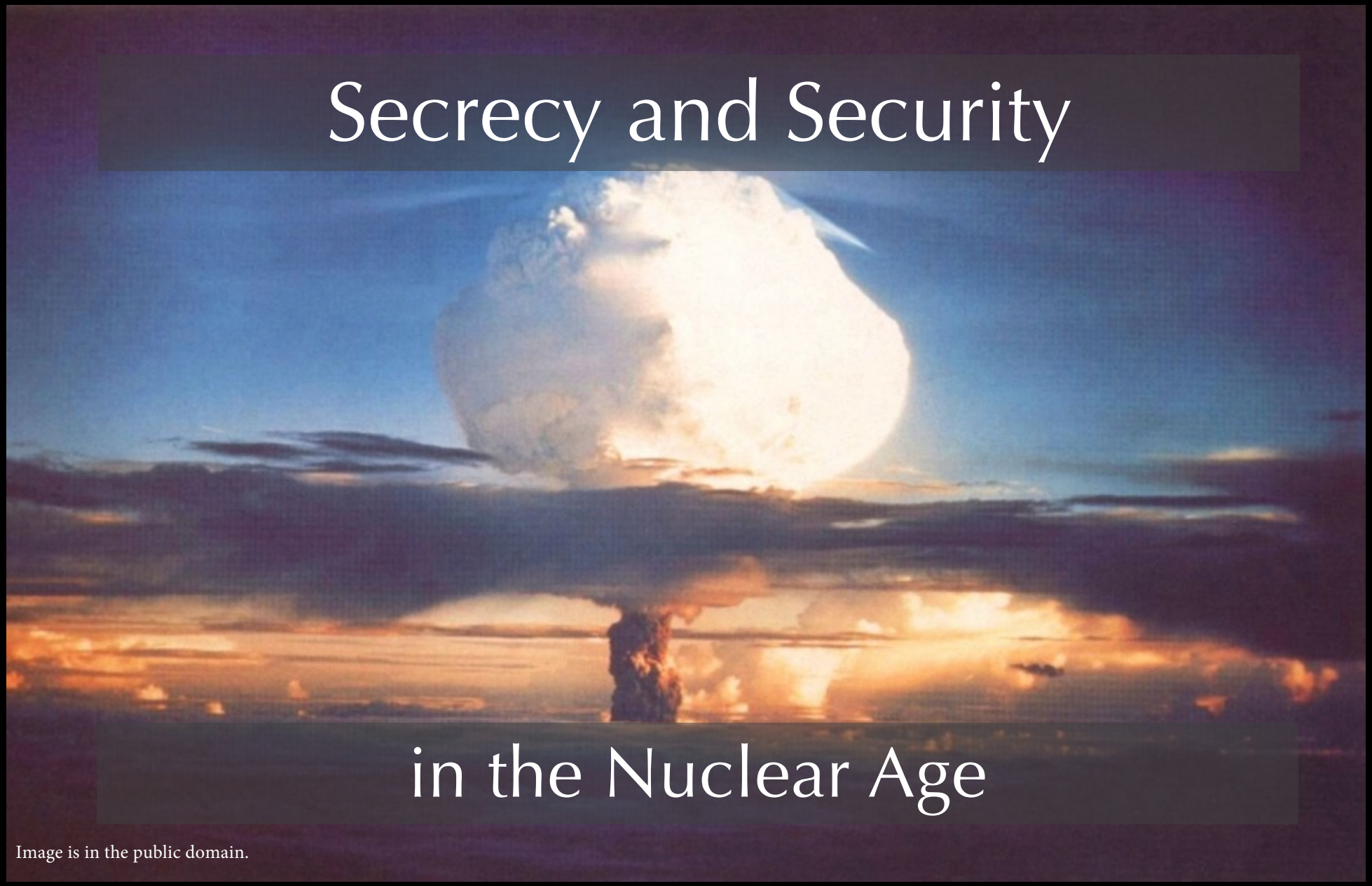
Secrecy and Security



in the Nuclear Age

Image is in the public domain.

8.225 / STS.042, Physics in the 20th Century
Professor David Kaiser, 28 October 2020

1. "The Atomic Secret"

2. The H-Bomb Question

3. From the LTBT to the ABM

The Work of Many People

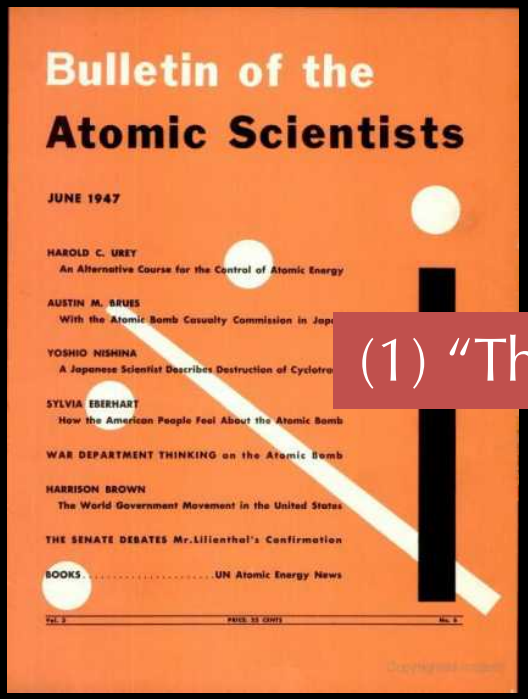
Isotope separation plant, Oak Ridge

Hanford Plutonium factory

The Manhattan Project employed more than 125,000 people at 30 sites.

The Making of a "Secret"

10 distinct responses emerged, 1945-55, to "what is the atomic secret?" They unfolded in lock-step with changing Cold War politics.



(1) "There is no secret."

(2) The only "secret" was whether or not a bomb could be built.

Image is in the public domain.

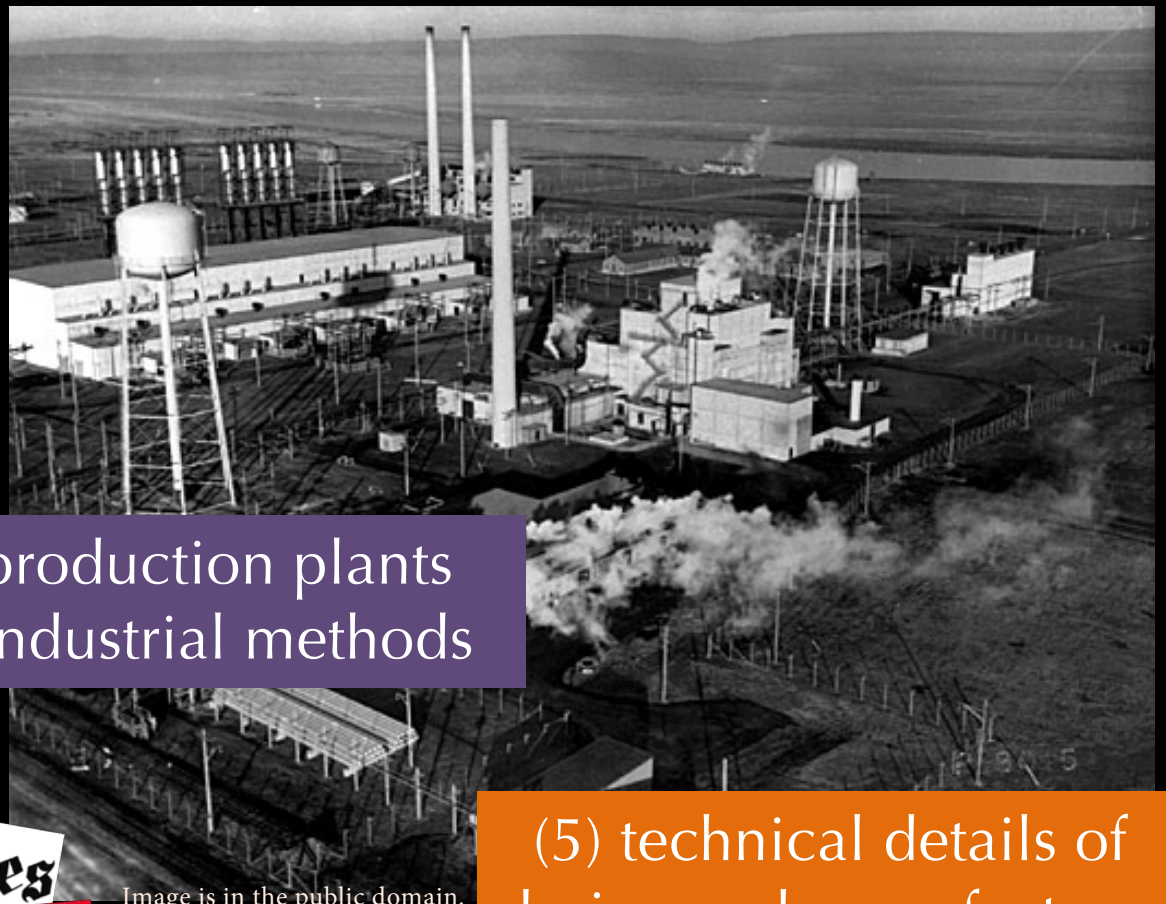
No secrets, no need for military control of atomic energy.

