 90% of the neutrons being captured or scattered and degraded to low energy.]

"The first production unit appeared in July 1981. Quantity production started in September and continued until August 1986 after 550 (including 325 'enhanced radiation' and 225 standard) W-79s were produced."

Hansen goes on to state that the W-79-1 model of the W-79 was the neutron bomb, which had a selectable yield of up to 2 kt: "the W-79-1 has three yields between a few hundred tons up to about two kilotons. Fission-fusion percentages range from 50:50 at the lower yield up to 25:75 at the higher yield."

The W-79-1 warhead is extremely small and the primary employs cylindrical implosion of Pu-239, instead of spherical implosion. I.e., the primary contains a core cylinder of Pu-239 which is surrounded by a beryllium neutron reflector and then a cylindrical shell of chemical high explosive.

This use of cylindrical implosion (not spherical implosion) for igniting fusion reactions was an old principle which was first tested in the Greenhouse-George nuclear test of 9 May 1951.

The reason of using a cylindrical primary is that the two ends of the fissioning plutonium rod in the centre are exposed and by placing a fusion charge nearby the exposed end, it is far easier to ignite fusion than in the case of a spherical implosion bomb where chemical high explosive has to first absorb then reradiate X-rays (which is a less efficient process because some energy is absorbed and used to create a shock wave instead of being passed on as X-rays, and the geometry - i.e. the bigger distance between the fusion charge and the fissioning material in the primary reduces the flux of radiation that hits the fusion charge).

Chuck Hansen's description claims that the fusion charge is a removable 'tritium reservoir' that is placed into a hollow area within the plutonium clinder of the fission primary, as in a boosted weapon. Actually, this is incorrect. In a cylindrical implosion weapon, unlike a spherical implosion weapon, fusion materials can be placed near the fissile material on the end of the plutonium cylinder, without taking up room within the cylinder itself: X-rays emitted by the end of the fissioning plutonium cylinder can then be used as in the Teller-Ulam configuration to do the necessary compression of the physically separated fusion fuel, which is a more efficient situation than 'boosting'.

Cylindrical implosion of the primary is required in a 2 kt neutron bomb artillery shell in order (1) to make the bomb fit into an artillery shell, and (2) to make the Teller-Ulam fusion system work efficiently at such low yields by eliminating the usual high explosive layer that is between the fissioning primary and the fusion charge if spherical implosion is used.

It is correct, however, that for efficient operation a very low yield neutron bomb of only 1 kt can utilise a fusion charge including a capsule of tritium gas (instead of just solid lithium-6 deuteride as is used in large thermonuclear weapons). This is not "boosting" as Chuck Hansen claimed, because the tritium is physically separated from the fission primary. The neutron bomb employs the Teller-Ulam concept. (It is not simply a boosted weapon, or the neutrons would be unable to escape easily.)

The W-66 warhead is another American neutron bomb, but the W-66 was for the "Sprint" ABM missile warhead: the neutrons would destroy incoming enemy ICBM warheads within the atmosphere (hence the need for low yield and no collateral damage, and the choice of using clean neutron bombs was ideal).

Theoretical research for the W-66 began with Samuel Cohen's work on the neutron bomb in 1958, but production engineering for the W-66 neutron bomb for the Sprint ABM warhead only began in January 1972, and the first W-66 warheads were manufactured in June 1974. By March 1975, 70 W-66 warheads had been produced.

The W-70 Mod 3 is another example of a neutron bomb. It was the warhead for the U.S. Army "Lance" missile.

Production engineering on the W-70 began in December 1970 and manufacture began in June 1973. By July 1977, 900 W-70s had been produced; these were ordinary thermonuclear warheads with selectable yields of up to 100 kt.

The development of the W-70 Mod 3, the neutron bomb version, began in April 1976 but was suspended by President Carter at the end of September 1977 for political reasons. Production engineering was resumed on 1 November 1978 and manufacture began in May 1981. From August 1981 to February 1983, 380 neutron bomb W-70 Mod 3 were built:

"Yield of the W-70 Mod 3 is selectable as one of two values: one slightly less than a kiloton and the other slightly in excess of a kiloton. Both yields are about 60% fusion and 40% fission." (Page 201 of Chuck Hansen's *U.S. Nuclear Weapons*, orion Books, 1988.)

The W-70 neutron bomb warhead is 465 pounds in mass, 97 inches long and 22 inches in diameter.

*At **4:07 pm**, **nige** said...*

The link in a comment above to a post about Samuel Cohen's neutron bomb is defective.

The correct links are:

http://glasstone.blogspot.com/2006/05/revised-edition-of-sam-cohens-shame-is.html

http://glasstone.blogspot.com/2006/06/third-edition-of-sam-cohens-book.html

Also relevant (discusses natural nuclear "pollution" hysteria **such as censorship from the popular media of all reports on the safe and complete containment of nuclear waste from the 15 Oklo nuclear reactors in the massive uranium ore seams of Gabon, Africa within sedimentary rock for the past 1,700 million years**):

http://glasstone.blogspot.com/2006/05/radioactivity-lingering-in-hiroshima.html

*At **10:10 pm**, **nige** said...*

The link to the quotation about Glasstone by **Dr David Forslund** near the beginning of this blog post no longer works because the "LANL - the real story" blog was taken down. However an archived version of that blog post containing the link with his comment about Glasstone is:

http://www.parrot-farm.net/~roberts/lanl-the-real-story/2005/05/open-debate-and-dissenting-views-have.html

Sunday, May 01, 2005
Open debate and dissenting views have always been at the heart of Los Alamos' culture
Open debate and dissenting views have always been at the heart of Los Alamos' culture. This Blog is simply the extension of the Laboratory's cultural identity while the Lab's management removed internal avenues for discussion. In the past, dissenting views have played a key role in helping the Nation's security. Los Alamos has earned a reputation for unparalleled integrity in providing scientific advice in support of the National security. This integrity was earned through over fifty years of service and key to this character has been intense internal dialogs on all the issues that the Laboratory is charged with stewarding.

Some visitors to this forum have suggested that the Blog is full of "whiners" or have suggested that it is a threat to our National security. These suggestions are made out of ignorance about the Laboratory and its history. At its origin, the Laboratory was endowed with a spirit of debate, and open discourse on important issues. All characteristics associated with the best in American society.

Early in the existence of the Laboratory, a key decision was made after vigorous debate regarding the degree of openness within the confines of the secret Laboratory. Robert Oppenheimer and General Leslie Groves led the opposing sides of this debate. Oppenheimer favored openness with the hope that many keen minds would be exposed to critical problems improving the chances for solution. Groves favored secrecy and compartmentalized work. Oppenheimer won and we are all safer and more secure for it. The success of the Manhattan Project was in large part due to the open atmosphere inside the Laboratory during WWII.

Thus open debate and dissent on important issues became a cornerstone of the Los Alamos culture. I submit that this cultural characteristic is as American as apple pie and stands at the very core of Los Alamos' identity. This Blog is a result of the view that current Laboratory management stood squarely opposed to these values. As a result, the employees sought alternative avenues to discuss issues critical to them and their future. In the past there would have been vigorous internal dissent and most of you visiting would have been completely oblivious to it, but safer and more secure as a result. Now that dissent internal to Lab has been shutdown, it has spilled onto the Internet. Many of the employees now believe that the Laboratory management cannot be trusted, do not harbor dissent and are not interested in debate. This Blog is the reaction. Above all, the culture of Los Alamos values the truth, open dissent and honest debate.

The people working at the Laboratory entered into a social contract that included the legacy of Oppenheimer with the right to open debate and dissent within the Laboratory. There is the perception that current Lab management does not seem to understand this and have violated this social contract through their recent actions. There are many reports of the management attacking the Laboratory's culture. These reported attacks have included an assault on the spirit of debate and dissent. In essence the employees feel that management turned their backs on the legacy given to them. The reaction of the employees could have been expected. Given the opportunity to engage in a dialog in an unfettered environment such as this Blog, people did what came naturally to them.

Hopefully the future will allow the necessary dissent and debate to occur within the confines of the Laboratory making this forum an unnecessary outlet. Hopefully the United States will have this Laboratory to help protect the Nation with the best in science. It is tragic that seemingly inept and careless management is destroying the Laboratory during a time when the Nation needs scientific answers to critical security issues. September 11th taught us all that we are at risk. Our National defense depends on our supremacy in Science and

Engineering. This supremacy is not secure and a true National resource is slipping from our collective grasp. This need not happen.

One way to interpret the mission of the Laboratory is to help provide the Nation and its citizens greater safety and security. If the Laboratory continues to decline, all of us will be less safe and less secure.

These views are mine as a private citizen.

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Posted by Bill Rider to LANL: The Real Story at 5/1/2005 06:42:06 PM

 # posted by Doug Roberts : 5/01/2005 06:51:00 PM
Comments:
I agree with Bill's view of the Lab. When I arrived at the Lab 36+ years ago, the culture he dscribes showed in many ways. Even though I was a lowly postdoc, we took a course on nuclear physics (as did every new employee) and then a class on elements of bomb design both taught by Samuel Glasstone. This was required training. Then we visited every major experimental facility on the mesa. After that approximately 3 weeks of training, I understand what the Lab was about and why it was important to the nation. I'm certain it contributed to my wanting to stay on after my postdoc and has helped me in my work over the years. This was part of the "openness" despite the secrecy associated with the Lab. I believe we have lost this over the years and it isn't totally due to current management but a gradual shift in areas of micromanagement by the government and changes within our culture. I'm not sure it is possible to regain this "openness", but it certainly contributed to the Lab's over the decades.
 # posted by David : 5/01/2005 07:03:00 PM [...]

At 2:26 pm, nige said...

The early history to the first edition of "The Effects of Atomic Weapons (1950)" can be found in the Foreword written by Norris E. Bradbury (Director of Los Alamos Scientific Laboratory) to that book (pages vii-viii):

"It was recommended some time ago that the Los Alamos Scientific Laboratory be given the responsibility for preparing for publication a handbook on the effects of atomic weapons. The recommendation was made by the Weapons Effects Classification Board, a committee of military and civilian scientists serving as advisers to the Atomic Energy Commission. The Board's recommendation was approved by the Atomic Energy Commission late in 1948, and this volume is the result.

"Its purpose is to present, as accurately as is possible in the light of present knowledge, a technical summary of the results to be expected from the detonation of atomic weapons. Of necessity, classified information vital to the national security has been omitted. ...

"With the concurrence of the Atomic Energy Commission a technical staff was appointed by the Los Alamos Scientific Laboratory to compile the material for the book. Members of this staff were: Dr Joseph O. Hirschfelder, professor of chemistry at the University of Wisconsn; Lt Col David B. Parker, Office of Deputy Assistant Chief of Staff, G-3, for Atomic Energy, U.S. Army General Staff; Arnold Kramish, a physicist on the staff of the Atomic Energy Commission in Washington, D.C.; and Dr Ralph Carlisle Smith, an assistant director of the Los Alamos Scientific Laboratory. ...

"When the first compilation had been prepared, Dr Samuel Glasstone, professor of physical chemistry and the author of well-known scientific treatises, including the Atomic Energy Commission Sourcebook on Atomic Energy, was requested by the editors to join them as Executive Editor in the final rewriting of the manuscript. Part of his work was to minimise as far as possible the repetition of subject matter and the inconsistencies resulting from the multiple sources and from the lack of accurate knowledge in this relatively new field.

"While the predictions of this book cannot be guaranteed to be precise, nevertheless they probably represent the most nearly quantitative approach to atomic bomb phenomenology which can be published at this time."

At 3:04 pm, nige said...

The footnote on page 235 of the 1950 "Effects of Atomic Weapons" gives the following formula for the initial gamma radiation dose from a 20 kt nominal nuclear weapon:

(3.8/D^2)*(10^11)e^{-D/1026) Roentgens,

where D is distance from bomb in feet.

Converting from distance units of feet to yards and scaling the bomb yield to 1 kt, this gives

(2.1/D^2)*(10^9)e^{-D/342) Roentgens,

which can be compared directly to the equivalent formula for initial gamma radiation from a 1 kt air burst on page 382 of the 1957 revision "The Effects of Nuclear Weapons":

(1.4/D^2)*(10^9)e^{-D/338) Roentgens.

That page (page 382 of the 1957 edition) does mention the large hydrodynamic enhancement of initial gamma radiation for weapons with yields exceeding 20 kt:

"If the total initial gamma radiation is proportional to the energy yield of the explosion and the relaxation length [i.e., the free path of 338

yards in the exponential term of the formula above] of the photons in air is assumed to be constant, the dose received from a W-kiloton burst would eb obtained upon multiplying the above expression by W. However, because of the sustained decrease in air pressure [this is incorrect: the pressure returns to normal relatively fast, and it is actually the decrease in air density which is sustained, because of the high temperature of the air left behind the shock wave] during the transmission of the delayed contribution of the initial gamma rays, and for other reasons, as mentioned in paragraph 8.38, the value of gamma [the mean free path or relaxation length of 338 yards in the exponent of the formula above], for yields higher than about 20 kilotons, is actually greater than 338 yards and varies with the energy yield."

The 1957 edition explains on page 384 how the neutron spectrum was empirically deduced by measuring the neutron induced specific activity in a range of elements which only get neutron induced activity if the neutron energy exceeds a particular threshold or cutoff: 2.5 MeV or more neutron energy is needed to produce significant induced radioactivity in sulphur, 1.5 MeV in U-238, 0.7 MeV in Np-237, and 0.1 keV in Pu-239 which is shielded with boron. Gold is activated by slow (thermalized) neutrons. By subtracting the relative neutron fluence deduced by each element, the neutron spectrum could be worked out:

"... over a considerable range of distances there is an equilibrium spectrum in which the energy distribution of the neutrons in the initial nuclear radiation is independent of distance from the explosion."

Neutron doses are a sensitive function of bomb design, because they are mostly emitted before the bomb has blown itself apart (unlike the fission product gamma rays), and because the average energy of the neutrons produced ranges from about 1-3 MeV for fission weapons up to 14 MeV for tritium-deuterium fusion neutrons. However, because neutrons are mostly emitted at very early times, they undergo little hydrodynamic enhancement because the low-density air region around the explosion does not develop until after the neutrons have been received. Hence, neutron doses are not enhanced significantly by the blast heated low-density air. For this reason, neutron doses are relatively less significant than gamma doses in the case of high-yield nuclear weapons where gamma but not neutron doses are subjected to hydrodynamic enhancement.

*At **3:28 pm**, **nige** said...*

On the subject of the tinme-delay in receiving initial radiation neutron and gamma doses, page 245 of the 1950 "Effects of Atomic Weapons" states that the velocity of neutrons of energy E MeV is 1.26*(10^9)*(E^0.5) cm/second (this is clearly a non-relativistic formula, because there is clearly a top possible speed of 3*10^10 cm/second, i.e. the velocity of light, approaching which the neutron mass increases substantially with energy, instead of the velocity increasing).

Because of elastic collisions with air molecules, neutrons don't travel with this effective speed but describe a "random walk" or zig-zag path, so that it can take up to a second for all the prompt neutrons to transverse 2000 feet:

"It would appear, therefore, that most of the neutrons reaching the earth would do so within such a short period of time after the explosion that evasive action would not be possible."

