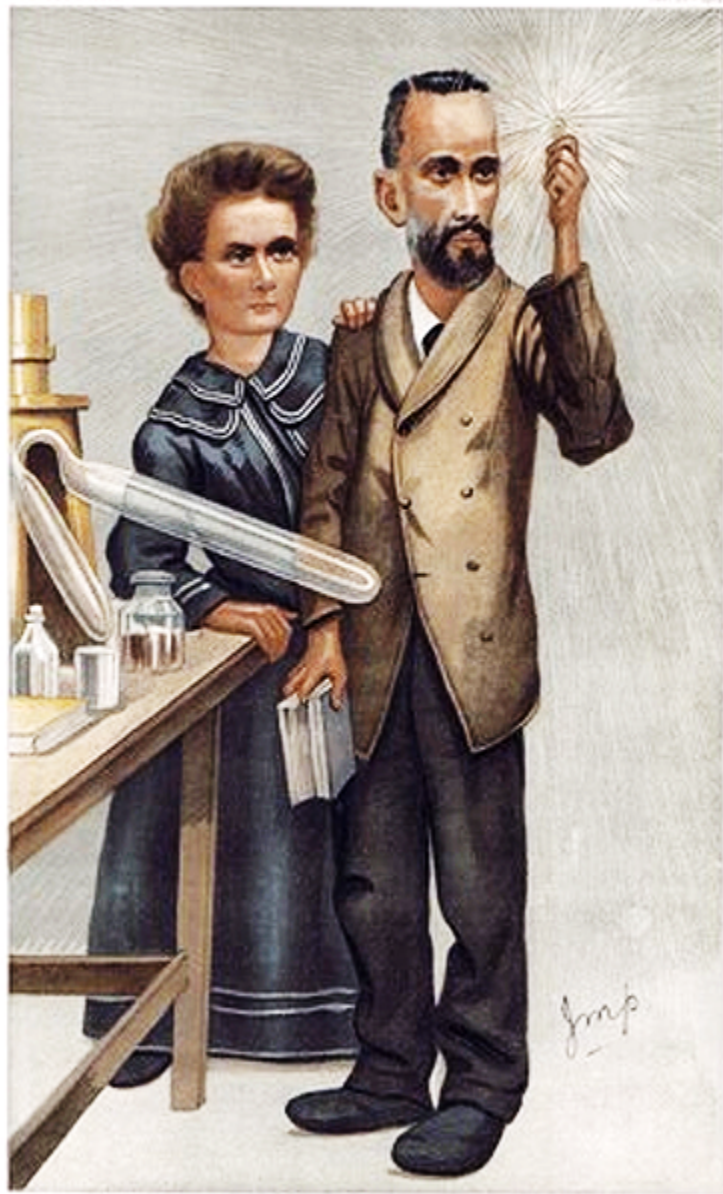


Death Rays: The History of Nuclear Fear

Spencer Weart
American Institute of Physics



SCIENCE ON ROAD TO REVOLUTIONIZE ALL EXISTENCE

The following article was delivered by Prof. Soddy as a lecture.

Prof. Soddy Believes That, as a Result of Discovery of Radioactivity,

with the pressure of the new life within, while for the future, science

Science Will Ultimately Solve Problem of Artificial Transmutation of the Elements---No Limit Then to Man's Power Over Nature.

radio-activity.

Prof. Soddy, who was born in 1877, is lecturer in physical chemistry and radio-activity at the University of Glasgow. Educated at Oxford, he was demonstrator in chemistry at McGill University, Montreal, from 1900 to 1902. He was the Wills lecturer of the Manchester Literary and Philosophical Society in 1904, the same year going to Western Australia as university extension lecturer. In 1905-06 he was President of the Glasgow Students Society. He has studied scientific investigations under Sir William Ramsay. He is the author of several works on radio-activity.

By Frederick Soddy, M. A., F. R. S.

S EVENTEEN years ago not a single fact was known of discovery made on the subject of "The Evolution of Matter." Philosophical theories of the essential unity of all matter, and of the possible transformation of one kind into another, have come down to us from the ancients. Actual attempts at such transformation or transmutation constituted the pseudo-science of alchemy in the Middle Ages, which the modern science of chemistry has displaced and discredited. But until 1896 there was no hint that around and about us there was going on, at the present time, a slow, continuous transformation of certain of the elements into others.

This process is not a transmutation, certainly, in so far as that word implies the artificial change of one element into another at will. But in every other sense it is a veritable transmutation of the elements going on naturally and spontaneously, capable of being experimentally demonstrated and theoretically correlated with other departments of knowledge. In 1896 the universal experience of physical and chemical science was that in all kinds of changes then known, and in all processes that had been studied, the elements remained essentially unchanged and unchangeable.