Image is in the public domain.

Secrets, Phase I: 1945-48

If atomic secrets did exist, they concerned "know-how" and industrial capacity, rather than textual information.

B-reactor,
Hanford, 1944



(3) raw materials and their handling

(4) production plants and industrial methods

(5) technical details of design and manufacture

Image is in the public domain.

First Hints of Soviet Espionage, 1945-1946

The Globe and Mail

Where to Find It — Fair and Cold

108rd Year. No. 30,008. Metropolitan Edition — TORONTO, MONDAY, FEBRUARY 18, 1946. — 2 Cents Per Copy — 28 PAGES

FBI JOINS OTTAWA SPY HUNT

Investigation Now Focused On Munitions Department

Documents Included In Roundup

Investigation of Spy Ring In Canada Started Last Fall

Secrecy Is Maintained By Officials

In September 1945, just days after Japan's official surrender, ***Igor Gouzenko*** defected from the Soviet embassy in Canada, sharing many secret documents with Canadian authorities. They implicated several Soviet espionage efforts in the UK and Canada during the war.

Gouzenko's materials led authorities to British physicist ***Alan Nunn May***, who had worked at the Chalk River nuclear reactor site near Ottowa during the war — part of the Manhattan Project — and who confessed to passing physical samples of fissionable U^{233} and U^{235} to the Soviets. ***May***, who had previously been a member of the Communist Party, deplored what he considered to be the lack of cooperation between the wartime allies.

Igor Gouzenko (in hood) on Canadian TV, 1946

Election-Year Politics and Atomic Secrets

HUAC released "atomic espionage" report in September 1948. They claimed that "Scientist X" had given a "complicated formula" to a Communist agent in March 1943.

Election-Year Politics and Atomic Secrets

HUAC's claim: "Scientist X read to [alleged Communist agent] a complicat formula, which [the agent] copied dow Scientist X gave as his reason for asking agent] to copy it down that the formula the handwriting of some other person, he, Scientist X, had to return the formu University of California radiation labora in the morning."

Military Intelligence Division surveillance transcript: The agent had asked the scientist for copies of an article that had "already been published." "I could certainly get reprints of it," the scientist is reported to have replied, but "the leaflet itself will give them [the Soviets] no knowledge" that would be helpful for making bombs.

Election-Year Politics and Atomic Secrets

HUAC released "atomic espionage" report in September 1948. They claimed that "Scientist X" had given a "complicated formula" to a Communist agent in March 1943.

Time, Oct 1948: "Hot formula"

ATOMIC SPY REPORT WILL SHOCK PUBLIC, OFFICIAL DECLARES

It Will Assert That Roosevelt, Truman and Clark 'Had All Facts' on Ring, He Adds

'AMATEURS' AIDED SOVIET

HUAC began a "trial by newspaper": at least 8 front-page headlines in the *New York Times* for the same story, 1948-49.

Secrets, Phase II: 1948-55

Following HUAC's media blitz, 5 different candidates for "the atomic secret" emerged. All now focused on textual *information*, not "know-how" or infrastructure.

(6) "complicated formulas"

(7) info on nuclear stockpile

(8) size and shape of bomb

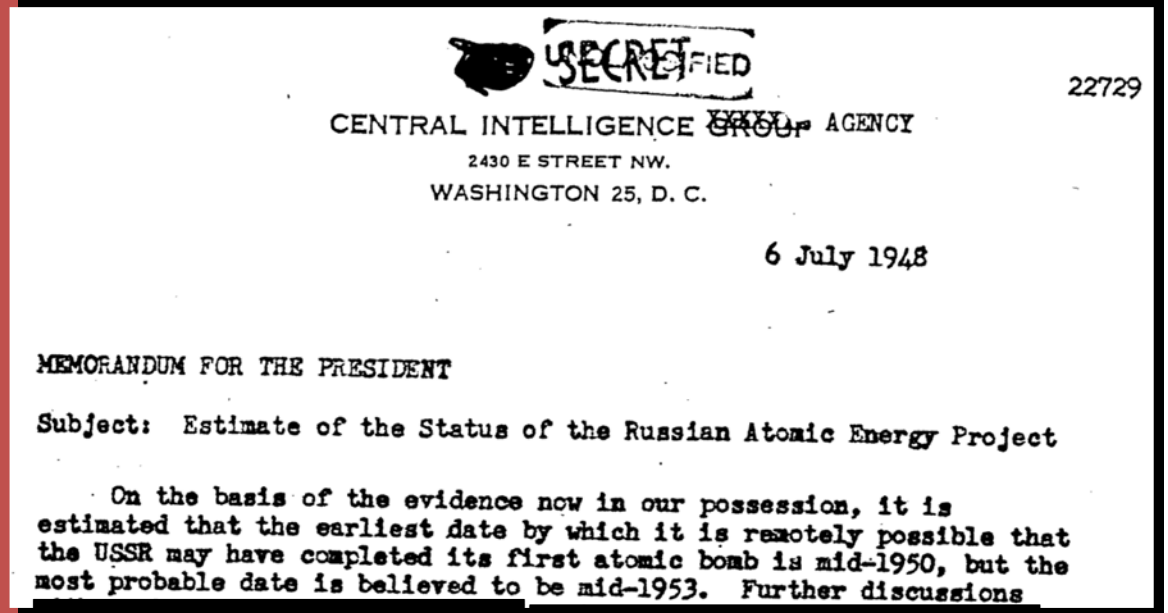
(9) blueprint of implosion mechanism

(10) general "principles" of bomb design

"Joe 1"

Late in August 1949, the Soviet Union secretly detonated its first fission bomb, which US authorities nicknamed "Joe-1" (in 'honor' of Joseph Stalin). On September 22, 1949, US President Harry Truman announced that the US had detected the nuclear detonation, following weeks of internal debate: making the announcement might reveal *how* the US could have detected it.

Until that time, US authorities had routinely predicted that it would take the Soviets 5 years to produce their own nuclear weapon — they just kept estimating "5 [more] years," even as more time went by. The initial estimates were fairly accurate after all. But the news of "Joe-1" nonetheless seemed shocking to many US officials and citizens, given the Cold War rivalry between the US and USSR.



SECRET

22729

CENTRAL INTELLIGENCE AGENCY
2430 E STREET NW.
WASHINGTON 25, D. C.

6 July 1948

MEMORANDUM FOR THE PRESIDENT

Subject: Estimate of the Status of the Russian Atomic Energy Project

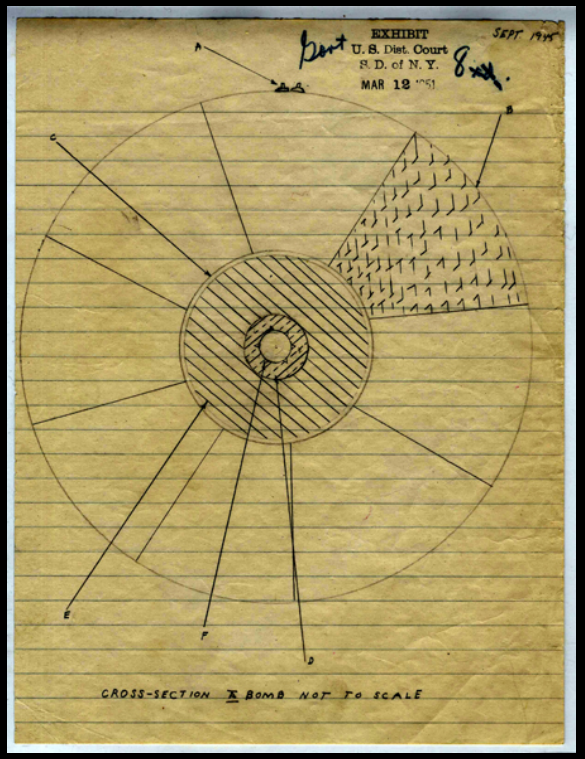
On the basis of the evidence now in our possession, it is estimated that the earliest date by which it is remotely possible that the USSR may have completed its first atomic bomb is mid-1950, but the most probable date is believed to be mid-1953. Further discussions

Image is in the public domain.

Klaus Fuchs Everywhere…

In January 1950, another member of the UK delegation to the wartime Manhattan Project, ***Klaus Fuchs***, confessed to espionage. Fuchs had been a leftist anti-fascist against the Nazis in his native Germany in the 1930s; had fled to the UK; and then had worked at *both* Oak Ridge *and* Los Alamos during the war.