Also, hydrodynamic would not be possible, because large low-density air regions would not have developed significantly within this time. This is why neutron radiation is relatively unavoidable and is a short-ranged effect with little collateral damage outside the target area, leading to Cohen's neutron bomb as a tactical nuclear weapon.

By contrast, page 238 of the 1950 "Effects of Atomic Weapons" shows that at 4200 feet from a 20 kt detonation (presumably Trinity test), 10% of the initial gamma radiation dose was received in 0.05 second, 20% in 0.14 second, 30% in 0.3 second, 40% in 0.6 second, 50% in 1.1 second, 80% in 10 seconds, 90% in 20 seconds, and 95% in 30 seconds.

Clearly, the initial gamma radiation is received over a longer interval than the neutron radiation is, so it undergoes more hydrodynamic enhancement in large detonations, and is easier to protect against.

Pages 238-9 of the 1950 "Effects of Atomic Weapons" state:

"Taking shelter quickly behind a convenient building or in a slit trench, an act which is conceivable within a second [or so] of seeing the bomb flash, might thus mean the difference between life and death to a human being at a point where the unprotected dosage would be near the median lethal value."

The footnote on page 233 of the 1950 "Effects of Atomic Weapons" states that the initial gamma ray mean energy is 4.5 MeV, compared to 0.7 MeV for fallout, while the table on that page states that 6.8 inches of concrete is needed to cut the fallout radiation dose rate by a factor of 10, compared to 15 inches of concrete to achieve the same protection against initial gamma rays.

This comparison is not strictly true, because the initial gamma rays of high energy are those due to high energy neutron captures in the air, and such gamma rays are only predominant near the detonation where the neutron dose is high. At great distances from high yield weapons, fission product gamma rays predominate, and the mean gamma ray energy is a lot lower than 4.5 MeV.

*At **10:22 pm**, **nige** said...*

Some vital reports by Dr. Carl F. Miller:

Accession Number : AD0476572
Title : BIOLOGICAL AND RADIOLOGICAL EFFECTS OF FALLOUT FROM NUCLEAR EXPLOSIONS. CHAPTER 1: THE NATURE OF FALLOUT. CHAPTER 2: FORMATION OF FALLOUT PARTICLES
http://www.dtic.mil/cgi-bin/GetTRDoc?AD=AD476572&Location=U2&doc=GetTRDoc.pdf
Corporate Author : STANFORD RESEARCH INST MENLO PARK CA
Personal Author(s) : Miller, Carl F.
Handle / proxy Url : http://handle.dtic.mil/100.2/AD476572
Report Date : MAR 1964
Pagination or Media Count : 89

Abstract : Contents: The Nature of Fallout; Local Fallout; World-Wide Fallout; Potential Hazards from Fallout; Radioactive Decay; The Standard Intensity and Contour Properties. Formation of Fallout Particles; General Description of Fallout Formation Processes; The Structure and Composition of Individual Fallout Particles; Solubility Properties of Fallout; Radioactive Elements in Fallout; The Condensation Process.

also:

FALLOUT AND RADIOLOGICAL COUNTERMEASURES, VOLUME 1
http://www.dtic.mil/cgi-bin/GetTRDoc?AD=AD410522&Location=U2&doc=GetTRDoc.pdf

The major purpose of this report is to outline and discuss these physical processes and the important parameters on which they depend.

Accession Number : AD0410522
Title : FALLOUT AND RADIOLOGICAL COUNTERMEASURES, VOLUME 1
Corporate Author : STANFORD RESEARCH INST MENLO PARK CA
Personal Author(s) : Miller, Carl F.
Handle / proxy Url : http://handle.dtic.mil/100.2/AD410522
Report Date : JAN 1963
Pagination or Media Count : 402

Abstract : The major purpose of this report is to outline and discuss these physical processes and the important parameters on which they depend. The data, data analyses, data correlation schemes, and discussions presented here are organized to emphasize size basic principles so that an appropriate methodology can be applied in evaluating the radiological consequences of nuclear war. An explosion of any kind, detonated near the surface of the earth, causes material to be thrown up or drawn into a chimney of hot rising gases and raised aloft. In a nuclear explosion, two important processes occur: (1) radioactive elements, which are produced and vaporized in the process, condense into or on this material; and (2) a large amount of non-radioactive material, rises thousands of feet into the air before the small particles begin to fall back. This permits the winds to scatter them over large areas of the earth's surface. Thus, when the particles reach the surface of the earth they are far from their place of origin and contain, within or on their surface, radioactive elements. Whether they are solid particles produced from soil minerals, or liquid (salt- containing) particles produced from sea water, they are called fallout. The composition of fallout can be described in terms of two or three components. One is the inactive carrier; this consists of the environmental material at the location of the detonation and is the major component in a near-surface detonation. The second component includes all the radioactive elements in the fallout.

and:

Fallout and Radiological Countermeasures. Volume 2
http://www.dtic.mil/cgi-bin/GetTRDoc?AD=AD410521&Location=U2&doc=GetTRDoc.pdf
Title : Fallout and Radiological Countermeasures. Volume 2. Corporate Author : STANFORD RESEARCH INST MENLO PARK CA. Personal Author(s) : Miller, Carl F.
Accession Number : AD0410521
Title : Fallout and Radiological Countermeasures. Volume 2
Corporate Author : STANFORD RESEARCH INST MENLO PARK CA
Personal Author(s) : Miller, Carl F.
Handle / proxy Url : http://handle.dtic.mil/100.2/AD410521
Report Date : JAN 1963
Pagination or Media Count : 290
Descriptors : *RADIOACTIVE CONTAMINATION, *FALLOUT, CLEANING, SEA WATER
Subject Categories : RADIO COUNTERMEASURES
RADIOACTIVITY, RADIOACTIVE WASTES & FISSION PROD

*At **9:03 pm**, **nige** said...*

Copy of a comment:

http://riofriospacetime.blogspot.com/2009/09/march-tomorrow.html

Public opinion was on Neville Chamberlain's side because the effects of war had been exaggerated in 1938 by the British War Office. Aerial bombing was predicted to cause 121 casualties/ton and the German air force was expected to deliver 600 tons of bombs daily on Britain, killing 2.2 million people per month, which for a long war is the same result as a heavy nuclear attack.

Chamberlain and the British public were scared by these false "predictions" which were based on the WWI unopposed attacks in daylight and had no relevance for inaccurate nighttime bombing when enemy bombers were subject to AA and fighter defenses.

In World War II a total of 71.27 kilotons of bombs, V1 cruise missiles and V2 supersonic ballistic missiles hit Britain, killing 60,595 and injuring 86,182, a casualty rate of 2 casualties/ton, 60 times fewer than the prediction!

If Chamberlain and - more important - the general public had known the true civilian threat in 1938 from aerial attack instead of the hysterical exaggerations officially promoted, then Hitler might have been stopped with less cost in human lives. Delaying the war gave Germany more time to prepare for war, which made the war worse than it would otherwise have been.

What will happen when Iran gets the U-235, and maybe gets some lithium and heavy water to make lithium deuteride to get a H-bomb (it's now known than lithium-6 deuteride isn't necessary; the 11-Mt Castle-Romeo nuclear test used only natural lithium and was a great success)? It will be just like Munich and Iran will be appeased through fear of a nuclear war.

*At **12:22 am**, **nige** said...*

For the record

Despite the fact that the BBC still fakes all nuclear explosion films with the sound of the blast falsely superimposed on the explosion flash, to make civil defense duck and cover seem stupid (actually, like thunder after lightning, the blast wave travels slower than light so the flash occurs in silence until the blast arrives, which can be many seconds later for the case of large areas of devastation from a nuclear explosion, giving plenty of time for “duck and cover” action to avoid flying glass when the blast finally arrives), the BBC did make one honest film about the Soviet Union’s “peace offensive” propaganda lies, the four-part 1995 “Messengers from Moscow” documentary. This documentary provides the framework for the outline of Soviet KGB and related "World Peace Council" inhumane activities facts presented in this blog post, although I supplemented it with numerous other sources as seen.

http://nationalinterest.org/article/confirmation-time-a-review-of-messengers-from-moscow-778

Confirmation Time: A Review of Messengers from Moscow
From the
 Summer 1995
issue

Dimitri K. Simes |
June 1, 1995

The end of Soviet communism has given Westerners unprecedented access to Moscow's historical resources. Various archives have been opened and living witnesses to history are suddenly prepared to tell their stories, even in front of foreign television cameras.

The abundance of new information coming straight from the horse's mouth is unlikely, however, to settle American debates about the origins and nature of the Cold War. History is an imprecise science allowing for a variety of interpretations--particularly when those doing the interpreting have a strong predisposition, or even a vested interest, in seeing things a certain way.

Still, the four-part documentary series Messengers from Moscow, shown in the United States by PBS and in Britain by the BBC, represents a powerful blow to two fundamentals of the liberal dogma--namely, that the Cold War resulted from a Western overreaction to largely defensive, even if rather heavy-handed, Soviet policies and that the preoccupation with the communist menace inside Western democracies amounted to a vicious witch hunt. The series, ably directed by Daniel Wolf and produced by Eugene B. Shirley with Herbert E. Ellision as chief consultant, is based on numerous on-camera interviews with Soviet insiders ranging from Stalin's second-in-command Vyacheslav Molotov to Brezhnev's personal physician. The accounts they present are sobering.

Molotov, in a 1972 taped conversation with poet Felix Chuyev, stated point blank that expanding Soviet borders "as far as possible" was his official duty. In Molotov's view, "there could not be a peaceful Germany unless it takes a socialist path." But he cautioned that it had to be accomplished "carefully," without provoking a war with the West.

*At **3:04 pm**, Anonymous said...*

Hello Nigel

I wish to ask you some short, and some long, questions in respect to a topic you have touched upon quite extensively, and your opinion on an idea I have had:

1. Firestorms and their relation to the 'nuclear winter' scenario.

I recently updated the wikipedia page on 'nuclear winter' and would like your input on the penultimate section-namely

'Firestorm formation', I also wrote the removal mechanisms section under the 'Mechanism' heading.

1b. I am mainly looking for some book and website reference sources for my claim of- 'exceptionally dry weather in the preceding days leading up to the Hiroshima bombing'- I may be mistaken, but I think I read that information here on your blog at one stage, but a web search revealed very little.
And some more substantial references to how Nagasaki did not develop into a firestorm[there are very conflicting reports on this], although fire most certainly did do extensive damage along the valley- evident from the pictures in the public domain, a firstorm is reported by some to not hhave developed, could you help me on corroborating this?

Also I would like to know your thoughts on "Whole world on fire" a book by a Stanford Professor, I referenced this book on the 'nuclear winter' wikipedia page also, it talks about how thermal effects were not factored into the damage caused by a nuclear weapon in the official effects models of the US, only the 'blast factor' was, She believes this was in error.

CONTINUED

*At **3:06 pm**, Anonymous said...*

CONTINUED second half
1c. What is your favourite book on Plutonium toxicity? I know of Bernard Cohen's eating duel with Ralph Nader but upon further investigation it turns out Cohen(to my surprise) may have been mistaken [leaving aside heavy metal poisoning that would occur] the cancer risk from activity alone seems absurb, a mere microgram increases your cancer risk from inhalation, http://www.ead.anl.gov/pub/doc/plutonium.pdf and here, calculations on whether Cohens duel was a sane one, although there is some contention on whether he intended on eating the PuO2 as a solid sphere rather than powdered, to minimise his dose recieved-

http://www.physicsforums.com/showthread.php?t=238446

If you have fault with these cancer probabilty estimates, may I ask what source/guidelines you personally find most reflective of reality?

2. Do you know of any scale model tests, done on miniature concrete cities, to see if a ~300kt weapon would create an appreciable burning hazard-to firestorm transition? Do you think this could reliably be tested in scale size, with sufficient flash bulb wattage and strobing control? in the effort to once and for all put the 'firestorm in modern cities' question to rest, by simulating the effects?

I would like your feedback!

As for the Wikipedia 'nuclear winter' help:

3. I am mainly looking for some book and website reference sources for my claim of- 'exceptionally dry weather in the preceding days leading up to the Hiroshima bombing'- I may be mistaken, but I think I read that information here on your blog at one stage, but a web search revealed very little.

4. I would also like to ask if you know of any good computer simulations that together with blast, take the thermal pulse into effect when calculating nuclear weapon effects, and if not what is your favourite online weapon effects program? I have found one but it has questionable accuracy, one can't examine the maths and it doesn't include blast:
http://www.nucleardarkness.org/nuclear/nuclearexplosionsimulator/

This one is much better showing how at low kt yield,blast damage radius is wider than thermal damage, and then thermal damage overtakes the magnitude of blast damage over about 20 kt.
http://www.fas.org/programs/ssp/nukes/nuclear_weapon_effects/nuclearwpneffctcalc.html

I ask this because I am Especially curious of the higher yields 200kt plus, as I think I've read that at these yields the energy fraction that goes into the thermal pulse(s) is higher than the blast energy fraction- which is around 2/5 or 40%. For example the lethal thermal effects of the 57 Mt Tsar bomba extended quite far beyond the lethal blast zone, with the oft cited- 'third degree burns out to 100km'[excusing the atmospheric focussing of the blast] this is further than the blast radius.
CONTINUED IN 3rd PART

*At **3:08 pm**, Anonymous said...*

CONTINUED FROM 2nd part. THIS IS THE 3rd third & final part:

5. With all the contradictory information out there, I think the world needs a COMPLETE- effects of nuclear weapons & civil defence/survival computer simulation/'game' that airs on the conservative side of things, so that the simulation can't be accused of giving people false hope. Basically a simulation like the countless other 'weapons effects' simulations on the web but also include how explosive yield and weapon design type varies the:
fallout, infra-red, gamma and neutron radiation doses at various distances from ground zero, and the effects on height of burst.

The holy grail of simulations, so to speak, would be like the simulation I describe above but with an additional way of depicting what happens millisecond by millisecond- describing the nuclear explosion fireball formation physics with descriptive text- for example focussing on the formation of the fireball and the 'double flash'- when the shock wave transistions to the non fireballed air. Showing how the thermalization of the X-rays occurs and heats the air, depicting visually a "follow the the neutron fluence" if you will, at incremental times the precentage of neutron scattering off Oxygen & Nitrogen in the air, the secondary neutron activation of materials on the ground, the spallation of air molecules by the neutrons etc.
Go the whole 9 yards!
package it up and sell it as an Iphone application :-)
Seriously though I think this would go a long way towards helping the civil defense message of educating people on what to expect and how to survive. Perhaps the idea could be extended into a full game, and unbeknownst to the player they quickly learn the protection afforded by simple concrete etc. Along with answering the common question of:
'should I stay indoors after the blast in the city or venture outdoors to get up wind? and under what conditions is this not advised? what do I need to know before making this decision? and when is the optimum time to leave to run up wind?'

Teach some immediate Post H hour triage-broken glass wounds, burns etc.

Then have the player do long term survival:
Water treatment, after available clean underground sources become unhealthy- from the leaching of radionuclides into the aquifier water supply- and rain water is not an option, because it is still far too high in activity to drink. teaching simple filtering but including how to make crude ion exchange and reverse osmosis equipment.
Then farming techniques(your character realistically gets thirsty & hungry etc.)
showing how effective skimming the heavily contaminated top soil and burying it is at reducing foodcrop uptake of radioisotopes like Sr-90 & Cs-137, the beneficial effects that adding extra lime-CaOH and KCl is at further reducing the uptake of these radioisotopes, possible include how to make lime from limestone and how to use abundant tree ash- a source of Calcium & potassium ions, to cut down on food crop uptake of Strontium and Cesium- post fallout.

but mainly the player has the ability to do as they please, they could even be allowed to purposefully start the game within the hazard zone so they could learn to notice the effects of the 'ghost phase' of radiation sickness etc.
Just learning and having fun as you go, what do you think?

Any help is appreciated!

Have a good day!p

*At **4:05 pm**, **nige** said...*

Hi Anonymous,

1. There had been no rain for 3 weeks before Hiroshima. Reference: Oughtershaw and Warren, *Medical Effects of the Atomic Bomb in Japan*, McGraw Hill, N.Y., 1956. The Hiroshima meteorological station records survived. The "nuclear winter" soot cloud in Hiroshima blocked out sunshine for 25 minutes, as proved by the sunshine chart recorder. That was for an overcrowded wooden city, which was a fire hazard in *peacetime* according to the U.S. Strategic Bombing Survey report on Hiroshima.

2. Professor Lynn Eden's "Whole World on Fire" is a classic example of a piece of wooden, formulaic scholarship, misguided severely by Dr Harold L. Brode, the editor of the final version of "Capabilities of Nuclear Weapons".

Brode is into whatever is *fashionable* in nuclear weapons effects, as is Eden. At RAND Corp in the 1960s, Brode was highly pro-civil defense when it was fashionable, then in the 1980s he went into nuclear winter firestorms when they were fashionable.

You can't understand Eden's errors without first understanding Brode's errors. Brode either hasn't read or ignores the declassified 1947 secret volumes of the U.S Strategic Bombing Survey evidence from interviews with the Japanese on the causes of the fires in Hiroshima and Nagasaki. Those fires were mainly from overturned charcoal braziers in paper screen and bamboo filled overcrowded wooden houses. The only definite thermal radiation ignition observer evidence was for BLACK coloured wartime air-raid "blackout curtains", now obsolete. How many people now hang black curtains in their windows, and how many have charcoal braziers in paper screen filled rooms?

Brode takes the 1953 Nevada "Encore" test inflammable rubbish-filled room window exposed to the fireball as the basis for predicting thermal effects (see the film "The House in the Middle"). Problems abound. First, TWO houses with identical sized windows were exposed at "Encore": only the one filled with inflammable stuff burned instantly with room "flashover", the other one - which Brode and Eden don't hype - had more modern fire-resistant furnishings and no excess rubbish so it just had slow smouldering which the recovery team was able to extinguish (any survivor could have similarly beaten out those smouldering points fast).

Next, in a modern city, you will have buildings and trees likely to be blocking your view of the fireball. Few windows have an unobstructed view, unlike the Nevada test. Then you get the automatic fire sprinkler systems in modern buildings. Nuclear weapons don't dump aviation fuel into a buildings like the aircraft in the 9/11 attacks. The fire potential is limited and controllable where it's possible to survive the blast and INR.

*At **4:05 pm**, **nige** said...*

Finally, and maybe most important of all, Nevada is drier than your average city. So ignited tinder and kindling is more likely to spread fire to the dried out woodwork of buildings fast.

Brode's manual contains a massive error on this, confusing the humidity effect on ignition energy in kindling with the humidity effect in solid wood.

If you have a sheet of damp paper, a modest increase in thermal radiation will dry it and ignite it, no problem.

But this is not true for damp wood. Thermal radiation *cannot dry out wood* or other heavy burnables, so *ignited kindling will have a serious difficulty in quickly igniting thick damp wood*.

The Brode EM-1 error is ignoring this step. They only take account of the humidity effect on the kine kindling, not the humidity effect on the wood or other combustibles and the difficulty kindling has when trying to ignite them.

Drop a burning sheet of newspaper on a damp wooden floor. What's the probability that the damp wooden floor will instantly become a roaring blaze? Zero, unless it's soaked in petrol. Unless the wood is tinder dry, it takes so long for fires to start that you can stamp out the kindling before they do start. You don't get flashover unless your wood is in a dry desert or you have a room full of kindling.

Another deception Brode and Eden fall for is the blast effect on burning pans of oil.

If you buy "magic" birthday candles for your cake (which contain a small amount of phosphorus), after they ignite it's hard to blow them out permanently. You blow, and they appear to go out briefly, then they "reignite". It's the same with pans of oil: once they're burning they get very hot and it's virtually impossible for a blast to put them out.

Eden deliberately seems to mix up these "impossible to blow out" oil pan fire blast studies with earlier studies proving that non-oil fires such as burning curtains ARE blown out by blast waves!

The trick is to claim the oil fire blowout failures disprove the blowout of fires in all circumstances. Not so. It's like comparing chalk and cheese. They're different.

*At **4:13 pm**, **nige** said...*

For a good summary of the data on the lack of rain in Hiroshima and Nagasaki before the explosions, please see page 143 of http://www.rerf.or.jp/shared/ds02/pdf/chapter03/cha03-p139-155.pdf

"More recently data have been found in the United States Strategic Bombing Survey (USSBS) of Hiroshima and Nagasaki that suggests the free water content of the soil may

have been less than previously assumed. The USSBS report for Hiroshima (1947a) states there had been practically no rain in the city for 3 weeks prior to the bombing, and the USSBS report for Nagasaki (1947b) states there had been no rain for 10 days prior to August 9, except for one light shower on August 5."

http://www.rerf.or.jp/shared/ds02/pdf/chapter03/cha03-p139-155.pdf

*At **6:33 am**, Anonymous said...*

Sadly an egregious explanation was given to the Hiroshima sunshine recording; that is, the recorder ONLY indicates that the sun was not focused when a cloud of dust was present, in analogy to looking at the sun through a cirrus cloud.

RE:
Nuclear winter and related lies debunked by actual firestorm data

Of thousands of nuclear test explosions, the one “nuclear winter” from the Hiroshima fire storm blocked out the sun for 25 minutes (from burst time at 8:15 am until 8:40) in Hiroshima as shown by the meteorological sunshine records printed in Figure 6 (3H) of Drs. Ashley W. Oughterson, Henry L. Barnett, George V. LeRoy, Jack D. Rosenbaum, Averill A. Liebow, B. Aubrey Schneider, and E. Cuyler Hammond, Medical Effects of Atomic Bombs: The Report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan, Volume 1, Office of the Air Surgeon, report NP-3036, April 19, 1951, U.S. Atomic Energy Commission.

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Glasstone's fake nuclear weapon data for unobstructed terrain debunked for cities! Realistic effects and credible nuclear weapon capabilities for deterring or stopping aggressive invasions and attacks which could escalate into major conventional or nuclear wars. Credible nuclear deterrence of invasions and conventional wars reduce the risk of large conventional and nuclear wars occurring through escalation of invasions such as the invasion of Belgium in 1914 and the invasion of Poland in 1939, of surprise attacks like those against France in 1940 and of Russia and Pearl Harbor in 1941, Afghanistan in 1979, Kuwait in 1990, or Crimea in 2014. Contrary to irrational, pseudo-scientific propaganda, the number of nuclear weapons is smaller than the millions of conventional weapons used in large wars and the correct scaling shows that the overall effects are similar, not massively different as often claimed for political propaganda by enemies of peace. Furthermore, the greater time delay of effects from nuclear weapons over the damaged area increases the efficiency of cheap civil defence countermeasures, as compared to conventional weapons. We need credible effects of nuclear weapons for real world peace: peace through tested, proved and practical declassified deterrence and countermeasures against collateral damage. Credible deterrence through simple, effective protection against concentrated and dispersed invasions and aerial attacks. Discussions of the facts as opposed to inaccurate, misleading lies of the "disarm or be annihilated" political dogma variety. Hiroshima and Nagasaki anti-nuclear propaganda debunked by the hard facts. Walls not wars. Walls bring people together by stopping divisive terrorists. In conclusion, credible nuclear deterrence of conventional war offers a beautiful opportunity to create a peaceful world, free from fear peddling, ranting dictators. The only oppositions you will meet will come from authoritarian obsessed fear peddling myth makers. If they can't tell the truth and face the facts, why listen to them? Please see our post on the need to *deter not only direct threats from nuclear attacks but also conventional wars and invasions* that can *escalate* into nuclear wars (as proved by the use of nuclear weapons in WWII, for example, after they were developed during the war itself and did not trigger or provoke the war), linked here, here, here, and here, here, here, and the true scaling law equivalence between a few thousand nuclear weapons and the several million tons of small conventional weapons in a non-nuclear world war as proved by our post summarising key points in Herman Kahn's much-abused call for credible deterrence, *On Thermonuclear War,* linked here. Peace comes through tested, proved and practical declassified countermeasures against the effects of nuclear weapons, chemical weapons and conventional weapons. Credible deterrence to end invasions and wars comes through simple, effective protection against invasions like low yield tactical weapons and walls, and civil defence against collateral damage. Peace comes through discussions of the facts as opposed to inaccurate,

misleading lies of the "disarm or be annihilated" political dogma variety, which are designed to exploit fear to close down criticisms of errors in mainstream orthodoxy. In particular, please see the post linked here on EMP results from an actual Russian 300 kt test at 290 km altitude over unwarned civilian infrastructure in Kazakhstan on 22 October 1962, which caused no injuries or deaths whatsoever (contrary to all of Jeremy Corbyn and CND style lying propaganda that any use of nuclear weapons on civilians would automatically kill millions), but shut down the communications and power supply lines! This is not secret, but does not make newspaper headlines to debunk CND style dogmas on the alleged incredibility of nuclear deterrence.

- **Hiroshima's air raid shelters were unoccupied because Japanese Army officers were having breakfast when B29s were detected far away, says Yoshie Oka, the operator of the Hiroshima air raid sirens on 6 August 1945...**
- **In a sample of 1,881 burns cases in Hiroshima, only 17 (or 0.9 percent) were due to ignited clothing and 15 (or 0.7%) were due to the firestorm flames...**
- **Dr Harold L. Brode's new book, Nuclear Weapons in ...**
- **800 war migrants drowned on 22 April by EU policy:...**
- **Photographed fireball shielding by cloud cover in ...**
- **Nuclear weapons effects "firestorm" and "nuclear w...**
- **Proved 97.5% survival in completely demolished houses ...**

How to achieve peace through tested, proved and practical declassified countermeasures against the effects of nuclear weapons, chemical weapons and conventional weapons. Credible deterrence through simple, effective protection against invasions and collateral damage. Discussions of the facts as opposed to inaccurate, misleading lies of the "disarm or be annihilated" political dogma variety. Hiroshima and Nagasaki anti-nuclear propaganda debunked by the hard facts. Walls not wars. Walls bring people together by stopping attacks by "divide and rule" style divisive terrorists, contrary to simplistic Vatican propaganda.

"There has never been a war yet which, if the facts had been put calmly before the ordinary folk, could not have been prevented." - British Foreign Secretary Ernest Bevin, House of Commons Debate on Foreign Affairs, Hansard, 23 November 1945, column 786 (unfortunately secret Cabinet committees called "democracy" for propaganda purposes have not been quite so successful in preventing war). Protection is needed against collateral civilian damage and contamination in conventional, chemical and nuclear attack, with credible low yield clean nuclear deterrence against conventional warfare which, in reality (not science fiction) costs far more lives. Anti scientific media, who promulgate and exploit terrorism for profit, censor (1) vital, effective civil defense knowledge and (2) effective, safe, low yield air burst clean weapons like the Mk54 and W79 which deter conventional warfare and escalation, allowing arms negotiations from a position of strength. This helped end the Cold War in the 1980s. Opposing civil defense and nuclear weapons that really deter conventional war, is complacent and dangerous.

War and coercion dangers have not stemmed from those who openly attack mainstream mistakes, but from those who camouflage themselves as freedom fighters to ban such free criticism itself, by making the key facts seem taboo, without even a proper debate, let alone financing research into unfashionable alternatives. Research and education in non-mainstream alternatives is needed before an unprejudiced debate, to establish all the basic facts for a real debate. "Wisdom itself cannot flourish, nor even truth be determined, without the give and take of debate and criticism." – Robert Oppenheimer (quotation from the H-bomb TV debate hosted by Eleanor Roosevelt, 12 February 1950).

"Apologies for freedom? I can't handle this! ... Deal from strength or get crushed every time ... Freedom demands liberty everywhere. I'm thinking, you see, it's not so easy. But we have to stand up tall and answer freedom's call!" – Freedom Kids

CONVENTIONAL WARS HAVE KILLED TENS OF MILLIONS OF PEOPLE, NUCLEAR WEAPONS CAN RAPIDLY DETER THIS REAL THREAT TO PEACE WITH MINIMAL CASUALTIES. 'During the critical period 8-15 February [1968], the U.S. command realized [that conventional] bombing was not sufficiently effective. ... The air campaign dropped over 110,000 tons of bombs and napalm on the area around Khe Sanh during the 77-day siege ... the most heavily bombed target in the history of conventional warfare.' – W. C. Yengst, S. J. Lukasik, and M. A. Jensen, *Nuclear Weapons that went to War,* SAID report DSWA-TR-97-25, September 1998 (quoted in the 2015 book by the secret *Capabilities of Nuclear Weapons* editor, Dr Harold L. Brode, *Nuclear Weapons in the Cold War,* page 287). British Nuclear Test Civil Defence Research

SECRET

DR. PENNEY'S DRAFT BROADCAST

Recorded: 30 October 1952

When the planning began, a lot of thought was given to deciding which type of explosion would provide information and experience of the greatest value. Purely scientific measurements are most easily made when the weapon is placed at the top of a high tower, but there were other weighty considerations. The Civil Defence authorities in this country badly needed more data about atomic explosions and, accordingly, the test was planned to get as much novel information as possible for Civil Defence. The decision was made to explode the weapon in a ship moored near land, thus simulating an explosion in a port. The ship was to be equipped as a scientific transmitting station, sending out by radio a vast number of measurements about the nuclear explosion before the equipment was destroyed. More scientific

CHANGE 1

Field Manual No 101-31-1

NUCLEAR WEAPONS EMPLOYMENT DOCTRINE AND PROCEDURES

Radius of vulnerability (emergency risk criterion: 5% combat ineffec

Figure 54. Radii of Vulnerability.

CATEGORY	PERSONNEL (LL) IN— (Based on Governing Effect)				
Radii listed are distances at which a 5 percent incidence of effect occurs. HOB used is $60W^{1/3}$ meters.					
Yield (KT)	Open	Open Foxholes	APCs	Tanks	Earth Shelter
	(Distances are in meters)				
0.1	700	600	600	500	300
1	1200	900	900	800	500
10	3200	1300	1300	1250	900
20	4000	1500	1450	1400	1000
100	8000	1900	1800	1800	1400
200	12000	2000	1900	1900	1500
300	14000	2100	1950	1950	1600

Protective factor = ratio area of effect in the op area of effect for shelte

Example: for 300 kt, the protective factor of open foxholes is equal to $(14,000)^2/(2,100)^2 = 44$.