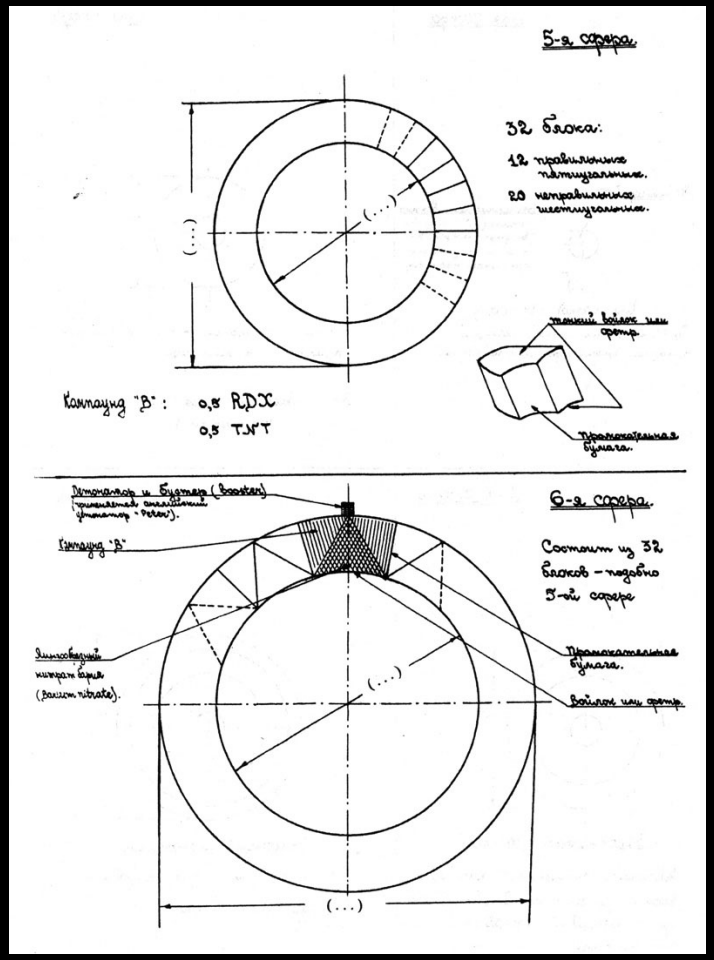
Klaus Fuchs's ID badge photo from wartime Los Alamos



David Greenglass's sketch of implosion lenses, entered as evidence during the Rosenbergs trial

Fuchs's confession led to the eventual arrest of ***Julius and Ethel Rosenberg***. Ethel's brother, ***David Greenglass***, had been a machinist at Los Alamos and shared some information with Julius, who passed it to a Soviet handler. To aid the prosecution, the AEC effectively *declassified* what was by then called "this nation's most closely guarded secret" to help secure the Rosenbergs' conviction (and execution).

An "Explanation" for the Soviet Bomb?



1946 diagrams of an implosion plutonium bomb by Soviet physicist Igor Kurchatov

Many commentators — at the time and since — concluded that the "backward" Soviets could never have produced a bomb so quickly on their own; they needed to rely on *espionage*. But:

- information obtained via espionage was often treated as (potential) *disinformation* by Soviet researchers;
- like the MED, the Soviets pursued several routes *in parallel*, rather than only follow what had worked in the US;
- they were working with different *materials* (epoxies, conventional explosives, etc.)

See ***Alex Wellerstein***, "***Nuclear Secrecy***" blog: https://blog.nuclearsecrecy.com/2012/11/30/soviet-drawings-of-an-american-bomb/

Klaus Fuchs Everywhere…

After the Fuchs case, there was a common slippage from Fuchs to all theorists.

Image is in the public domain.

The Terrifying Import of the Fuchs Case

One year after his sentencing we see he united explosive knowledge and an immature mind.

By REBECCA WEST

LONDON.

T is a lie that there is no new thing under the sun. The past had no product to match Dr. Klaus Emil Fuchs, who was sentenced to fourteen years' imprisonment at the Old Bailey

related to the H-bomb as well as the A-bomb, how many scientists had worked to get that information, the size and cost of the equipment they had used in the process, and how many years of work and how much expense

"Warped mentalities" and unbalanced education gave theorists "an almost diseased yearning to remold the world after the image of their own work in physical science."
JCAE, April 1951

PURE SCIENTISTS CALLED RED PREY

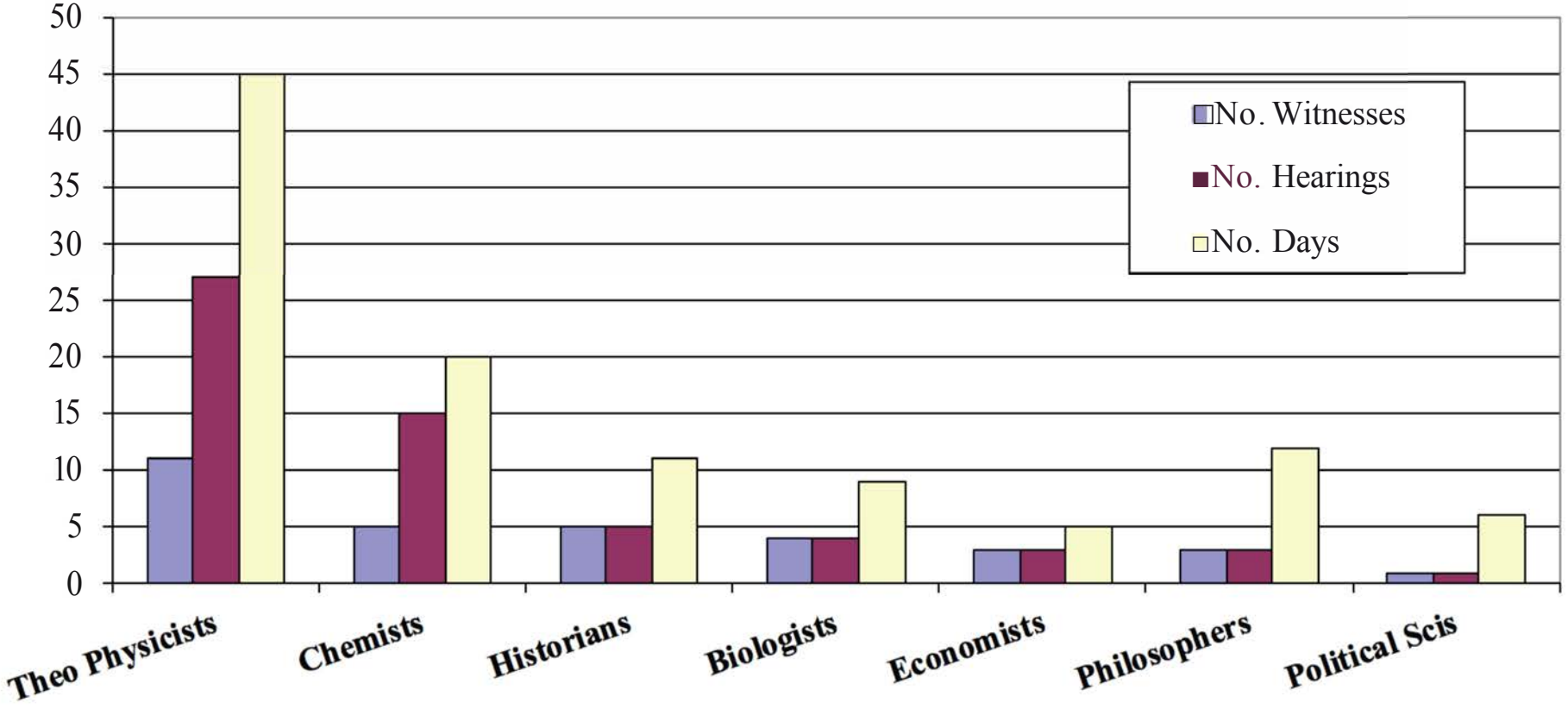
Judge, in Sentencing Student for Contempt of Congress, Deplores Defections

Special to The New York Times.

WASHINGTON, Dec. 13—A Federal judge asserted here today that "the younger generation of pure scientists" had become a "fertile field for Communist propaganda."

"The younger generation o… scientists specifically enga… research in physics has succumbed to Communistic propaganda."
Judge A. Holtzoff, December 1956

HUAC Hearings, 1946-55



Questions?

The H-Bomb Question

In October 1949, the AEC's *General Advisory Committee* recommended *against* crash-course development of an H-bomb. Some committee members argued that such a weapon would be "an evil thing in any light."

AEC General Advisory Committee, late 1940s

Image is in the public domain.

The New York Times.

CITY EDITION

NEW YORK, WEDNESDAY, JUNE 2, 1954.

FIVE CENTS

DR. OPPENHEIMER IS BARRED FROM SECURITY CLEARANCE, THOUGH 'LOYAL,' 'DISCREET'

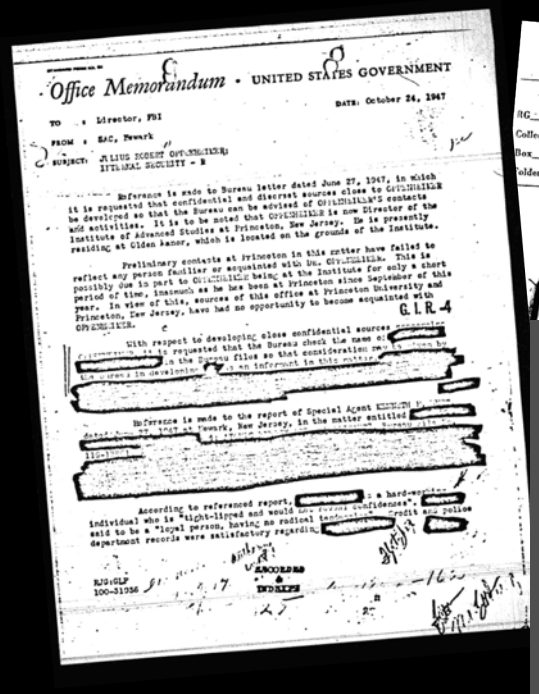
Dissent Charges Decision Is a 'Black Mark' on Nation

One-Man Minority Fears Impact on Other Scientists—Charges Oppenheimer Was Victim of Double Jeopardy

PANEL DECISION 2-1

Scientist Calls Findings Contradictory, Seeks to Take Fight to A. E. C.

Nuclear Doves?



Office Memorandum • UNITED STATES GOVERNMENT

TO : Director, FBI

FROM : SAC, Newark

SUBJECT: J. ROBERT OPPENHEIMER
INTERNAL SECURITY - R

Reference is made to Bureau letter dated June 27, 1947, in which it is requested that confidential and discreet sources close to OPPENHEIMER be developed so that the Bureau can be advised of OPPENHEIMER'S contacts and activities. It is to be noted that OPPENHEIMER is now Director of the Institute of Advanced Studies at Princeton, New Jersey. He is presently residing at Olden Manor, which is located on the grounds of the Institute.

Preliminary contacts at Princeton in this matter have failed to reflect any person familiar or acquainted with Dr. OPPENHEIMER. This is possibly due in part to OPPENHEIMER being at the Institute for only a short period of time, inasmuch as he has been at Princeton since September of this year. In view of this, sources of this office at Princeton University and Princeton, New Jersey, have had no opportunity to become acquainted with OPPENHEIMER.

G.I.R-4

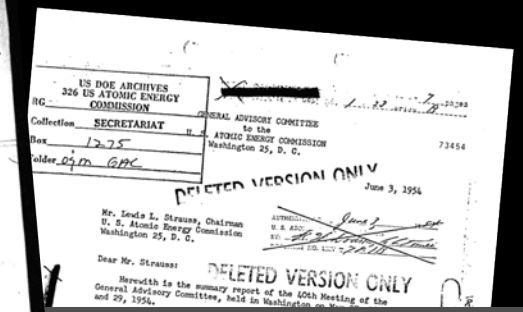
With respect to developing close confidential sources [redacted] it is requested that the Bureau check the name of [redacted] in the Bureau files as that consideration may be given to [redacted] in developing [redacted] as an informant in this matter.

Reference is made to the report of Special Agent [redacted] at Newark, New Jersey, in the matter entitled [redacted]

According to referenced report, [redacted] is a hard-working individual who is "right-lipped and would [redacted] confidences". [redacted] credit and police said to be a "loyal person, having no radical tendencies". [redacted] department records were satisfactory regarding [redacted]

RJG:GLP
100-21956

RECORDED
INDEXED



US DOE ARCHIVES
326 US ATOMIC ENERGY COMMISSION
RG [redacted]
Collection SECRETARIAT
Box 1275
Folder 091 GAC

GENERAL ADVISORY COMMITTEE
to the
ATOMIC ENERGY COMMISSION
Washington 25, D. C.

73454

DELETED VERSION ONLY

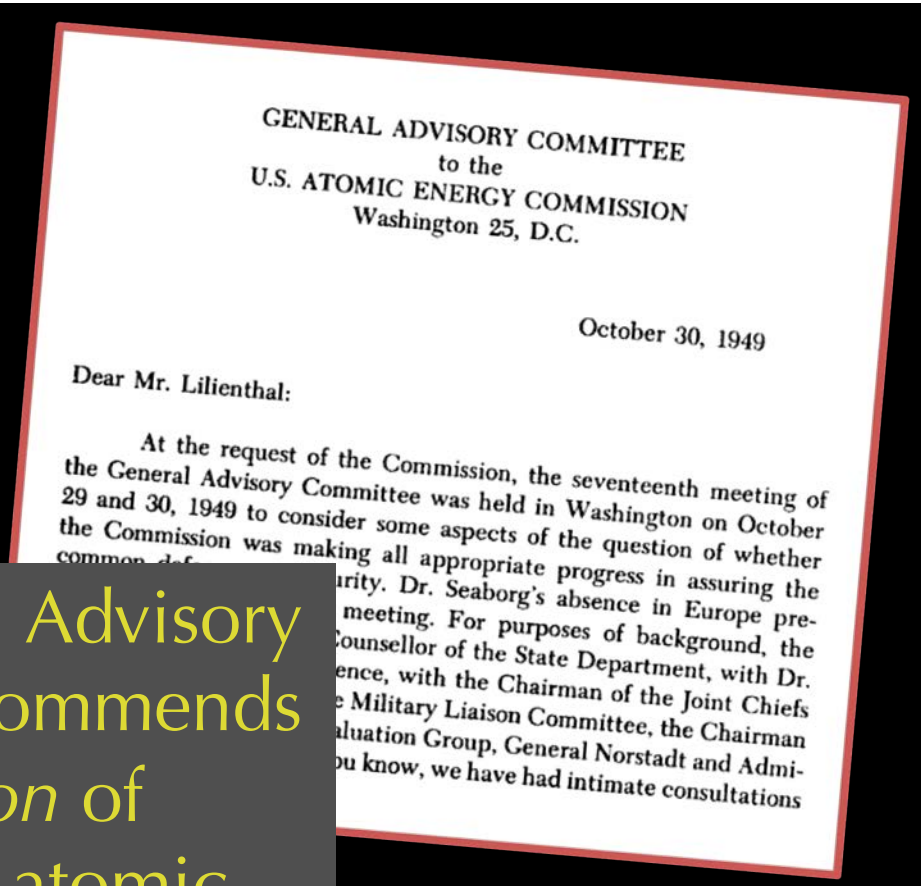
June 3, 1954

Mr. Lewis L. Strauss, Chairman
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Strauss:

Herewith is the summary report of the 40th Meeting of the General Advisory Committee, held in Washington on May 29, 1954.

DELETED VERSION ONLY



GENERAL ADVISORY COMMITTEE
to the
U.S. ATOMIC ENERGY COMMISSION
Washington 25, D.C.

October 30, 1949

Dear Mr. Lilienthal:

At the request of the Commission, the seventeenth meeting of the General Advisory Committee was held in Washington on October 29 and 30, 1949 to consider some aspects of the question of whether the Commission was making all appropriate progress in assuring the common def[ence] [and] [sec]urity. Dr. Seaborg's absence in Europe prevented meeting. For purposes of background, the Counsellor of the State Department, with Dr. ence, with the Chairman of the Joint Chiefs e Military Liaison Committee, the Chairman aluation Group, General Norstadt and Admiu know, we have had intimate consultations

"The General Advisory Committee recommends an *intensification* of efforts to make atomic weapons available for tactical purposes…"

Not only had the GAC advised an aggressive strategy of *expanding* nuclear-weapons capabilities, but the minority report that objected to an H-bomb on moral grounds was written by *Enrico Fermi* and *I. I. Rabi*, not by *Oppenheimer*.

A New Vista

A major study ("Project Vista") was conducted at Caltech in summer 1951, sponsored by the U.S. Army and Air Force.

Recommendation: The US and NATO should deploy hundreds of fission weapons throughout Western Europe to repel the Soviet army in case of an invasion. Oppenheimer and colleagues thus pushed for a "first-use" nuclear policy against an invading army.

Though it angered the "big bomb"/SAC lobby in the Air Force, it rapidly became official US policy.