Open	Open Foxholes	APCs	Tanks	Ea Sh
1	1.36	1.36	1.96	5
1	1.78	1.78	2.25	5
1	6.06	6.06	6.55	12
1	7.11	7.61	8.16	16
1	17.7	19.8	19.8	32
1	36.0	39.9	39.9	64
1	44.4	51.5	51.5	76

Calculation of the injury-averting protective factors by simple open foxholes and earth sh function of weapon yield. Most countermeasures are relatively ineffective against tactico wapons (due to the predominating neutron radiation effect at 0.1 kt yield), but are extrem against strategic nuclear weapons with yields of 100, 200 and 300 kt (protective factors of

The definition of protective factor used here is the factor by which casualties numbers are

Richard P. Feynman, 'This Unscientific Age', in *The Meaning of It All,* Penguin Books, London, 1998, pages 106-9:

'Now, I say if a man is absolutely honest and wants to protect the populace from the effects of radioactivity, which is what our scientific friends often say they are trying to do, then he should work on the biggest number, not on the smallest number, and he should try to point out that the [natural cosmic] radioactivity which is absorbed by living in the city of Denver is so much more serious [than the smaller doses from nuclear explosions] ... that all the people of Denver ought to move to lower altitudes.'

"If a man reads or hears a criticism of anything in which he has an interest, watch ... if he shows concern with any question except 'is it true?' he thereby reveals that his own attitude is unscientific. Likewise if ... he judges an idea not on its merits but with reference to the author of it; if he criticizes it as 'heresy'; if he argues that authority must be right because it is authority ... The path of truth is paved with critical doubt, and lighted by the spirit of objective enquiry... the majority of people have resented what seems in retrospect to have been purely matter of fact ... nothing has aided the persistence of falsehood, and the evils resulting from it, more than the unwillingness of good people to admit the truth ... the tendency continues to be shocked by natural comment, and to hold certain things too 'sacred' to think about. ... How rarely does one meet anyone whose first reaction to anything is to ask: 'is it true?' Yet, unless that is a man's natural reaction, it shows that truth is not uppermost in his mind, and unless it is, true progress is unlikely."

- Sir Basil Henry Liddell Hart, *Why Don't We Learn from History?,* PEN Books, 1944; revised edition, Allen and Unwin, 1972.

Civil defense countermeasures, to be taken seriously by the population, require the publication of solid facts with the scientific evidence to support those facts against political propaganda to the contrary. Secrecy over the effects of nuclear weapons tests does not hinder plutonium and missile production by rogue states, but it does hinder civil defense countermeasures, by permitting lying political propaganda to go unopposed (see linked post, here).

Terrorists successfully prey on the vulnerable. The political spreading of lies concerning threats and the alleged 'impossibility' of all countermeasures, terrorizing the population in order to 'justify' supposedly pro-peace disarmament policies in the 1920s-1930s, resulted in the secret rearmament of fascist states which were terrorizing the Jews and others, eventually leading to World War II.

Political exaggerations about nuclear weapons effects today:

(1) encourage terrorist states and other groups to secretly invest in such weapons to use either for political intimidation or for future use against countries which have no countermeasures, and

(2) falsely dismiss, in the eyes of the media and the public, cheap relatively effective countermeasures like civil defense and ABM.

Therefore, doom-mongering media lies *make us vulnerable to the proliferation threat* today in two ways, just as they led to both world wars:

(1) Exaggerations of offensive technology and a down-playing of simple countermeasures such as trenches, encouraged belligerent states to start World War I in the false belief that modern technology implied overwhelming firepower which would terminate the war quickly on the basis of offensive preparedness: if the facts about simple trench countermeasures against shelling and machine guns during the American Civil War had been properly understood, it would have been recognised by Germany that a long war based on munitions production and logistics would be necessary, and war would have been seen to be likely to lead to German defeat against countries with larger overseas allies and colonies that could supply munitions and the other resources required to win a long war.

(2) Exaggerations of aerial bombardment technology after World War I led to disarmament 'supported by' false claims that it was impossible to have any defense against a perceived threat of instant annihilation from thousands of aircraft carrying gas and incendiary bombs, encouraging fascists to secretly rearm in order to successfully take advantage of the fear and vulnerability caused by this lying political disarmament propaganda.

Contrived dismissal of civil defense by Marxist "Cambridge Scientists Anti-War Group" bigots: (a) appeased war-mongering enemies, and (b) maximised war mortality rates. Idealism kills. Super effective, fully proof-tested, cheap civil defense makes nuclear deterrence credible to stop conventional war devastation by avoiding collateral damage, tit-for-tat retaliation and escalation.

Historically, it has been proved that having weapons is not enough to guarantee a reasonable measure of safety from terrorism and rogue states; countermeasures are also needed, both to make any deterrent credible and to negate or at least mitigate the effects of a terrorist attack. Some people who wear seatbelts die in car crashes; some people who are taken to hospital in ambulances, even in peace-time, die. Sometimes, lifebelts and lifeboats cannot save lives at sea. This lack of a 100% success rate in saving lives doesn't disprove the value of everyday precautions or of hospitals and medicine. Hospitals don't lull motorists into a false sense of security, causing them to drive faster and cause more accidents. Like-minded 'arguments' against ABM and civil defense are similarly vacuous.

'As long as the threat from Iran persists, we will go forward with a missile system that is cost-effective and proven. If the Iranian threat is eliminated, we will have a stronger basis for security, and the driving force for missile-defense construction in Europe will be removed.'

- President Obama, Prague Castle, Czech Republic, 4 April 2009.

Before 9/11, Caspar Weinberger was quizzed by skeptical critics on the BBC News program *Talking Point, Friday, May 4, 2001: Caspar Weinberger quizzed on new US Star Wars ABM plans:*

'The [ABM] treaty was in 1972 ... The theory ... supporting the ABM treaty [which prohibits ABM, thus making nations vulnerable to terrorism] ... that it will prevent an arms race ... is perfect nonsense because we have had an arms race all the time we have had the ABM treaty, and we have seen the greatest increase in proliferation of nuclear weapons that we have ever had. ... So the ABM treaty preventing an arms race is total nonsense. ...

'You have to understand that without any defences whatever you are very vulnerable. It is like saying we don't like chemical warfare - we don't like gas attacks - so we are going to give up and promise not to have any defences ever against them and that of course would mean then we are perfectly safe. ...

'The Patriot was not a failure in the Gulf War - the Patriot was one of the things which defeated the Scud and in effect helped us win the Gulf War. One or two of the shots went astray but that is true of every weapon system that has ever been invented. ...

'The fact that a missile defence system wouldn't necessarily block a suitcase bomb is certainly not an argument for not proceeding with a missile defence when a missile that hits can wipe out hundreds of thousands of lives in a second. ...

'The curious thing about it is that missile defence is not an offensive weapon system - missile defence cannot kill anybody. Missile defence can help preserve and protect your people and our allies, and the idea that you are somehow endangering people by having a defence strikes me almost as absurd as saying you endanger people by having a gas mask in a gas attack. ...

'President Bush said that we were going ahead with the defensive system but we would make sure that nobody felt we had offensive intentions because we would accompany it by a unilateral reduction of our nuclear arsenal. It seems to me to be a rather clear statement that proceeding with the missile defence system would mean fewer arms of this kind.

'You have had your arms race all the time that the ABM treaty was in effect and now you have an enormous accumulation and increase of nuclear weapons and that was your arms race promoted by the ABM treaty. Now if you abolish the ABM treaty you are not going to get another arms race - *you have got the arms already there* - and if you accompany the missile defence construction with the unilateral reduction of our own nuclear arsenal then it seems to me you are finally getting some kind of inducement to reduce these weapons.'

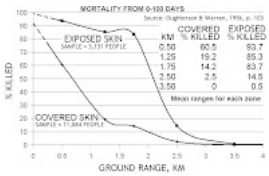
Before the ABM system is in place, and afterwards if ABM fails to be 100% effective in an attack, or is bypassed by terrorists using a bomb in a suitcase or in a ship, civil defense is required and can be effective at saving lives:

'Paradoxically, the more damaging the effect, that is the farther out its lethality stretches, the more can be done about it, because in the last fall of its power it covers vast areas, where small mitigations will save very large numbers of people.'

- Peter Laurie, *Beneath the City Streets: A Private Inquiry into the Nuclear Preoccupations of Government,* Penguin, 1974.

'The purpose of a book is to save people [the] time and effort of digging things out for themselves. ... we have tried to leave the reader with something tangible – what a certain number of calories, roentgens, etc., means in terms of an effect on the human being. ... we must think of the people we are writing for.'

– Dr Samuel Glasstone, DSc, letter dated 1 February 1957 to Colonel Dent L. Lay, Chief, Weapons Effects Division, U.S. Armed Forces Special Weapons Project, Washington, D.C., pages 2 and 4, concerning the preparation of *The Effects of Nuclear Weapons*.



Glasstone and Dolan stated in *The Effects of Nuclear Weapons* (1977), Table 12.17 on page 546, that the median distance in Hiroshima for survival after 20 days was 0.12 miles for people in concrete buildings and 1.3 miles for people standing outdoors. Therefore the median distances for survival in modern city buildings and in the open differed by a factor of 11 for Hiroshima; the difference in areas was thus a factor of 11^2 or about 120. *Hence, taking cover in modern city buildings reduces the casualty rates and the risks of being killed by a factor of 120 for Hiroshima conditions, contrary to popular media presented political propaganda that civil defence is hopeless*. This would reduce 120,000 casualties to 1,000 casualties.

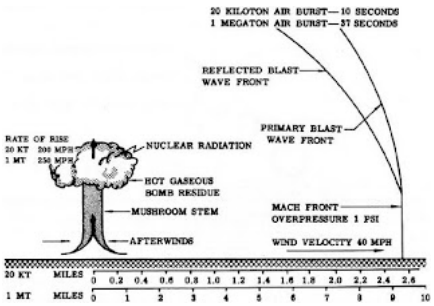
From Dr Glasstone's *Effects of Nuclear Weapons* (1962/64 ed., page 631): 'At distances between 0.3 and 0.4 mile from ground zero in Hiroshima the average survival rate, for at least 20 days after the nuclear explosion, was less than 20 percent. Yet in two reinforced concrete office buildings, at these distances, almost 90 percent of the nearly 800 occupants survived more than 20 days, although some died later of radiation injury. Furthermore, of approximately 3,000 school students who were in the open and unshielded within a mile of ground zero at Hiroshima, about 90 percent were dead or missing after the explosion. But of nearly 5,000 students in the same zone who were shielded in one way or another, only 26 percent were fatalities. ... survival in Hiroshima was possible in buildings at such distances that the overpressure in the open was 15 to 20 pounds per square inch. ... it is evident ... that the area over which protection could be effective in saving lives is roughly eight to ten times as great as that in which the chances of survival are small.'

Lord Mayhew, House of Lords debate on Civil Defence (General Local Authority Functions) Regulations, Hansard, vol. 444, cc. 523-49, 1 November 1983: '... if there had been effective civil defence at Hiroshima probably thousands of lives would have been saved and much human suffering would have been avoided. There is no question about it. ...'

Since the 1977 update by Glasstone and Dolan, extensive new updates to EM-1 for a further revised edition of *The Effects of Nuclear Weapons* have not actually been published with unlimited public distribution, due to President Carter's 1979 executive order which transferred responsibility for civil defense from the jurisdiction of the U.S. Department of Defense's Defense Civil Preparedness Agency to the new agency (which is not an Agency of the U.S. Department of Defense, and is not concerned with the analysis of nuclear weapons test effects data), the Federal Emergency Management Agency. However, the February 1997 U.S. Department of Defense's Defense Special Weapons Agency 0602715H RDT&E Budget Item Justification Sheet (R-2 Exhibit) states that a revision of Glasstone and Dolan's unclassified *Effects of Nuclear Weapons* was budgeted for 1997-9:

"FY 1997 Plans: ... Provide text to update Glasstone's book, *The Effects of Nuclear Weapons,* the standard reference for nuclear weapons effects. ... Update the unclassified textbook entitled, *The Effects of Nuclear Weapons.* ... Continue revision of Glasstone's book, *The Effects of Nuclear Weapons,* the standard reference for nuclear weapons effects. ... FY1999 Plans ... Disseminate updated *The Effects of Nuclear Weapons.*"

The new publications are either classified or unclassified with limited distribution restrictions (e.g., Bridgman's *Introduction to the Physics of Nuclear Weapons Effects,* which includes several chapters on nuclear weapons design to enable initial radiation outputs to be calculated precisely) which prevents up-to-date basic nuclear effects information to justify civil defense against the latest nuclear threats from being widely disseminated; the books are printed for use only by government agencies. The problem with this approach is that widespread public understanding of the best information for civil defense countermeasures is prevented.



'The evidence from Hiroshima indicates that blast survivors, both injured and uninjured, in buildings later consumed by fire [caused by the blast overturning charcoal braziers used for breakfast in inflammable wooden houses filled with easily ignitable bamboo furnishings and paper screens] were generally able to move to safe areas following the explosion. Of 130 major buildings studied by the U.S. Strategic Bombing Survey ... 107 were ultimately burned out ... Of those suffering fire, about 20 percent were burning after the first half hour. The remainder were consumed by fire spread, some as late as 15 hours after the blast. This situation is not unlike the one our computer-based fire spread model described for Detroit.'

- Defense Civil Preparedness Agency, U.S. Department of Defense, *DCPA Attack Environment Manual, Chapter 3: What the Planner Needs to Know About Fire Ignition and Spread,* report CPG 2-1A3, June 1973, Panel 27.

***The Effects of the Atomic Bomb on Hiroshima, Japan,* US Strategic Bombing Survey, Pacific Theatre, report 92, volume 2 (May 1947, secret):**

Volume one, page 14:

"... the city lacked buildings with fire-protective features such as automatic fire doors and automatic sprinkler systems", and pages 26-28 state the heat flash in Hiroshima was only:

"... capable of starting primary fires in exposed, easily combustible materials such as dark cloth, thin paper, or dry rotted wood exposed to direct radiation at distances usually within 4,000 feet of the point of detonation (AZ)."

Volume two examines the firestorm and the ignition of clothing by the thermal radiation flash in Hiroshima:

Page 24:

"Scores of persons throughout all sections of the city were questioned concerning the ignition of clothing by the flash from the bomb. ... Ten school boys were located during the study who had been in school yards about 6,200 feet east and 7,000 feet west, respectively, from AZ [air zero]. These boys had flash burns on the portions of their faces which had been directly exposed to rays of the bomb. The boys' stories were consistent to the effect that their clothing, apparently of cotton materials, 'smoked,' but did not burst into flame. ... a boy's coat ... started to smoulder from heat rays at 3,800 feet from AZ." [Contrast this to the obfuscation and vagueness in Glasstone, *The Effects of Nuclear Weapons*!]