Bang for Buck

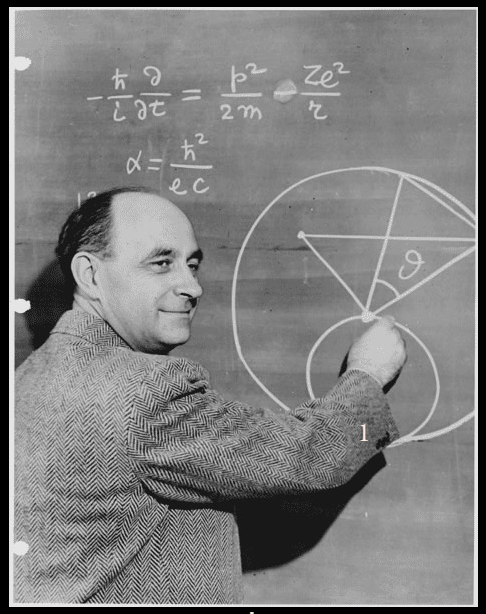
As of April 1947, the US had components for *7* fission bombs. By the end of 1949, the entire US stockpile totaled only ***235*** bombs.

Fat Man on Tinian, August 1945

Strategic Air Command, Korea, August 1952

Delivery systems (aircraft) would limit the size of H-bombs, even if they could be built. Thus "there appears to be no chance of their being an economical alternative to fission weapons," based on "the strict criteria of damage area per dollar." *GAC, 1949*

Tritium versus Plutonium



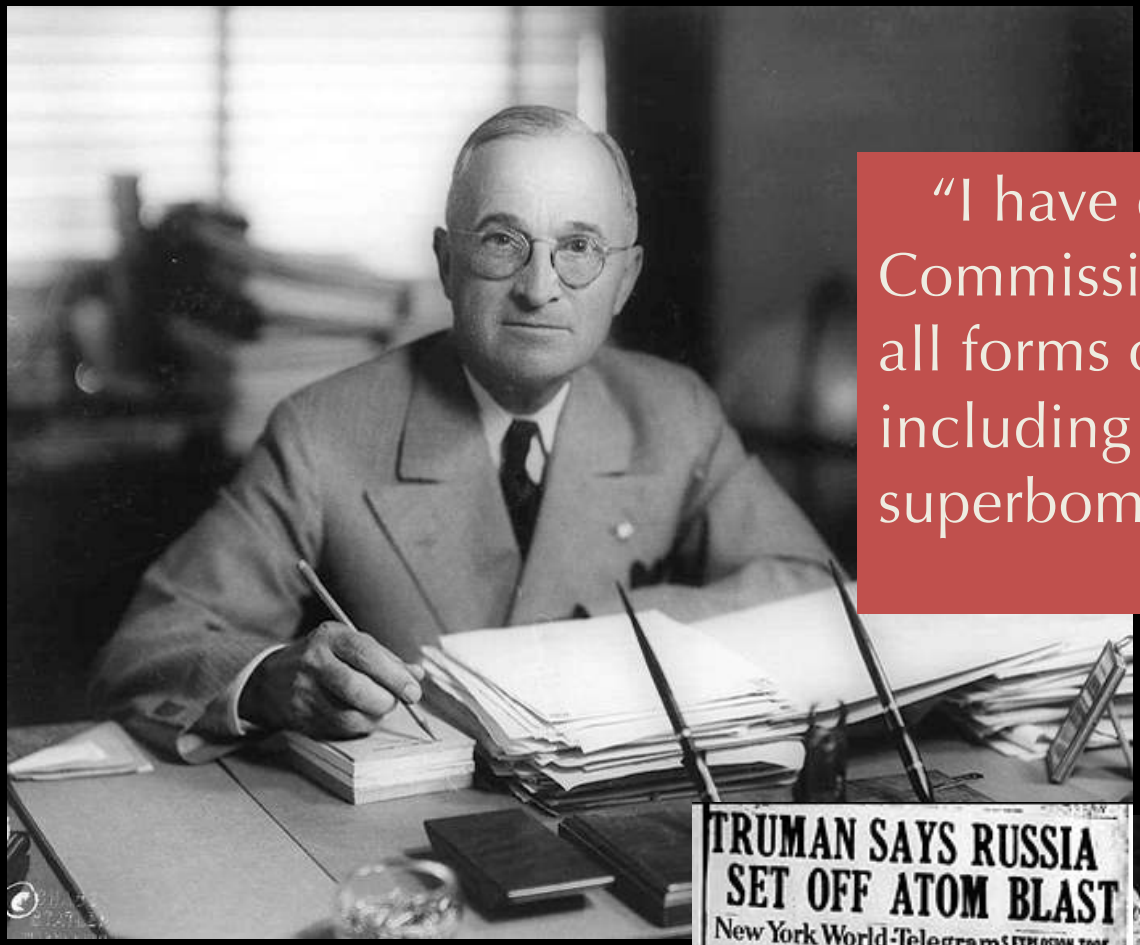
Enrico Fermi, late 1940s

By October 1949, all known H-bomb designs required large amounts of ***tritium*** (H^3), which was ***rare*** and ***expensive*** to produce. Designs called for 1 – 5 kg of H^3 per bomb. Producing 10g of H^3 meant *not* producing 80g of Pu.

The US would need to forgo 100 – 150 fission bombs per H-bomb, and there would not be sufficient H^3 for a single H-bomb for 5 years.

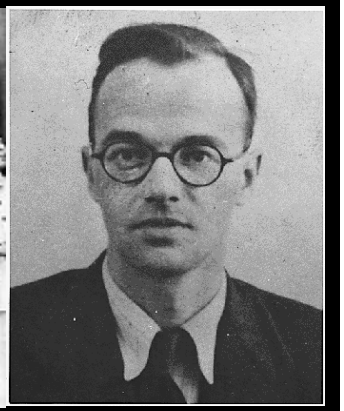
Savannah River reactor site, established 1950

Truman Gives Order



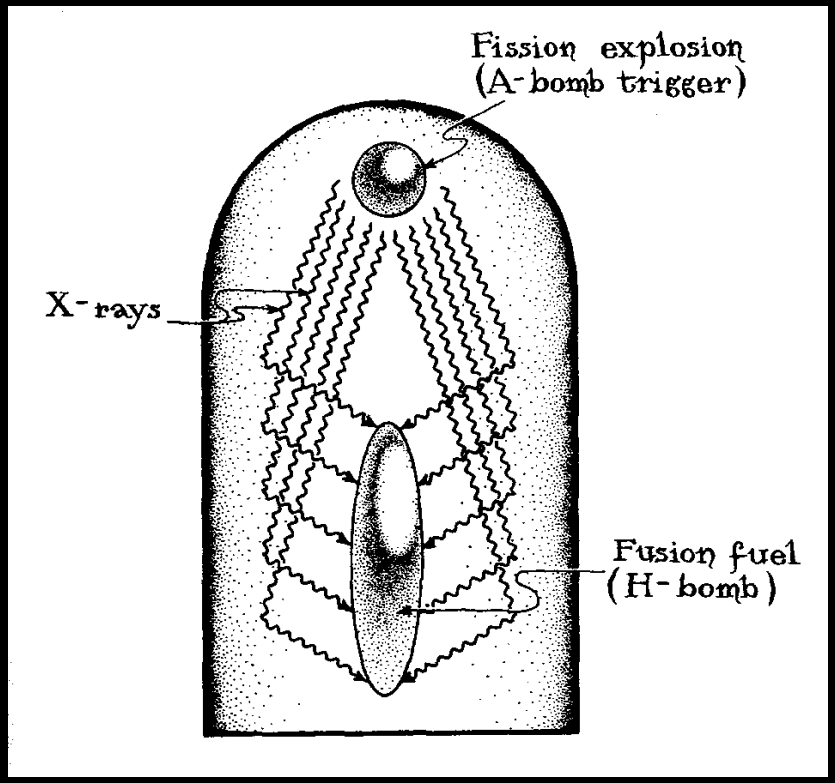
"I have directed the Atomic Energy Commission to continue its work on all forms of atomic weapons, including the so-called hydrogen or superbomb."

President Truman, 31 January 1950



23 Sept 1949 | 1 Oct 1949 | 27 Jan 1950

The Ulam-Teller Idea

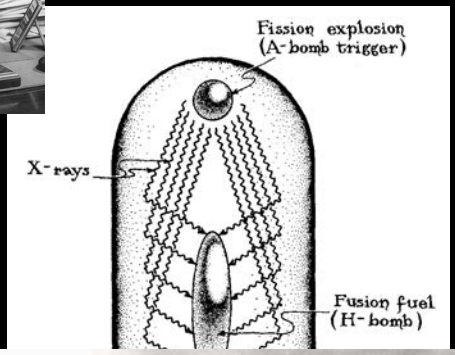


Conceptual breakthrough, March 1951: use radiation pressure (and not just heat) from fission primary to compress fusion fuel.