Page 88:

"Ignition of the City. ... Only directly exposed surfaces were flash burned. Measured from GZ, flash burns on wood poles were observed at 13,000 feet, granite was roughened or spalled by heat at 1,300 feet, and vitreous tiles on roofs were blistered at 4,000 feet. ... six persons who had been in reinforced-concrete buildings within 3,200 feet of air zero stated that black cotton blackout curtains were ignited by radiant heat ... dark clothing was scorched and, in some cases, reported to have burst into flame from flash heat [*although as the 1946 unclassified USSBS report admits, most*

***immediately beat the flames out with their hands without sustaining injury, because the clothing was not drenched in gasoline, unlike peacetime gasoline tanker road accident victims*]**

"... but a large proportion of over 1,000 persons questioned was in agreement that a great majority of the original fires was started by debris falling on kitchen charcoal fires, by industrial process fires, or by electric short circuits. Hundreds of fires were reported to have started in the centre of the city within 10 minutes after the explosion. Of the total number of buildings investigated [135 buildings are listed] 107 caught fire, and in 69 instances, the probable cause of initial ignition of the buildings or their contents was as follows: (1) 8 by direct radiated heat from the bomb (primary fire), (2) 8 by secondary sources, and (3) 53 by fire spread from exposed [wooden] buildings."

'It is true that the Soviets have tested nuclear weapons of a yield higher than that which we thought necessary, but the 100-megaton bomb of which they spoke two years ago does not and will not change the balance of strategic power. The United States has chosen, deliberately, to concentrate on more mobile and more efficient weapons, with lower but entirely sufficient yield ...' - President John F. Kennedy in his television broadcast to the American public, 26 July 1963.

'During World War II many large cities in England, Germany, and Japan were subjected to terrific attacks by high-explosive and incendiary bombs. Yet, when proper steps had been taken for the protection of the civilian population and for the restoration of services after the bombing, there was little, if any, evidence of panic. It is the purpose of this book to state the facts concerning the atomic bomb, and to make an objective, scientific analysis of these facts. It is hoped that as a result, although it may not be feasible completely to allay fear, it will at least be possible to avoid panic.'

– Dr George Gamow (the big bang cosmologist), Dr Samuel Glasstone, DSc (Executive Editor of the book), and Professor Joseph O. Hirschfelder, *The Effects of Atomic Weapons,* Chapter 1, p. 1, Paragraph 1.3, U.S. Department of Defense, September 1950.

'The consequences of a multiweapon nuclear attack would certainly be grave ... Nevertheless, recovery should be possible if plans exist and are carried out to restore social order and to mitigate the economic disruption.'

- Philip J. Dolan, editor of *Nuclear Weapons Employment* FM 101-31 (1963), *Capabilities of Nuclear Weapons* DNA-EM-1 (1972), and *The Effects of Nuclear Weapons* (1977), Stanford Research Institute, Appendix A of the U.S. National Council on Radiological protection (NCRP) symposium *The Control of Exposure to the Public of Ionising Radiation in the Event of Accident or Attack,* 1981.

'Suppose the bomb dropped on Hiroshima had been 1,000 times as powerful ... It could not have killed 1,000 times as many people, but at most the entire population of Hiroshima ... [regarding the hype about various nuclear "overkill" exaggerations] there is enough water in the oceans to drown everyone ten times.'

- Professor Brian Martin, PhD (physics), 'The global health effects of nuclear war', *Current Affairs Bulletin,* Vol. 59, No. 7, December 1982, pp. 14-26.

In 1996, half a century after the nuclear detonations, data on cancers from the Hiroshima and Nagasaki survivors was published by D. A. Pierce et al. of the Radiation Effects Research Foundation, RERF (*Radiation Research* vol. 146 pp. 1-27; *Science* vol. 272, pp. 632-3) for 86,572 survivors, of whom 60% had received bomb doses of over 5 mSv (or 500 millirem in old units) suffering 4,741 cancers of which only 420 were due to radiation, consisting of 85 leukemias and 335 solid cancers.

'Today we have a population of 2,383 [radium dial painter] cases for whom we have reliable body content measurements. . . . All 64 bone sarcoma [cancer] cases occurred in the 264 cases with more than 10 Gy [1,000 rads], while no sarcomas appeared in the 2,119 radium cases with less than 10 Gy.'

- Dr Robert Rowland, Director of the Center for Human Radiobiology, *Bone Sarcoma in Humans Induced by Radium: A Threshold Response?,* Proceedings of the 27th Annual Meeting, European Society for Radiation Biology, Radioprotection colloquies, Vol. 32CI (1997), pp. 331-8.

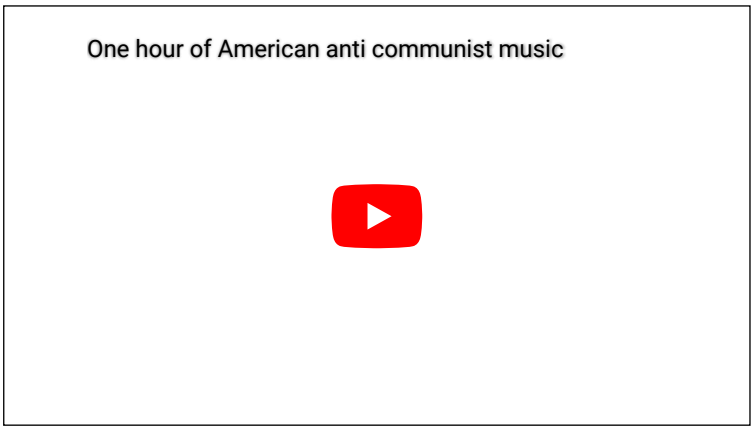
Zbigniew Jaworowski, 'Radiation Risk and Ethics: Health Hazards, Prevention Costs, and Radiophobia', *Physics Today,* April 2000, pp. 89-90:

'... it is important to note that, given the effects of a few seconds of irradiation at Hiroshima and Nagasaki in 1945, a threshold near 200 mSv may be expected for leukemia and some solid tumors. [Sources: UNSCEAR, *Sources and Effects of Ionizing Radiation,* New York, 1994; W. F. Heidenreich, et al., *Radiat. Environ. Biophys.,* vol. 36 (1999), p. 205; and B. L. Cohen, *Radiat. Res.,* vol. 149 (1998), p. 525.] For a protracted lifetime natural exposure, a threshold may be set at a level of several thousand millisieverts for malignancies, of 10 grays for radium-226 in bones, and probably about 1.5-2.0 Gy for lung cancer after x-ray and gamma irradiation. [Sources: G. Jaikrishan, et al., *Radiation Research,* vol. 152 (1999), p. S149 (for natural exposure); R. D. Evans, *Health Physics,* vol. 27 (1974), p. 497 (for radium-226); H. H. Rossi and M. Zaider, *Radiat. Environ. Biophys.,* vol. 36 (1997), p. 85 (for radiogenic lung cancer).] The hormetic effects, such as a decreased cancer incidence at low doses and increased longevity, may be used as a guide for estimating practical thresholds and for setting standards. ...

'Though about a hundred of the million daily spontaneous DNA damages per cell remain unrepaired or misrepaired, apoptosis, differentiation, necrosis, cell cycle regulation, intercellular interactions, and the immune system remove about 99% of the altered cells. [Source: R. D. Stewart, *Radiation Research,* vol. 152 (1999), p. 101.] ...

'[Due to the Chernobyl nuclear accident in 1986] as of 1998 (according to UNSCEAR), a total of 1,791 thyroid cancers in children had been registered. About 93% of the youngsters have a prospect of full recovery. [Source: C. R. Moir and R. L. Telander, *Seminars in Pediatric Surgery,* vol. 3 (1994), p. 182.] ... The highest average thyroid doses in children (177 mGy) were accumulated in the Gomel region of Belarus. The highest incidence of thyroid cancer (17.9 cases per 100,000 children) occurred there in 1995, which means that the rate had increased by a factor of about 25 since 1987.

'This rate increase was probably a result of improved screening [not radiation!]. Even then, the incidence rate for occult thyroid cancers was still a thousand times lower than it was for occult thyroid cancers in nonexposed populations (in the US, for example, the rate is 13,000 per 100,000 persons, and in Finland it is 35,600 per 100,000 persons). Thus, given the prospect of improved diagnostics, there is an enormous potential for detecting yet more [fictitious] "excess" thyroid cancers. In a study in the US that was performed during the period of active screening in 1974-79, it was determined that the incidence rate of malignant and other thyroid nodules was greater by 21-fold than it had been in the pre-1974 period. [Source: Z. Jaworowski, *21st Century Science and Technology,* vol. 11 (1998), issue 1, p. 14.]'



'Professor Edward Lewis used data from four independent populations exposed to radiation to demonstrate that the incidence of leukemia was linearly related to the accumulated dose of radiation. ... Outspoken scientists, including Linus Pauling, used Lewis's risk estimate to inform the public about the danger of nuclear fallout by estimating the number of leukemia deaths that would be caused by the test detonations. In May of 1957 Lewis's analysis of the radiation-induced human leukemia data was published as a lead article in Science magazine. In June he presented it before the Joint Committee on Atomic Energy of the US Congress.' – Abstract of thesis by Jennifer Caron, *Edward Lewis and Radioactive Fallout: the Impact of Caltech Biologists Over Nuclear Weapons Testing in the 1950s and 60s,* Caltech, January 2003.

Dr John F. Loutit of the Medical Research Council, Harwell, England, in 1962 wrote a book called Irradiation of Mice and Men (University of Chicago Press, Chicago and London), discrediting the pseudo-science from geneticist Edward Lewis on pages 61, and 78-79:

'... Mole [R. H. Mole, *Brit. J. Radiol.,* v32, p497, 1959] gave different groups of mice an integrated total of 1,000 r of X-rays over a period of 4 weeks. But the dose-rate - and therefore the radiation-free time between fractions - was varied from 81 r/hour intermittently to 1.3 r/hour continuously. The incidence of leukemia varied from 40 per cent (within 15 months of the start of irradiation) in the first group to 5 per cent in the last compared with 2 per cent incidence in irradiated controls. …

'What Lewis did, and which I have not copied, was to include in his table another group - spontaneous incidence of leukemia (Brooklyn, N.Y.) - who are taken to have received only natural background radiation throughout life at the very low dose-rate of 0.1-0.2 rad per year: the best estimate is listed as 2 x 10^{-6} like the others in the table. But the value of 2 x 10^{-6} was not calculated from the data as for the other groups; it was merely adopted. By its adoption and multiplication with the average age in years of Brooklyners - 33.7 years and radiation dose per year of 0.1-0.2 rad - a mortality rate of 7 to 13 cases per million per year due to background radiation was deduced, or some 10-20 per cent of the observed rate of 65 cases per million per year. ...

'All these points are very much against the basic hypothesis of Lewis of a linear relation of dose to leukemic effect irrespective of time. Unhappily it is not possible to claim for Lewis's work as others have done, "It is now possible to calculate - within narrow limits - how many deaths from leukemia will result in any population from an increase in fall-out or other source of radiation" [Leading article in *Science,* vol. 125, p. 963, 1957]. This is just wishful journalese.

'The burning questions to me are not what are the numbers of leukemia to be expected from atom bombs or radiotherapy, but what is to be expected from natural background .... Furthermore, to obtain estimates of these, I believe it is wrong to go to [1950s inaccurate, dose rate effect ignoring, data from] atom bombs, where the radiations are qualitatively different [i.e., including effects from neutrons] and, more important, the dose-rate outstandingly different.'

Samuel Glasstone and Philip J. Dolan, *The Effects of Nuclear Weapons,* 3rd ed., 1977, pp. 611-3:

'From the earlier studies of radiation-induced mutations, made with fruitflies [by Nobel Laureate Hermann J. Muller and other geneticists who worked on plants, who falsely hyped their insect and plant data as valid for mammals like humans during the June 1957 U.S. Congressional

Hearings on fallout effects], it appeared that the number (or frequency) of mutations in a given population ... is proportional to the total dose ... More recent experiments with mice, however, have shown that these conclusions need to be revised, at least for mammals. [*Mammals are biologically closer to humans, in respect to DNA repair mechanisms, than short-lived insects whose life cycles are too small to have forced the evolutionary development of advanced DNA repair mechanisms, unlike mammals that need to survive for decades before reproducing*.] When exposed to X-rays or gamma rays, the mutation frequency in these animals has been found to be dependent on the exposure (or dose) rate ...

'At an exposure rate of 0.009 roentgen per minute [0.54 R/hour], the total mutation frequency in female mice is indistinguishable from the spontaneous frequency. [Emphasis added.] There thus seems to be an exposure-rate threshold below which radiation-induced mutations are absent ... with adult female mice ... a delay of at least seven weeks between exposure to a substantial dose of radiation, either neutrons or gamma rays, and conception causes the mutation frequency in the offspring to drop almost to zero. ... recovery in the female members of the population would bring about a substantial reduction in the 'load' of mutations in subsequent generations.'

George Bernard Shaw cynically explains groupthink brainwashing bias:

'We cannot help it because we are so constituted that we always believe finally what we wish to believe. The moment we want to believe something, we suddenly see all the arguments for it and become blind to the arguments against it. The moment we want to disbelieve anything we have previously believed, we suddenly discover not only that there is a mass of evidence against, but that this evidence was staring us in the face all the time.'

From the essay titled 'What is Science?' by Professor Richard P. Feynman, presented at the fifteenth annual meeting of the National Science Teachers Association, 1966 in New York City, and published in *The Physics Teacher,* vol. 7, issue 6, 1968, pp. 313-20:

'... great religions are dissipated by following form without remembering the direct content of the teaching of the great leaders. In the same way, it is possible to follow form and call it science, but that is pseudo-science. In this way, we all suffer from the kind of tyranny we have today in the many institutions that have come under the influence of pseudoscientific advisers.

'We have many studies in teaching, for example, in which people make observations, make lists, do statistics, and so on, but these do not thereby become established science, established knowledge. They are merely an imitative form of science analogous to the South Sea Islanders' airfields - radio towers, etc., made out of wood. The islanders expect a great airplane to arrive. They even build wooden airplanes of the same shape as they see in the foreigners' airfields around them, but strangely enough, their wood planes do not fly. The result of this pseudoscientific imitation is to produce experts, which many of you are. ... you teachers, who are really teaching children at the bottom of the heap, can maybe doubt the experts. As a matter of fact, I can also define science another way: Science is the belief in the ignorance of experts.'

Richard P. Feynman, 'This Unscientific Age', in *The Meaning of It All,* Penguin Books, London, 1998, pages 106-9:

'Now, I say if a man is absolutely honest and wants to protect the populace from the effects of radioactivity, which is what our scientific friends often say they are trying to do, then he should work on the biggest number, not on the smallest number, and he should try to point out that the [natural cosmic] radioactivity which is absorbed by living in the city of Denver is so much more serious [than the smaller doses from nuclear explosions] ... that all the people of Denver ought to move to lower altitudes.'

Feynman is *not* making a point about low level radiation effects, but about the politics of ignoring the massive natural background radiation dose, while provoking hysteria over much smaller measured fallout pollution radiation doses. Why is the anti-nuclear lobby so concerned about banning nuclear energy - which is not possible even in principle since most of our nuclear radiation is from the sun and from supernova debris contaminating the Earth from the explosion that created the solar system circa 4,540 million years ago - when they could cause much bigger radiation dose reductions to the population by concentrating on the bigger radiation source, natural background radiation. It is possible to shield natural background radiation by the air, e.g. by moving the population of high altitude cities to lower altitudes where there is more air between the people and outer space, or banning the use of high-altitude jet aircraft. The anti-nuclear lobby, as Feynman stated back in the 1960s, didn't crusade to reduce the bigger dose from background radiation. Instead they chose to argue against the *much smaller* doses from fallout pollution. Feynman's argument is still today falsely interpreted as a political statement, when it is actually exposing pseudo-science and countering political propaganda. It is still ignored by the media. It has been pointed out by Senator Hickenlooper on page 1060 of the May-June 1957 U.S. Congressional Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, *The Nature of Radioactive Fallout and Its Effects on Man:*

'I presume all of us would earnestly hope that we never had to test atomic weapons ... but by the same token I presume that we want to save thousands of lives in this country every year and we could just abolish the manufacture of [road accident causing] automobiles ...'

Dihydrogen monoxide is a potentially very dangerous chemical containing hydrogen and oxygen which has caused numerous severe burns by scalding and deaths by drowning, contributes to the greenhouse effect, accelerates corrosion and rusting of many metals, and contributes to the erosion of our natural landscape: 'Dihydrogen monoxide (DHMO) is colorless, odorless, tasteless, and kills uncounted thousands of people every year. Most of these deaths are caused by accidental inhalation of DHMO, but the dangers of dihydrogen monoxide do not end there. Prolonged exposure to its solid form causes severe tissue damage. Symptoms of DHMO ingestion can include excessive sweating and urination, and possibly a

bloated feeling, nausea, vomiting and body electrolyte imbalance. For those who have become dependent, DHMO withdrawal means certain death.'

From the site for the petition against dihydrogen monoxide: 'Please sign this petition and help stop This Invisible Killer. Get the government to do something now. ... Contamination Is Reaching Epidemic Proportions! Quantities of dihydrogen monoxide have been found in almost every stream, lake, and reservoir in America today. But the pollution is global, and the contaminant has even been found in Antarctic ice. DHMO has caused millions of dollars of property damage in the Midwest, and recently California.'

A recent example of the pseudoscientific radiation 'education' masquerading as science that Feynman (quoted above) objected to in the 1960s was published in 2009 in an article called 'The proportion of childhood leukaemia incidence in Great Britain that may be caused by natural background ionizing radiation' in *Leukemia,* vol. 23 (2009), pp. 770–776, which falsely asserts - in contradiction to the evidence that the no-threshold model is *contrary* to Hiroshima and Nagasaki data: 'Risk models based primarily on studies of the Japanese atomic bomb survivors imply that low-level exposure to ionizing radiation, including ubiquitous natural background radiation, also raises the risk of childhood leukaemia. Using two sets of recently published leukaemia risk models and estimates of natural background radiation red-bone-marrow doses received by children, about 20% of the cases of childhood leukaemia in Great Britain are predicted to be attributable to this source.' The authors of this pseudoscience which is the opposite of the facts are R. Wakeford (Dalton Nuclear Institute, University of Manchester, Manchester, UK), G. M. Kendall (Childhood Cancer Research Group, Oxford, UK), and M. P. Little (Department of Epidemiology and Public Health, Imperial College, London, UK). It is disgusting and sinful that the facts about childhood leukemia are being lied on so blatantly for non-scientific purposes, and it is to be hoped that these leukemia investigators will either correct their errors or alternatively be banned from using scientific literature to promote false dogma for deception until they mend the error of their ways and repent their sins in this matter.

Protein P53, discovered only in 1979, is encoded by gene TP53, which occurs on human chromosome 17. P53 also occurs in other mammals including mice, rats and dogs. P53 is one of the proteins which continually repairs breaks in DNA, which easily breaks at body temperature: the DNA in each cell of the human body suffers at least two single strand breaks every second, and one double strand (i.e. complete double helix) DNA break occurs at least once every 2 hours (5% of radiation-induced DNA breaks are double strand breaks, while 0.007% of spontaneous DNA breaks at body temperature are double strand breaks)! Cancer occurs when several breaks in DNA happen to occur by chance at nearly the same time, giving several loose strand ends at once, which repair proteins like P53 then repair incorrectly, causing a mutation which can be proliferated somatically. This cannot occur when only one break occurs, because only two loose ends are produced, and P53 will reattach them correctly. But if low-LET ionising radiation levels are increased to a certain extent, causing more single strand breaks, P53 works faster and is able deal with faster breaks as they occur, so that multiple broken strand ends do not arise. This prevents DNA strands being repaired incorrectly, and prevents cancer - a result of mutation caused by faults in DNA - from arising. Too much radiation of course overloads the P53 repair mechanism, and then it cannot repair breaks as they occur, so multiple breaks begin to appear and loose ends of DNA are wrongly connected by P53, causing an increased cancer risk.

1. DNA-damaging free radicals are equivalent to a source of sparks which is always present naturally.

2. Cancer is equivalent the fire you get if the sparks are allowed to ignite the gasoline, i.e. if the free radicals are allowed to damage DNA without the damage being repaired.

3. Protein P53 is equivalent to a fire suppression system which is constantly damping out the sparks, or repairing the damaged DNA so that cancer doesn't occur.

In this way of thinking, the 'cause' of cancer will be down to a failure of a DNA repairing enzyme like protein P53 to repair the damage.

Dr Jane Orient, 'Homeland Security for Physicians', *Journal of American Physicians and Surgeons,* vol. 11, number 3, Fall 2006, pp. 75-9:

'In the 1960s, a group of activist physicians called Physicians for Social Responsibility (PSR) undertook to "educate the medical profession and the world about the dangers of nuclear weapons," beginning with a series of articles in the *New England Journal of Medicine*. [Note that journal was publishing information for anti-civil defense propaganda back in 1949, e.g. the article in volume 241, pp. 647-53 of New England Journal of Medicine which falsely suggests that civil defense in nuclear war would be hopeless because a single burned patient in 1947 with 40% body area burns required 42 oxygen tanks, 36 pints of plasma, 40 pints of whole blood, 104 pints of fluids, 4,300 m of gauze, 3 nurses and 2 doctors. First, only unclothed persons in direct line of sight without shadowing can get 40% body area burns from thermal radiation, second, duck and cover offers protection in a nuclear attack warning, and G. V. LeRoy had already published, two years earlier, in J.A.M.A., volume 134, 1947, pp. 1143-8, that less than 5% of burns in Hiroshima and Nagasaki were caused by building and debris fires. In medicine it is always possible to expend vast resources on patients who are fatally injured. In a mass casualty situation, doctors should not give up just because they don't have unlimited resources; as at Hiroshima and Nagasaki, they would need to do their best with what they have.] On its website, www.psr.org, the group boasts that it "led the campaign to end atmospheric nuclear testing." With this campaign, the linear no-threshold (LNT) theory of radiation carcinogenesis became entrenched. It enabled activists to calculate enormous numbers of potential casualties by taking a tiny risk and multiplying it by the population of the earth. As an enduring consequence, the perceived risks of radiation are far out of proportion to actual risks, causing tremendous damage to the American nuclear industry. ... Efforts to save lives were not only futile, but unethical: Any suggestion that nuclear war could be survivable increased its likelihood and was thus tantamount to warmongering, PSR spokesmen warned. ...

'For the mindset that engendered and enables this situation, which jeopardizes the existence of the United States as a nation as well as the lives of millions of its citizens, some American physicians and certain prestigious medical organizations bear a heavy responsibility.

'Ethical physicians should stand ready to help patients to the best of their ability, and not advocate sacrificing them in the name of a political agenda. Even very basic knowledge, especially combined with simple, inexpensive advance preparations, could save countless lives.'

Dr Theodore B. Taylor, *Proceedings of the Second Interdisciplinary Conference on Selected Effects of a General War,* DASIAC Special Report 95, July 1969, vol. 2, DASA-2019-2, AD0696959, page 298 (also linked here):

'I must just say that as far as I'm concerned I have had some doubts about whether we should have had a civil defense program in the past. I have no doubt whatsoever now, for this reason, that I've seen ways in which the deterrent forces can fail to hold things off, so that no matter what our national leaders do, criminal organizations, what have you, groups of people over which we have no control whatsoever, can threaten other groups of people.'

This point of Taylor is the key fact on the morality. Suppose we disarm and abandon nuclear power. That won't stop fallout from a war, terrorists, or a foreign reactor blast from coming. Civil defence knowledge is needed. Even when America has ABM, it will be vulnerable to wind carried fallout. No quantity of pacifist hot air will protect people against radiation.

Charles J. Hitch and Roland B. McKean of the RAND Corporation in their 1960 book *The Economics of Defense in the Nuclear Age,* Harvard University Press, Massachusetts, pp. 310-57:

'With each side possessing only a small striking force, a small amount of cheating would give one side dominance over the other, and the incentive to cheat and prepare a preventative attack would be strong ... With each side possessing, say, several thousand missiles, a vast amount of cheating would be necessary to give one side the ability to wipe out the other's striking capability. ... the more extensive a disarmament agreement is, the smaller the force that a violator would have to hide in order to achieve complete domination. Most obviously, "the abolition of the weapons necessary in a general or 'unlimited' war" would offer the most insuperable obstacles to an inspection plan, since the violator could gain an overwhelming advantage from the concealment of even a few weapons.'

Disarmament after World War I caused the following problem which led to World War II (reported by Winston S. Churchill in the London Daily Express newspaper of November 1, 1934):

'Germany is arming secretly, illegally and rapidly. A reign of terror exists in Germany to keep secret the feverish and terrible preparations they are making.'

British Prime Minister Thatcher's address to the United Nations General Assembly on disarmament on 23 June 1982, where she pointed out that in the years since the nuclear attacks on Hiroshima and Nagasaki, 10 million people had been killed by 140 non-nuclear conflicts:

'The fundamental risk to peace is not the existence of weapons of particular types. It is the disposition on the part of some states to impose change on others by resorting to force against other nations ... Aggressors do not start wars because an adversary has built up his own strength. They start wars because they believe they can gain more by going to war than by remaining at peace.'

J. D. Culshaw, the then Director of the U.K. Home Office Scientific Advisory Branch, stated in his article in the Scientific Advisory Branch journal *Fission Fragments,* September 1972 (issue No. 19), classified 'Restricted':

'Apart from those who don't want to know or can't be bothered, there seem to be three major schools of thought about the nature of a possible Third World War ...

*** 'The first group think of something like World War II but a little worse ...**

*** '... the second of World War II but very much worse ...**

*** 'and the third group think in terms of a catastrophe ...**

'When the Armageddon concept is in favour, the suggestion that such problems exist leads to "way out" research on these phenomena, and it is sufficient to mention a new catastrophic threat [e.g., 10 years later this was done by Sagan with "nuclear winter" hype, which turned out to be fake because modern concrete cities can't produce firestorms like 1940s wooden-built areas of Hamburg, Dresden and Hiroshima] to stimulate research into the possibilities of it arising. The underlying appeal of this concept is that if one could show that the execution of all out nuclear, biological or chemical warfare would precipitate the end of the world, no one but a mad man would be prepared to initiate such a war. [However, as history proves, plenty of mad men end up gaining power and leading countries into wars.]'

J. K. S. Clayton, then Director of the U.K. Home Office Scientific Advisory Branch, stated in his introduction, entitled *The Challenge - Why Home Defence?,* to the 1977 Home Office Scientific Advisory Branch *Training Manual for Scientific Advisers:*

'Since 1945 we have had nine wars - in Korea, Malaysia and Vietnam, between China and India, China and Russia, India and Pakistan and between the Arabs and Israelis on three occasions. We have had confrontations between East and West over Berlin, Formosa and Cuba. There

have been civil wars or rebellions in no less than eleven countries and invasions or threatened invasions of another five. Whilst it is not suggested that all these incidents could have resulted in major wars, they do indicate the aptitude of mankind to resort to a forceful solution of its problems, sometimes with success. ...'

It is estimated that Mongol invaders exterminated 35 million Chinese between 1311-40, without modern weapons. Communist Chinese killed 26.3 million dissenters between 1949 and May 1965, according to detailed data compiled by the Russians on 7 April 1969. The Soviet communist dictatorship killed 40 million dissenters, mainly owners of small farms, between 1917-59. Conventional (non-nuclear) air raids on Japan killed 600,000 during World War II. The single incendiary air raid on Tokyo on 10 March 1945 killed 140,000 people (more than the total for nuclear bombs on Hiroshima and Nagasaki combined) at much less than the $2 billion expense of the Hiroshima and Nagasaki nuclear bombs! Non-nuclear air raids on Germany during World War II killed 593,000 civilians. The argument that the enemy will continue stocking megaton fallout weapons if we go to cleaner weapons is irrelevant for deterrence, since we're not planning to start war, just to credibly deter invasions. You should not try to lower your standards of warfare to those of your enemy to appease groupthink taboos, or you will end up like Britain's leaders in the 1930s, trying to collaborate with fascists for popular applause.

House of Lords debate *Nuclear Weapons: Destructive Power,* published in Hansard, 14 June 1988:

Lord Hailsham of Saint Marylebone: 'My Lords, if we are going into the question of lethality of weapons and seek thereby to isolate the nuclear as distinct from the so-called conventional range, is there not a danger that the public may think that Vimy, Passchendaele and Dresden were all right —sort of tea parties—and that nuclear war is something which in itself is unacceptable?'

Lord Trefgarne: 'My Lords, the policy of making Europe, or the rest of the world, safe for conventional war is not one that I support.'

House of Commons debate *Civil Defence* published in Hansard, 26 October 1983:

Mr. Bill Walker (Tayside, North): 'I remind the House that more people died at Stalingrad than at Hiroshima or Nagasaki. Yet people talk about fighting a conventional war in Europe as if it were acceptable. One rarely sees demonstrations by the so-called peace movement against a conventional war in Europe, but it could be nothing but ghastly and horrendous. The casualties would certainly exceed those at Stalingrad, and that cannot be acceptable to anyone who wants peace'

On 29 October 1982, Thatcher stated of the Berlin Wall: 'In every decade since the war the Soviet leaders have been reminded that their pitiless ideology only survives because it is maintained by force. But the day comes when the anger and frustration of the people is so great that force cannot contain it. Then the edifice cracks: the mortar crumbles ... one day, liberty will dawn on the other side of the wall.'

On 22 November 1990, she said: 'Today, we have a Europe ... where the threat to our security from the overwhelming conventional forces of the Warsaw Pact has been removed; where the Berlin Wall has been torn down and the Cold War is at an end. These immense changes did not come about by chance. They have been achieved by strength and resolution in defence, and by a refusal ever to be intimidated.'

'The case for civil defence stands regardless of whether a nuclear deterrent is necessary or not. ... Even if the U.K. were not itself at war, we would be as powerless to prevent fallout from a nuclear explosion crossing the sea as was King Canute to stop the tide.' - U.K. Home Office leaflet, Civil Defence, 1982.

'... peace cannot be guaranteed absolutely. Nobody can be certain, no matter what policies this or any other Government were to adopt, that the United Kingdom would never again be attacked. Also we cannot tell what form such an attack might take. Current strategic thinking suggests that if war were to break out it would start with a period of conventional hostilities of uncertain duration which might or might not escalate to nuclear conflict. ... while nuclear weapons exist there must always be a chance, however small, that they will be used against us [like gas bombs in World War II]. ... as a consequence of war between other nations in which we were not involved fall out from nuclear explosions could fall on a neutral Britain. ... conventional war is not the soft option that is sometimes suggested. It is also too easily forgotten that in World War II some 50 million people died and that conventional weapons have gone on killing people ever since 1945 without respite.' - - The Minister of State, Scottish Office (Lord Gray of Contin), House of Lords debate on Civil Defence (General Local Authority Functions) Regulations, Hansard, vol. 444, cc. 523-49, 1 November 1983.