First workable H-bomb design; required much less H^3.

Ivy Mike Tests

January 1950: Truman gives order for "crash course" development of a hydrogen bomb

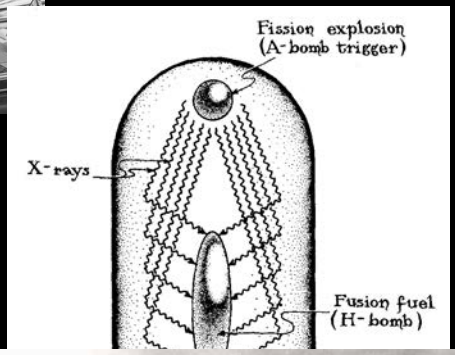


March 1951: (Top-secret) Ulam-Teller idea to use radiation pressure to catalyze fusion reactions

September 1952: The US establishes a second full-scale nuclear weapons lab in Livermore, CA, to work exclusively on H-bomb designs. ("Our main competition was Los Alamos rather than the Soviets...")

Ivy Mike Tests

January 1950: Truman gives order for "crash course" development of a hydrogen bomb



March 1951: (Top-secret) Ulam-Teller idea to use radiation pressure to catalyze fusion reactions

...nes a
...s lab in
...y on H-
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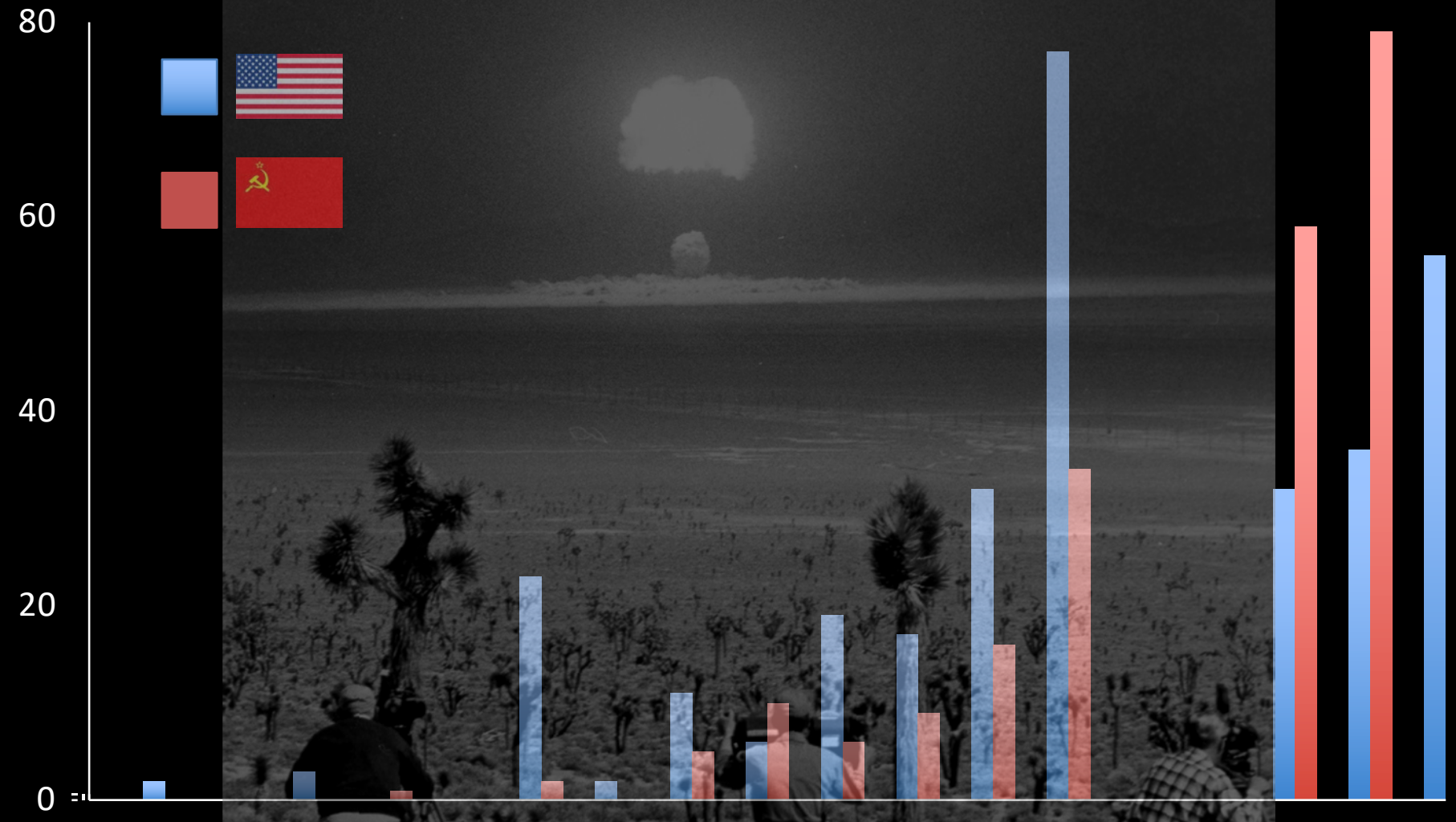
November 1952: The first US H-bomb design is tested (Ivy Mike test) near the Enewetok Atoll in the Pacific Ocean: 10.4 *megatons*.