'All of us are living in the light and warmth of a huge hydrogen bomb, 860,000 miles across and 93 million miles away, which is in a state of continuous explosion.' - Dr Isaac Asimov.

'Dr Edward Teller remarked recently that the origin of the earth was somewhat like the explosion of the atomic bomb...' – Dr Harold C. Urey, *The Planets: Their Origin and Development,* Yale University Press, New Haven, 1952, p. ix.

'But compared with a supernova a hydrogen bomb is the merest trifle. For a supernova is equal in violence to about a million million million million hydrogen bombs all going off at the same time.' – Sir Fred Hoyle (1915-2001), *The Nature of the Universe,* Pelican Books, London, 1963, p. 75.

'In fact, physicists find plenty of interesting and novel physics in the environment of a nuclear explosion. Some of the physical phenomena are valuable objects of research, and promise to provide further understanding of nature.' – Dr Harold L. Brode, The RAND Corporation, 'Review of

Nuclear Weapons Effects,' *Annual Review of Nuclear Science,* Volume 18, 1968, pp. 153-202.

'It seems that similarities do exist between the processes of formation of single particles from nuclear explosions and formation of the solar system from the debris of a [4 x 10^{28} megatons of TNT equivalent, type Ia] supernova explosion. We may be able to learn much more about the origin of the earth, by further investigating the process of radioactive fallout from the nuclear weapons tests.' – Dr Paul K. Kuroda (1917-2001), University of Arkansas, 'Radioactive Fallout in Astronomical Settings: Plutonium-244 in the Early Environment of the Solar System,' pages 83-96 of *Radionuclides in the Environment: A Symposium Sponsored By the Division of Nuclear Chemistry and Technology At the 155th Meeting of the American Chemical Society, San Francisco, California, April 1-3, 1968*, edited by Symposium Chairman Dr Edward C. Freiling (1922-2000) of the U.S. Naval Radiological Defense Laboratory, Advances in Chemistry Series No. 93, American Chemical Society, Washington, D.C., 1970.

Dr Paul K. Kuroda (1917-2001) in 1956 correctly predicted the existence of water-moderated natural nuclear reactors in flooded uranium ore seams, which were discovered in 1972 by French physicist Francis Perrin in three ore deposits at Oklo in Gabon, where sixteen sites operated as natural nuclear reactors with self-sustaining nuclear fission 2,000 million years ago, each lasting several hundred thousand years, averaging 100 kW. The radioactive waste they generated remained in situ for a period of 2,000,000,000 years without escaping. They were discovered during investigations into why the U-235 content of the uranium in the ore was only 0.7171% instead of the normal 0.7202%. Some of the ore, in the middle of the natural reactors, had a U-235 isotopic abundance of just 0.440%. Kuroda's brilliant paper is entitled, 'On the Nuclear Physical Stability of the Uranium Minerals', published in the *Journal of Chemical Physics*, vol. 25 (1956), pp. 781–782 and 1295–1296.

A type Ia supernova explosion, always yielding 4 x 10^{28} megatons of TNT equivalent, results from the critical mass effect of the collapse of a white dwarf as soon as its mass exceeds 1.4 solar masses due to matter falling in from a companion star. The degenerate electron gas in the white dwarf is then no longer able to support the pressure from the weight of gas, which collapses, thereby releasing enough gravitational potential energy as heat and pressure to cause the fusion of carbon and oxygen into heavy elements, creating massive amounts of radioactive nuclides, particularly intensely radioactive nickel-56, but half of all other nuclides (including uranium and heavier) are also produced by the 'R' (rapid) process of successive neutron captures by fusion products in supernovae explosions. Type Ia supernovae occur typically every 400 years in the Milky Way galaxy. On 4 July 1054, Chinese astronomers observed in the sky (without optical instruments) the bright supernova in the constellation Taurus which today is still visible as the Crab Nebula through telescopes. The Crab Nebula debris has a diameter now of 7 light years and is still expanding at 800 miles/second. The supernova debris shock wave triggers star formation when it encounters hydrogen gas in space by compressing it and seeding it with debris; bright stars are observed in the Orion Halo, the 300 light year diameter remains of a supernova. It is estimated that when the solar system was forming 4,540 million years ago, a supernova occurred around 100 light years away, and the heavy radioactive debris shock wave expanded at 1,000 miles/second. Most of the heavy elements including iron, silicon and calcium in the Earth and people are the stable end products of originally radioactive decay chains from the space burst fallout of a 7 x 10^{26} megatons thermonuclear explosion, created by fusion and successive neutron captures after the implosion of a white dwarf; a supernova explosion.

How would a 10^{55} megaton hydrogen bomb explosion differ from the big bang? Ignorant answers biased in favour of curved spacetime (ignoring quantum gravity!) abound, such as claims that explosions can't take place in 'outer space' (disagreeing with the facts from nuclear space bursts by Russia and America in 1962, not to mention natural supernova explosions in space!) and that explosions produce sound waves in air by definition! There are indeed major differences in the nuclear reactions between the big bang and a nuclear bomb. But it is helpful to notice the solid physical fact that implosion systems suggest the mechanism of gravitation: in implosion, TNT is well-known to produce an *inward* force on a bomb core, but Newton's 3rd law says there is an equal and opposite reaction force *outward*. In fact, you can't have a radially outward force without an inward reaction force! It's the rocket principle. The rocket accelerates (with force $F = ma$) *forward* by virtue of the recoil from accelerating the exhaust gas (with force $F = -ma$) in the *opposite* direction! Nothing massive accelerates without an equal and opposite reaction force. Applying this *fact* to the measured 6 x 10^{-10} ms^{-2} ~ Hc cosmological acceleration of matter radially outward from observers in the universe which was predicted accurately in 1996 and later observationally discovered in 1999 (by Perlmutter, et al.), we find an outward force $F = ma$ and inward reaction force by the 3rd law. The inward force allows quantitative predictions, and is mediated by gravitons, predicting gravitation in a checkable way (unlike string theory, which is just a landscape of 10^{500} different perturbative theories and so can't make any falsifiable predictions about gravity). So it seems as if nuclear explosions do indeed provide helpful analogies to natural features of the world, and the mainstream lambda-CDM model of cosmology - with its force-fitted unobserved *ad hoc* speculative 'dark energy' - ignores and sweeps under the rug major quantum gravity effects which increase the physical understanding of particle physics, particularly force unification and the relation of gravitation to the existing electroweak SU(2) x U(1) section of the Standard Model of fundamental forces.

Richard Lieu, Physics Department, University of Alabama, 'Lambda-CDM cosmology: how much suppression of credible evidence, and does the model really lead its competitors, using all evidence?', http://arxiv.org/abs/0705.2462.

Even Einstein grasped the possibility that general relativity's lambda-CDM model is at best just a classical approximation to quantum field theory, at the end of his life when he wrote to Besso in 1954:

'I consider it quite possible that physics cannot be based on the [classical differential equation] field principle, i.e., on continuous structures. In that case, nothing remains of my entire castle in the air, [non-quantum] gravitation theory included ...'

'Science is the organized skepticism in the reliability of expert opinion.' - Professor Richard P. Feynman (quoted by Professor Lee Smolin, *The Trouble with Physics,* Houghton-Mifflin, New York, 2006, p. 307).

'The expression of dissenting views may not seem like much of a threat to a powerful organization, yet sometimes it triggers an amazingly hostile response. The reason is that a single dissenter can puncture an illusion of unanimity. ... Among those suppressed have been the engineers who tried to point out problems with the Challenger space shuttle that caused it to blow up. More fundamentally, suppression is a denial of the open dialogue and debate that are the foundation of a free society. Even worse than the silencing of dissidents is the chilling effect such practices have on others. For every individual who speaks out, numerous others decide to play it safe and keep quiet. More serious than external censorship is the problem of self-censorship.'

— Professor Brian Martin, University of Wollongong, 'Stamping Out Dissent', Newsweek, 26 April 1993, pp. 49-50

In 1896, Sir James Mackenzie-Davidson asked Wilhelm Röntgen, who discovered X-rays in 1895: 'What did you think?' Röntgen replied: 'I did not think, I investigated.' The reason? Cathode ray expert J. J. Thomson in 1894 saw glass fluorescence far from a tube, but due to prejudice (expert opinion) he avoided investigating that X-ray evidence! 'Science is the organized skepticism in the reliability of expert opinion.' - Richard Feynman, in Lee Smolin, *The Trouble with Physics,* Houghton-Mifflin, 2006, p. 307.

Mathematical symbols in this blog: your computer's browser needs access to standard character symbol sets to display Greek symbols for mathematical physics. If you don't have the symbol character sets installed, the density symbol 'ρ' (*Rho*) will appear as 'r' and the 'π' (*Pi*) symbol will as 'p', causing confusion with the use of 'r' for radius and 'p' for momentum in formulae. This problem exists with Mozilla Firefox 3, but not with Microsoft Explorer which displays Greek symbols.

About Me

Name: nige

Currently designing secure active server page (ASP) front ends for client SQL databases. In 1982 I began programming in basic, and at college learned Fortran while a physics undergraduate a decade later. Afterwards, I switched from mainstream physics and mathematical education to part-time programming student, while working in a series of jobs including four years in credit control. www.quantumfieldtheory.org http://glasstone.blogspot.co.uk/2015/07/capabilities-of-nuclear-weapons.html/ http://www.math.columbia.edu/~woit/wordpress/?p=273#comment-5322. http://www.math.columbia.edu/~woit/wordpress/?p=353&cpage=1#comment-8728. http://www.math.columbia.edu/~woit/wordpress/?p=215#comment-4082.

View my complete profile

From 1945-62, America tested 216 nuclear weapons in the atmosphere, totalling 154 megatons, with a mean yield of 713 kilotons

From 1949-62, Russia tested 214 nuclear weapons in the atmosphere, totalling 281 megatons, with a mean yield of 1.31 megatons

From 1952-8, Britain tested 21 nuclear weapons in the atmosphere, totalling 10.8 megatons, with a mean yield of 514 kilotons

From 1960-74, France tested 46 nuclear weapons in the atmosphere, totalling 11.4 megatons, with a mean yield of 248 kilotons

From 1964-80, China tested 23 nuclear weapons in the atmosphere, totalling 21.5 megatons, with a mean yield of 935 kilotons

In summary, from 1945-80, America, Russia, Britain, France and China tested 520 nuclear weapons in the atmosphere, totalling 478.7 megatons, with a mean yield of 921 kilotons

Mean yield of the 5,192 nuclear warheads and bombs in the deployed Russian nuclear stockpile as of January 2009: 0.317 Mt. Total yield: 1,646 Mt.

Mean yield of the 4,552 nuclear warheads and bombs in the deployed U.S. nuclear stockpile as of January 2007: 0.257 Mt. Total yield: 1,172 Mt.

For diffraction damage where damage areas scale as the two-thirds power of explosive yield, this stockpile's area damage potential can be compared to the 20,000,000 conventional bombs of 100 kg size (2 megatons of TNT equivalent total *energy*) dropped on Germany during World War II: (Total nuclear bomb blast diffraction damaged ground *area*)/(Total conventional blast diffraction damaged ground *area* to Germany during World War II) = $[4{,}552*(0.257\ \text{Mt})^{2/3}]/[20{,}000{,}000*(0.0000001\ \text{Mt})^{2/3}]$ = 1,840/431 = 4.3. Thus, although the entire U.S. stockpile has a TNT *energy* equivalent to 586 times that of the 2 megatons of conventional bombs dropped on Germany in World War II, it is only capable of causing 4.3 times as much diffraction type damage area, because *any given amount of explosive energy is far more efficient when distributed over many small explosions than in a single large explosion! Large explosions are inefficient because they cause unintended collateral damage, wasting energy off the target area and injuring or damaging unintended targets!*

In a controlled sample of 36,500 survivors, 89 people got leukemia over a 40 year period, above the number in the unexposed control group. (Data: *Radiation Research,* volume 146, 1996, pages 1-27.) Over 40 years, in 36,500 survivors monitored, there were 176 leukemia deaths which is 89 more than the control (unexposed) group got naturally. There were 4,687 other cancer deaths, but that was merely 339 above the number in the control (unexposed) group, so this is statistically a much smaller rise than the leukemia result. Natural leukemia rates, which are very low in any case,

were increased by 51% in the irradiated survivors, but other cancers were merely increased by just 7%. Adding all the cancers together, the total was 4,863 cancers (virtually all natural cancer, nothing whatsoever to do with radiation), which is just 428 more than the unexposed control group. Hence, the total increase over the natural cancer rate due to bomb exposure was only 9%, spread over a period of 40 years. There was no increase whatsoever in genetic malformations.

There should be a note here about how unnatural radioactive pollution is (not) in space: the earth's atmosphere is a radiation shield equivalent to being protected behind a layer of water 10 metres thick. This reduces the cosmic background radiation by a factor of 100 of what it would be without the earth's atmosphere. Away from the largely uninhabited poles, the Earth's magnetic field also protects us against charged cosmic radiations, which are deflected and end up spiralling around the magnetic field at high altitude, in the Van Allen trapped radiation belts. ***On the Moon, for example, there is no atmosphere or significant magnetic field so the natural background radiation exposure rate at solar minimum is 1 milliRoentgen per hour (about 10 microSieverts/hour) some 100 times that on the Earth (0.010 milliRoentgen per hour or about 0.10 microSieverts/hour). The Apollo astronauts visiting the Moon wore dosimeters and they received an average of 275 milliRoentgens (about 2.75 milliSieverts) of radiation (well over a year's exposure to natural background at sea level) in over just 19.5 days.*** **It is a lot more than that during a solar flare, which is one of the concerns for astronauts to avoid (micrometeorites are another concern in a soft spacesuit).**

The higher up you are above sea level, the less of the atmosphere there is between you and space, so the less shielding you have to protect you from the intense cosmic space radiations (emitted by thermonuclear reactors we call 'stars', as well as distant supernovae explosions). At sea level, the air above you constitutes a radiation shield of 10 tons per square metre or the equivalent of having a 10 metres thick water shield between you and outer space. As you go up a mountain or up in an aircraft, the amount of atmosphere between you and space decreases, thus radiation levels increase with altitude because there is less shielding. ***The normal background radiation exposure rate shoots up by a factor of 20, from 0.010 to 0.20 milliRoentgens per hour, when any airplane ascends from sea level to 36,000 feet cruising altitude.*** **(The now obsolete British Concorde supersonic transport used to maintain radiation-monitoring equipment so that it could drop to lower-altitude flight routes if excessive cosmic radiation due to solar storms were detected.) Flight aircrew get more radiation exposure than many nuclear industry workers at nuclear power plants. Residents of the high altitude city of Denver get 100 milliRoentgens (about 1 milliSievert) more annual exposure than a resident of Washington, D.C., but the mainstream anti-radiation cranks don't campaign for the city to be shut to save kids radiation exposure, for mountain climbing to be banned, etc.!**

1994 revised Introduction to Kearny's Nuclear War Survival Skills, by Dr Edward Teller, January 14, 1994:

'If defense is neglected these weapons of attack become effective. They become available and desirable in the eyes of an imperialist dictator, even if his means are limited. Weapons of mass destruction could become equalizers between nations big and small, highly developed and primitive, if defense is neglected. If defense is developed and if it is made available for general prevention of war, weapons of aggression will become less desirable. Thus defense makes war itself less probable. ... One psychological defense mechanism against danger is to forget about it. This attitude is as common as it is disastrous. It may turn a limited danger into a fatal difficulty.'