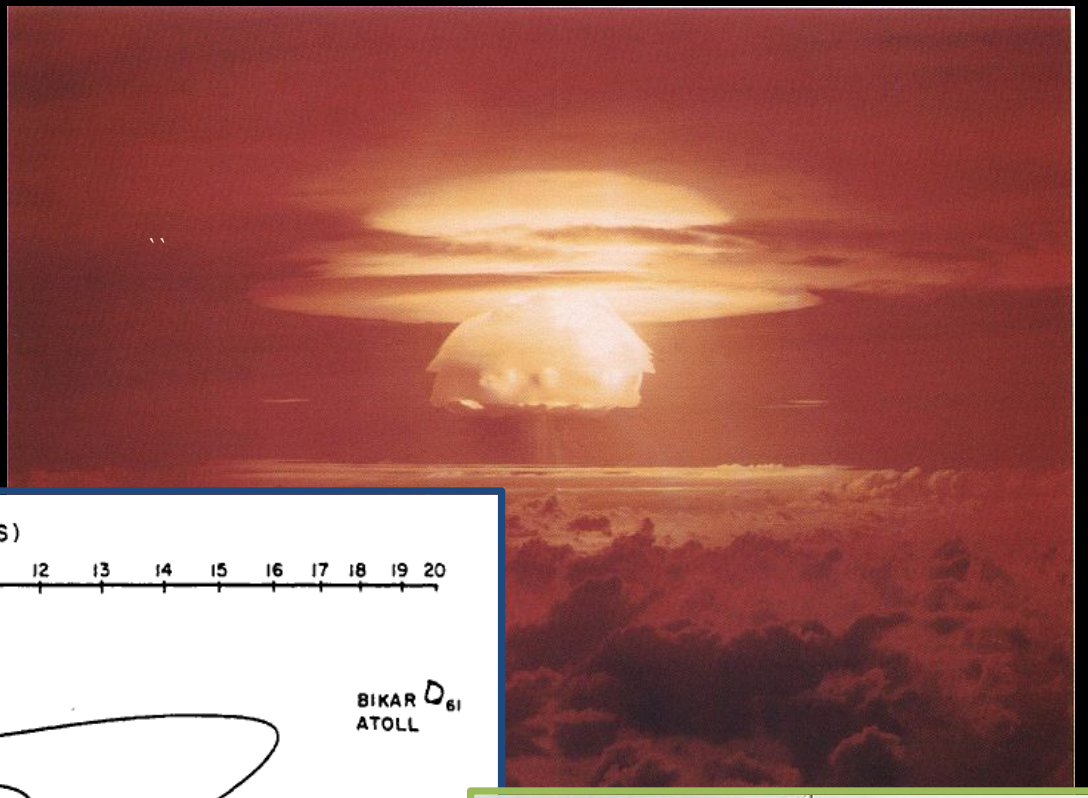
Above-Ground Nuclear Tests, 1946 – 1963



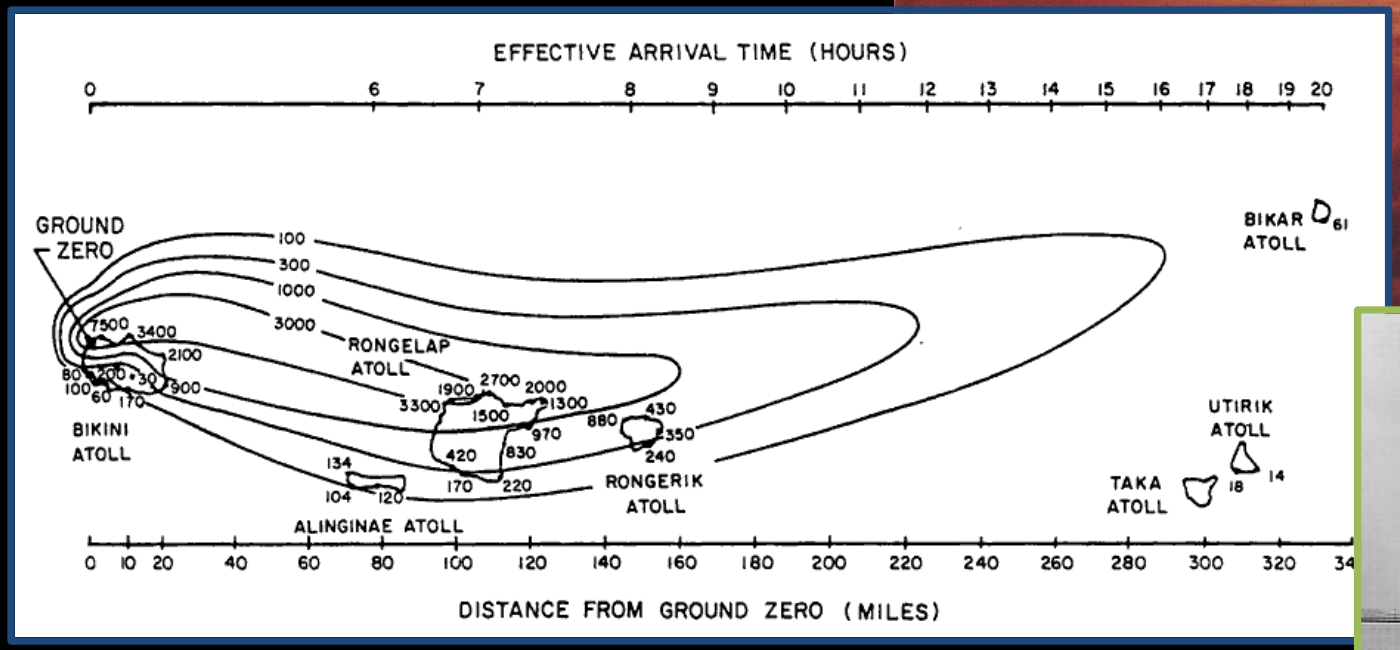
Operation Teapot, March 1955

Questions?

"Lucky Dragon" and Fall-Out



Castle-Bravo, 1 March 1954,
15 megatons



Fishermen on the Daigo
Fukuryu Maru ("Lucky Dragon")

Images are in the public domain.

Domestic Fall-Out

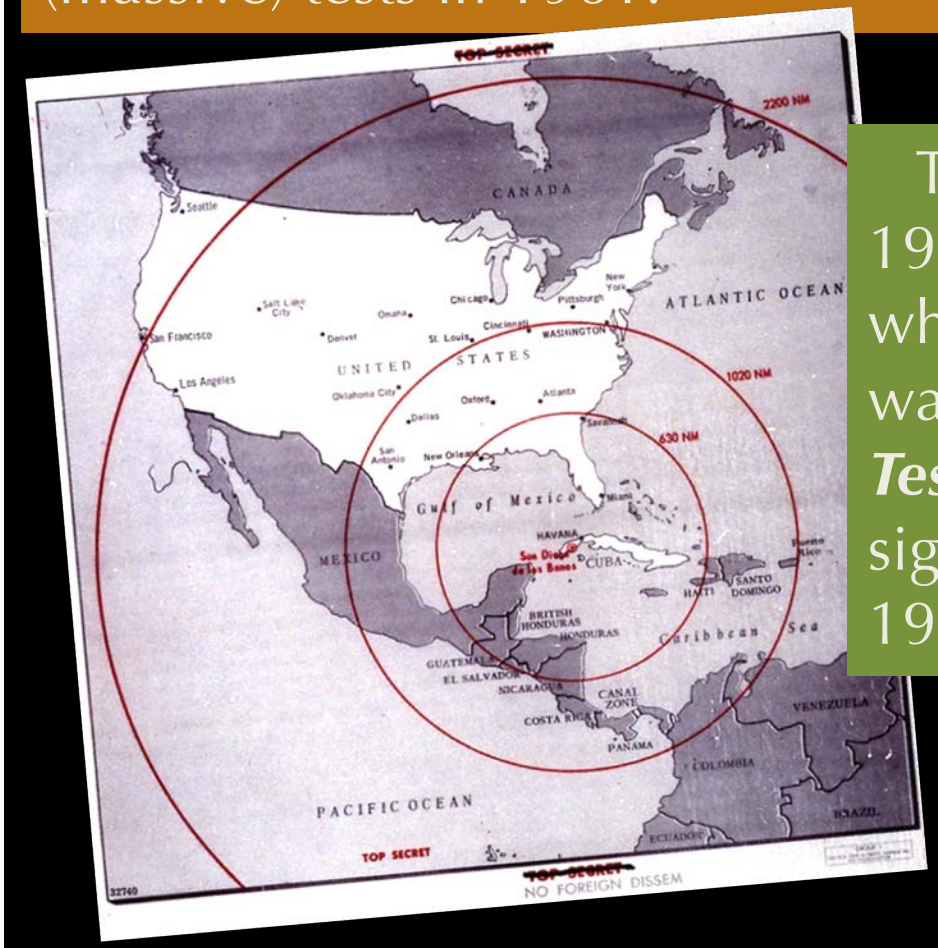
1956

In spring 1957, Linus Pauling drafted a petition to stop nuclear testing; it quickly acquired 9000 signatures.

In 1958, the St. Louis-based *Committee for Nuclear Information* began a nationwide baby-tooth survey to monitor Strontium-90 levels.

Driving Tests Underground

Bowing to political pressure, Eisenhower ordered a unilateral moratorium on US testing in 1958; but testing began again after the Soviets resumed their own (massive) tests in 1961.



The matter came to a head in October 1962 with the ***Cuban Missile Crisis***, which paved the way for the ***Limited Test Ban Treaty***, signed in August 1963.

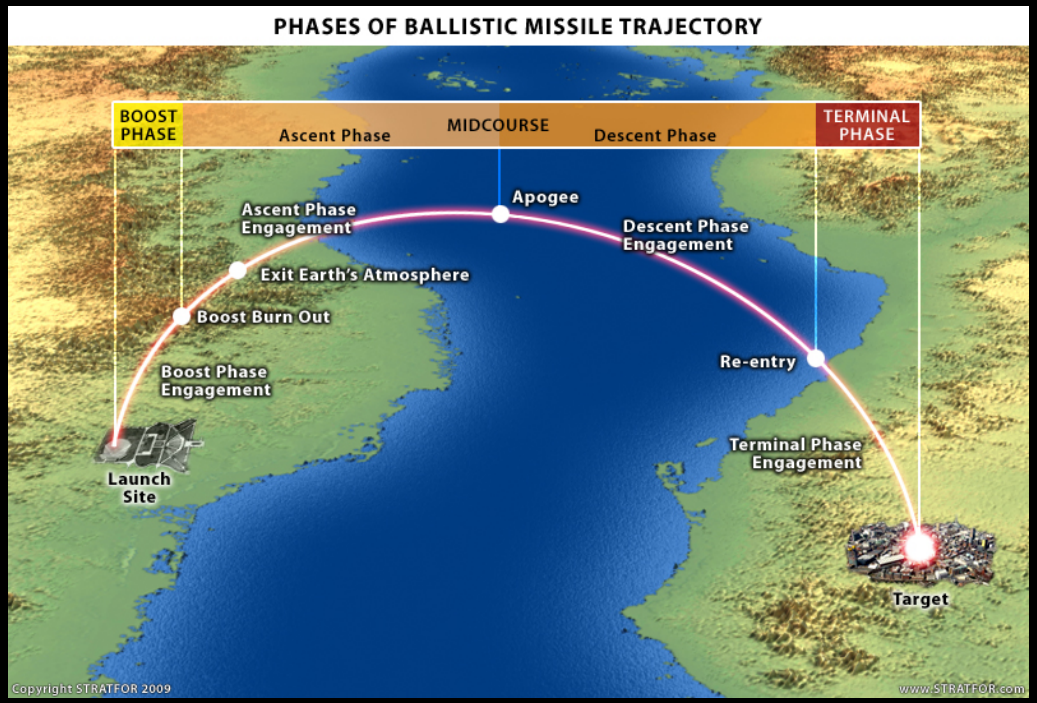
Images are in the public domain.