Advice of Robert Watson-Watt (Chief Scientist on the World War II British Radar Project, defending Britain against enemy attacks): 'Give them the third best to go on with, the second best comes too late, the best never comes.'

From Wikipedia (a source of groupthink): 'Groupthink is a type of thought exhibited by group members who try to minimize conflict and reach consensus without critically testing, analyzing, and evaluating ideas. Individual creativity, uniqueness, and independent thinking are lost in the pursuit of group cohesiveness, as are the advantages of reasonable balance in choice and thought that might normally be obtained by making decisions as a group. During groupthink, members of the group avoid promoting viewpoints outside the comfort zone of consensus thinking. A variety of motives for this may exist such as a desire to avoid being seen as foolish, or a desire to avoid embarrassing or angering other members of the group. Groupthink may cause groups to make hasty, irrational decisions, where individual doubts are set aside, for fear of upsetting the group's balance.'

Links

- **Google News**
- **Dr Carl E. Baum's EMP theory and interaction notes**
- **The Atomic Heritage Foundation**
- **Radiation Effects Research Foundation lumps data together to cover up benefits of low dose radiation in Hiroshima and Nagasaki Life Span Study!**
- **DTRA (Defense Threat Reduction Agency) Nuclear testing histories (PDF files)**
- **Samuel Glasstone and Philip J. Dolan**
- **Carl F. Miller's fallout research at nuclear tests**
- **British Home Office Scientific Advisory Branch**
- **Samuel Cohen's book about the collateral damage averting, invasion-deterring neutron bomb he invented, and the lying political attacks he endured as a result**
- **Jerry Emanuelson's review of EMP facts, including the direct dependence of the EMP on the Earth's natural magnetic field strength at the burst location**
- **Essays by 1950s American nuclear weapon effects test (and neutron bomb design) experts, discrediting anti-civil defence propaganda**

- **Neutron bomb inventor Samuel Cohen's 2006 book on the history of the neutron bomb, the most moral weapon ever invented due to its purely military deterrent capabilities, and the pesudo-scientific propaganda war he has had to endure from the enemies of deterrence**
- **Karl-Ludvig Grønhaug's EMP reports page with useful PDF downloads on prompt EMP and MHD-EMP measurements from nuclear tests (Norwegian language)**
- **Colonel Derek L. Duke's factual book on nuclear weapons accidents, *Chasing Loose Nukes, as told to Fred Dungan***
- **The H-Bomb and the birth of the Universe: 'For 100 Million years after time began, the universe was dark as pitch. The clouds of hydrogen condensed into huge nuclear fireballs. That moment-when the universe first lit up-was the moment of creation that matters...'**
- **American *EMP Interaction* manual: comprehensive theory of both the EMP source mechanism and the EMP pick-up in cables and antenna by electromagnetic inductance (30 MB PDF file)**
- **British Mission to Japan, *The Effects of the Atomic Bombs at Hiroshima and Nagasaki*, H. M. Stationery Office, London, 1946 (high quality 42.5 MB pdf file).**
- **1950 edition (high quality 82.7 MB PDF file) of U.S. Department of Defense book *The Effects of Atomic Weapons***
- **1957 edition (high quality 90.8 MB PDF file) of subsequently deleted sections on nuclear tests of civil defense countermeasures from U.S. Department of Defense book *The Effects of Nuclear Weapons***
- **1957 edition (low quality 30.6 MB PDF file) of entire U.S. Department of Defense book *The Effects of Nuclear Weapons***
- **1962/64 edition (high quality 188 MB PDF file) of major revised sections in the U.S. Department of Defense book *The Effects of Nuclear Weapons***
- **1962/64 edition (high quality 43.8 MB PDF file) of 74 pages of subsequently deleted material dealing with thermal ignition of houses at nuclear tests and civil defense countermeasures chapter, from the U.S. Department of Defense book *The Effects of Nuclear Weapons***
- **1977 edition (single 36.8 MB PDF file) of U.S. Department of Defense book *The Effects of Nuclear Weapons***
- **Bill Forstchen, "One Second After" book about EMP attack risk and its effects on USA.**
- **U.S. Department of Energy Opennet Documents Online (includes many Nevada and Pacific nuclear test reports as PDF files)**
- **Defense Technical Information Center (DTIC)'s Scientific and Technical Information Network (STINET) Service (other declassified Nevada and Pacific test reports)**
- **Highlights from ABM testing history**
- **THAAD Goes Another ABM Test**
- **Alex Wellerstein's Restricted Data blog contains some interesting news (but beware of his uncritical use of unobstructed dry desert and nude skin thermal radiation and other effects predictions from the 1977 edition of Glasstone and Dolan; he deletes critically objective comments and pretends that honest criticisms of propaganda as being ignorant deception are rude as an excuse for ignoring the facts and refusing to engage in objective discussion of controversial aspects of this topic; basically if you pay homage and engage in groupthink bias you may be tolerated).**
- **Carey Sublette's Nuclear Weapon Archive (it contains errors from Chuck Hansen's compilation, and it is concentrated on bomb building, not on civil defence countermeasure evaluations done at nuclear tests; note that Chuck Hansen's books and CDs give a false quotation from Neil O' Hines's book *Proving Ground*son the effects of the 1952 Mike explosion on nearby Engebi Island, where Hines later in the book states that the native rats in fact *survived the intense close-in blast, heat and fallout under a few unches of soil, despite the initial ignorant belief that they could not have survived!!!*)**

- **Quantum Field Theory**
- **Los Alamos Science journal**
- **Excellent particle physics gauge theory (fundamental force interaction) issue of Los Alamos Science journal**

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MARTIN MARIETTA

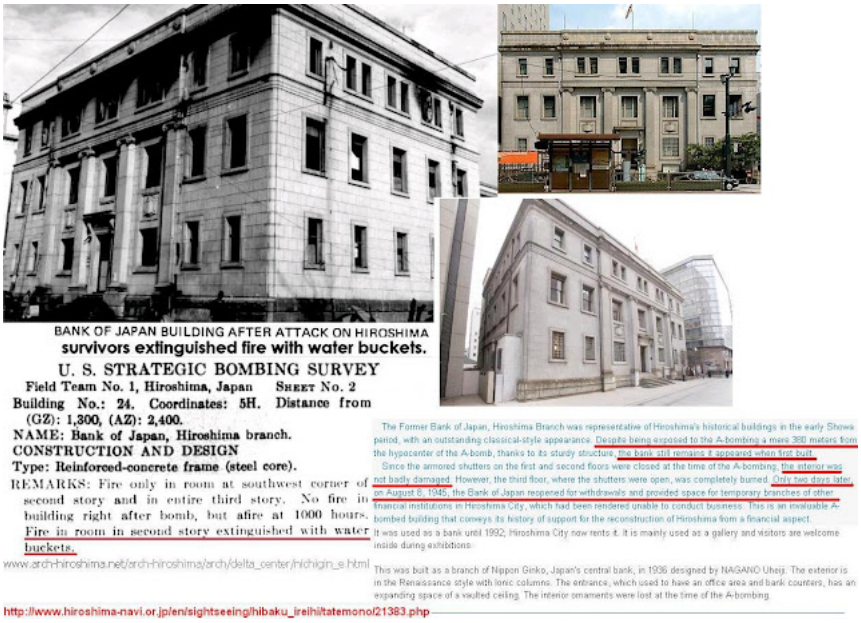
Technical Options for Protecting Civilians from Toxic Vapors and Gases

C. V. Chester

EMP radiation from nuclear space bursts in 1962

Checkmate detonation as seen from another camera

Welcome to the science of the Big Bang...



BANK OF JAPAN BUILDING AFTER ATTACK ON HIROSHIMA
survivors extinguished fire with water buckets.
U. S. STRATEGIC BOMBING SURVEY
Field Team No. 1, Hiroshima, Japan SHEET No. 2
Building No.: 24. Coordinates: 5H. Distance from (GZ): 1,300, (AZ): 2,400.
NAME: Bank of Japan, Hiroshima branch.
CONSTRUCTION AND DESIGN
Type: Reinforced-concrete frame (steel core).
REMARKS: Fire only in room at southwest corner of second story and in entire third story. No fire in building right after bomb, but afire at 1000 hours. Fire in room in second story extinguished with water buckets.

www.arch-hiroshima.net/arch-hiroshima/arch/delta_center/hichigin_e.html

The Former Bank of Japan, Hiroshima Branch was representative of Hiroshima's historical buildings in the early Showa period, with an outstanding classical-style appearance. Despite being exposed to the A-bombing a mere 380 meters from the hypocenter of the A-bomb, thanks to its sturdy structure, the bank still remains it appeared when first built.

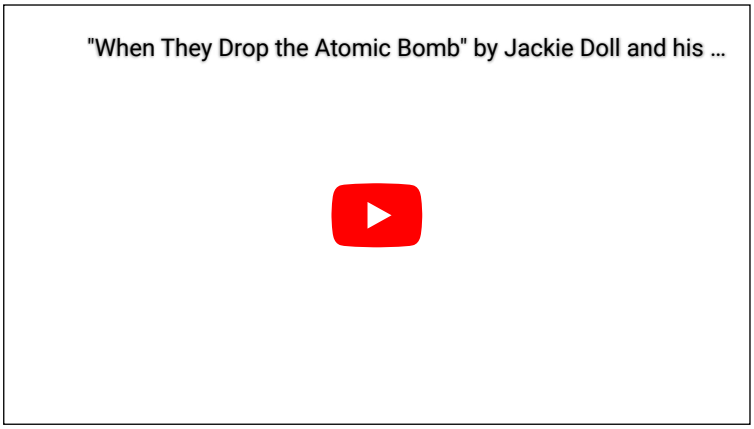
Since the armored shutters on the first and second floors were closed at the time of the A-bombing, the interior was not badly damaged. However, the third floor, where the shutters were open, was completely burned. Only two days later, on August 8, 1945, the Bank of Japan reopened for withdrawals and provided space for temporary branches of other financial institutions in Hiroshima City, which had been rendered unable to conduct business. This is an invaluable A-bombed building that conveys its history of support for the reconstruction of Hiroshima from a financial aspect.

It was used as a bank until 1992; Hiroshima City now rents it. It is mainly used as a gallery and visitors are welcome inside during exhibitions.

This was built as a branch of Nippon Ginko, Japan's central bank, in 1936 designed by NAGANO Uheiji. The exterior is in the Renaissance style with Ionic columns. The entrance, which used to have an office area and bank counters, has an expanding space of a vaulted ceiling. The interior ornaments were lost at the time of the A-bombing.

http://www.hiroshima-navi.or.jp/en/sightseeing/hibaku_ireihi/tatemono/21383.php

The Bank of Japan, Hiroshima, survived 380 m from Ground Zero, within the firestorm area, when fires were extinguished by water buckets by its survivors, the majority of people in the building having survived. Secret US Strategic Bombing Survey report proves civil defense for modern concrete buildings is effective. The building was reopened as a bank on 8 August, merely two days after nuclear attack, and continued in use as a bank until 1992. It remains in Hiroshima. This beautifully designed and sturdy reinforced concrete building was designed in 1936 by Nagano Uheiji. We need to ensure that the worst mistakes of the past are never repeated, if we are just, moral and caring towards our fellow human beings who do not deserve to be fed lies and dangerously complacent one-sided, biased propaganda based on a populist love of obsolete dogma, and/or a hatred of the search for objective fact, by pseudo-educationalists who prefer to live in utopia than in the real world of their fellow folk!"



ACKNOWLEDGEMENTS: **(1). Thank you to http://www.militarystory.org/nuclear-detonations-in-urban-and-suburban-areas/ for re-blogging a typical post from this glasstone.blogspot.com blog, kicking out the lies from under secrecy obsessed loons who want disarmament to start WWIII.**

(2). Thank you to **https://www.nextbigfuture.com/2016/02/are-nuclear-weapons-100-times-less.html for reblogging: "Are [strategic, not tactical] Nuclear Weapons 100 times Less Effective Than Supposed? Nigel B. Cook's Glasstone.Blogspot Blog has beautiful coverage of many nuclear topics here. http://glasstone.blogspot.co.uk/ Cook is a master researcher who digs up incredible piles of research on all topics nuclear and the following is digest of various writings of his gathered for easy access centered on the remarkable thesis that the effects of nuclear weapons, while literally awesome, have been exaggerated or misunderstood to an even greater extent, with perhaps very considerable military consequences."**

TIPS: There is compendium debunking commonplace anti-nuclear CND disarmament propaganda, exaggerations and fake news on nuclear weapons effects and deterrent capabilities **linked here**. Also, each post on this blog can be viewed in either a simple format, e.g. for this current post, **https://glasstone.blogspot.com/2022/02/analogy-of-1938-munich-crisis-and.html** is the simple (faster loading) format, or you can view it (slower loading) in a fancy format by adding: **?m=1** to the end of the URL, e.g. **https://glasstone.blogspot.com/2022/02/analogy-of-1938-munich-crisis-and.html?m=1**

"The Budapest **Memorandum on Security Assurances ... at the OSCE conference in Budapest, Hungary on 5 December 1994 ... signed by three nuclear powers: the Russian Federation, the United Kingdom and the United States ... prohibited the Russian Federation, the United Kingdom and the United States from threatening or using military force or economic coercion against Ukraine, Belarus, and Kazakhstan. As a result of other agreements and the memorandum, between 1993 and 1996, Belarus, Kazakhstan and Ukraine gave up their nuclear weapons**." - Wiki.

NATO needs to come to its senses and rearm to deter WWIII instead of stupidly leaving Putin with more nuclear weapons than anyone else, to intimidate like Hitler (see 1930s newspapers below, which spell out the problem plainly). The problem is, the media is dominated by nuclear liars just as it was dominated by gas war liars in the 1930s, who encouraged war while pretending to be doing the opposite. Fighting a conventional war using Ukraine as proxy, while having an inferior nuclear stockpile, is hardly credible nuclear deterrence (please click here for our brief declassified data debunking Glasstone's lying data on nuclear weapons effects) . Also see the compendium **linked here for more detail on the actual declassified effects found in Hiroshima, contrary to Glasstone's very deceptive treatment. "Disarmament and arms control" charlatans, quacks, cranks, liars, mass murdering Russian affiliates, and evil genocidal Marxist media exposed for what it is, what it was in the 1930s when it enabled Hitler to murder tens of millions in war**!

http://glasstone.blogspot.com/2006_03_28_archive.html http://glasstone.blogspot.com/2006_03_29_archive.html
http://glasstone.blogspot.com/2006_03_30_archive.html http://glasstone.blogspot.com/2006_03_31_archive.html
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