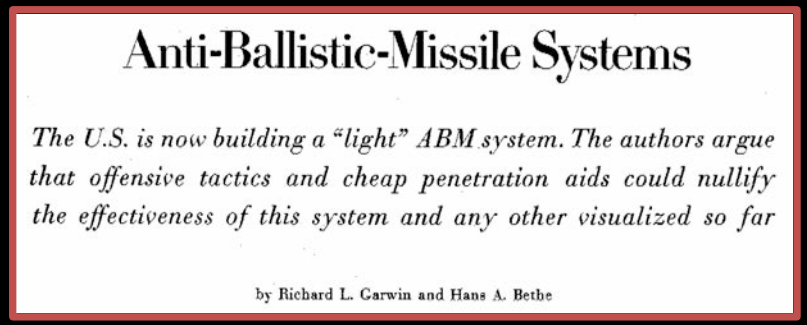
Debating Missile Defense

In 1968, Hans Bethe and Richard Garwin publicly challenged US policy on anti-ballistic missile systems, arguing that they would easily be derailed by decoys.

Bethe

Garwin





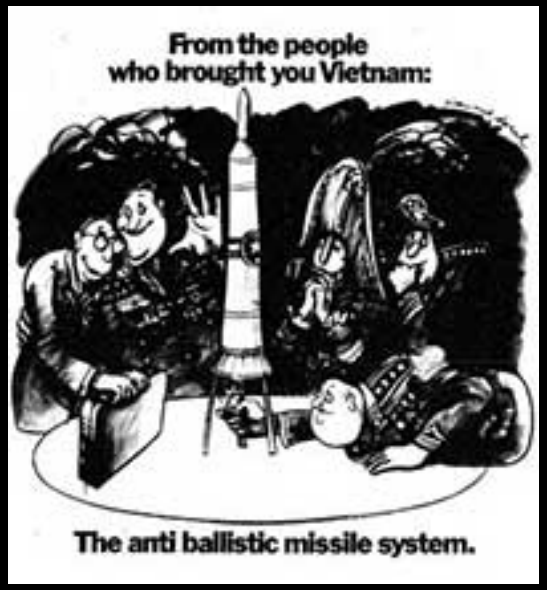
Anti-Ballistic-Missile Systems

The U.S. is now building a "light" ABM system. The authors argue that offensive tactics and cheap penetration aids could nullify the effectiveness of this system and any other visualized so far

by Richard L. Garwin and Hans A. Bethe

ABM and Vietnam

The anti-ABM campaign attracted hundreds of scientists who also opposed the Vietnam War. The efforts helped spark the "March 4 Movement" at MIT in 1969.



Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

A Continuing Debate

Despite protests and critiques of system feasibility, the US and USSR signed an ABM treaty in 1972, limiting each country to two systems: one to protect its capital, and one to protect an ICBM silo.

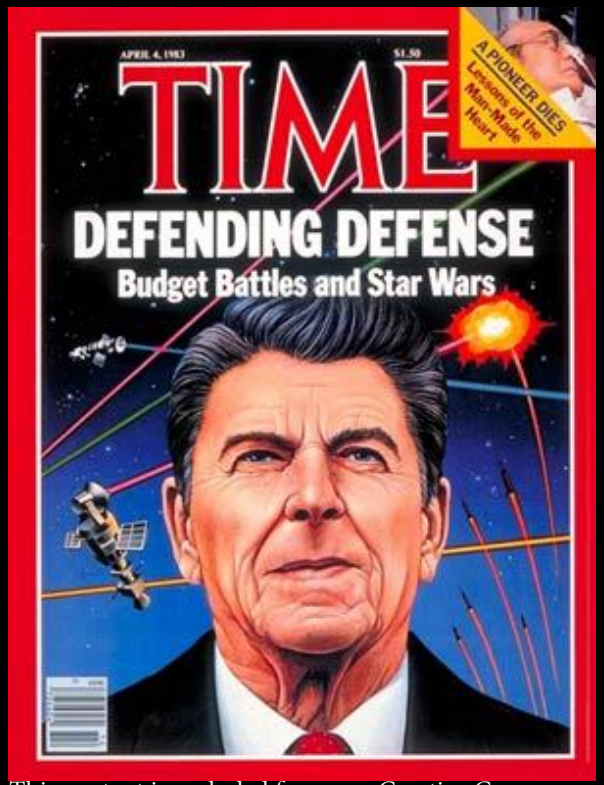
Safeguard radar, North Dakota, 1975

Image is in the public domain.

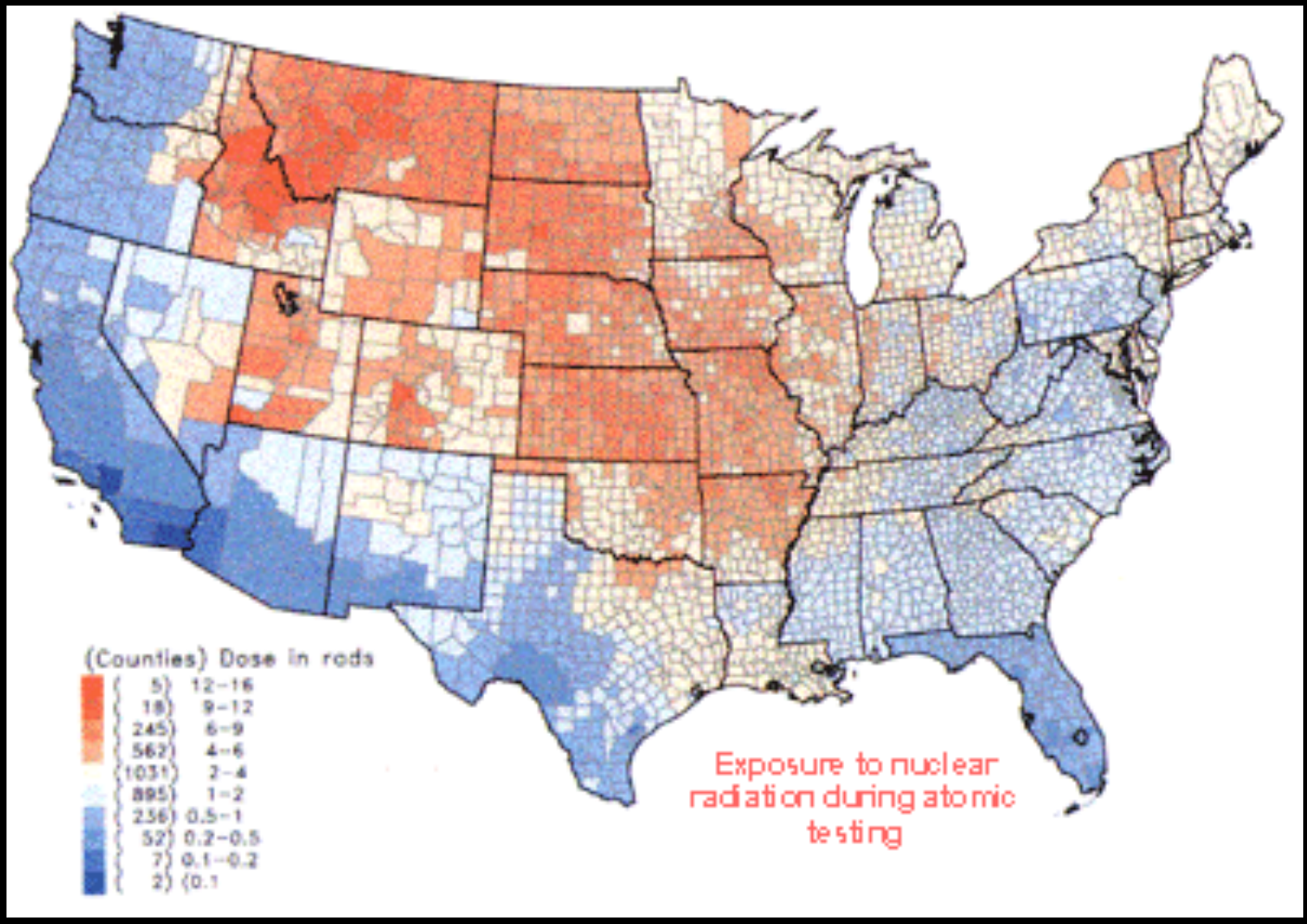
Sprint missile test, 1975

Image is in the public domain.

President Reagan announced his "Strategic Defense Initiative" (or "Star Wars") in March 1983; and the US withdrew from the ABM treaty in 2002. The debate goes on…



"National Sacrifice Zones"



3000 square miles of Continental US
now deemed officially uninhabitable.

Our Nukes, Ourselves

Since World War II, nuclear issues have always been intertwined with domestic matters — cultural and political forces that, on the face of it, had little to do with weapons or international relations.

In turn, these broader currents — changing ideas about how science is done and how scientists should behave — have shaped nuclear policies and the weapons themselves.

STS.042J / 8.225J Einstein, Oppenheimer, Feynman: Physics in the 20th Century
Fall 2020