Might Transmute.

The efforts of the medieval alchemist toward transmutation seem to have been largely dominated by the idea that at a very high temperature one element, such as lead, might be changed into another, such as gold. But modern chemistry in this direction, by the aid of the electric furnace and its more direct, has

well called them, to whatever treatment they may be subjected, "remain unbroken and unweary." This conclusion, though now challenged, still remains unshaken with regard to all the processes and changes known up to 1896, but since that time, thanks to the discovery of the entirely new phenomenon of radioactivity, new natural processes have come to light in which certain of the elements have been proved to be in course of change.

Found With Uranium.

The discovery of radioactivity was made by Becquerel with the element uranium, the element with the heaviest and most complex atom known, and shortly afterward it was found that thorium, the element with the next heaviest and most complex atom, showed similar properties. These elements and all their compounds give out rays of a new kind, allied to the X-rays rather than to light in their power of penetrating opaque metals. Like the X-rays, these rays are invisible to the unaided eye. They are studied by three methods—the photographic method, which depends on their power of darkening a sensitive film in the same way as light; the fluorescent method, in which the rays cause certain fluorescent substances to glow; and by the electric or ionization method, dependent on the power of the rays to render gases conductors of electricity.

The use of these methods led to the discovery, mainly by M. and Mme. Curie, that in a natural state in minerals containing uranium and thorium these elements are associated with minute quantities of other extremely powerful radioactive elements, radium, polonium, actinium, &c. So that it is possible to concentrate the radioactivity of large quantities of mineral, and to obtain minute preparations so powerfully active that some of the effects may be demonstrated to large audiences. With a few milligrams, for example, of a pure radium compound, the rays can be made visible to an audience through a thick plate of lead by means of a fluorescent screen.

The explanation of the phenomenon, due to Rutherford and Soddy in 1902, is that the atoms of the radio-elements are in process of spontaneous disintegration, in which small parts of the original atoms are expelled with enormous velocity as alpha-rays or alpha-particles, the residues of the atom forming an entirely new element,



FREDERICK SODDY, F.R.S.

is the most powerful substance known. So far all attempts to accelerate or retard the rate of disintegration have been failures, though many such experiments have been tried.

Results Would Be Vast.

Success would mean the accomplishment of a veritable transmutation in the alchemist's sense, and from the point of view of the energy liberated would be of infinitely more importance than the mere change of one element into another. Conversely, from the standpoint of modern chemistry, it is quite impossible to regard the radio-elements as differing entirely from the non-radioactive elements in regard to the amount of energy held within the atom, and which would be evolved if the atom were broken up. If it were possible to accelerate the rate of change of a radio-element, probably the same means would suffice to break up other elements at present entirely non-radioactive and unchanging, and to obtain from them as well quantities of energy of the same order as those obtainable from radium, and a million times greater than any at present utilized.

Considering how completely the face of the globe has been transformed by virtue of the proper utilization and control of the energy liberated in the combustion of fuel, it is not too much to say that the general solution of the problem of the artificial transmutation of the elements would absolutely revolutionize the whole condition of existence. Already it is becoming evident that these newly discovered processes play a large part in chemical evolution. They alone, of all known processes, are at once powerful and enduring enough to supply the wealth of energy dissipated so prodigally throughout the universe over apparently endless periods of time. In comparison with the enormous amounts of energy stored up within the ultimate atoms of matter, and which would be liberated and rendered available if these could be artificially broken up at will, the sources at present available to man are insignificant indeed.

Yet their proper utilization has rendered the world of to-day barely recognizable as the successor of that of only a century ago. Physical science at least places no limit to the upward path of progress, and no end to the power and supremacy over nature to which the race may in due course attain.

The progress and application of sci-

ence are constantly multiplying his individual power; ennobled the lower animals and the lower orders of his own species to carry on the heavy labor of the world; adjusted his course to the favoring wind and the flowing tide; seized on the passing opportunities and the fluctuating currents of the time; and developed into a skilled master mariner of the well-poised car and the well-trimmed sail.

Scientific man drives straight on like a steamship, beside of burden, slaves, and other devices for increasing and multiplying the physical powers of the individual he has outgrown. Class, communities, nationalities have survived their primary purpose, and, in consequence, frontiers and territorial possessions are changing their political significance. The race have been shipped and the sails, to catch the varying winds of circumstance, have been furled forever.

In short, man has secured the control of larger and purely inanimate sources of energy wherewith to carry on the main work of the world. The energy evolved by coal and fuel during combustion, and by the "white heat" of burning waterfalls, is transformed, subdivided, and retransformed in a thousand ways, still in one form or other it enters and lightens the labors of every enterprise and of every home.

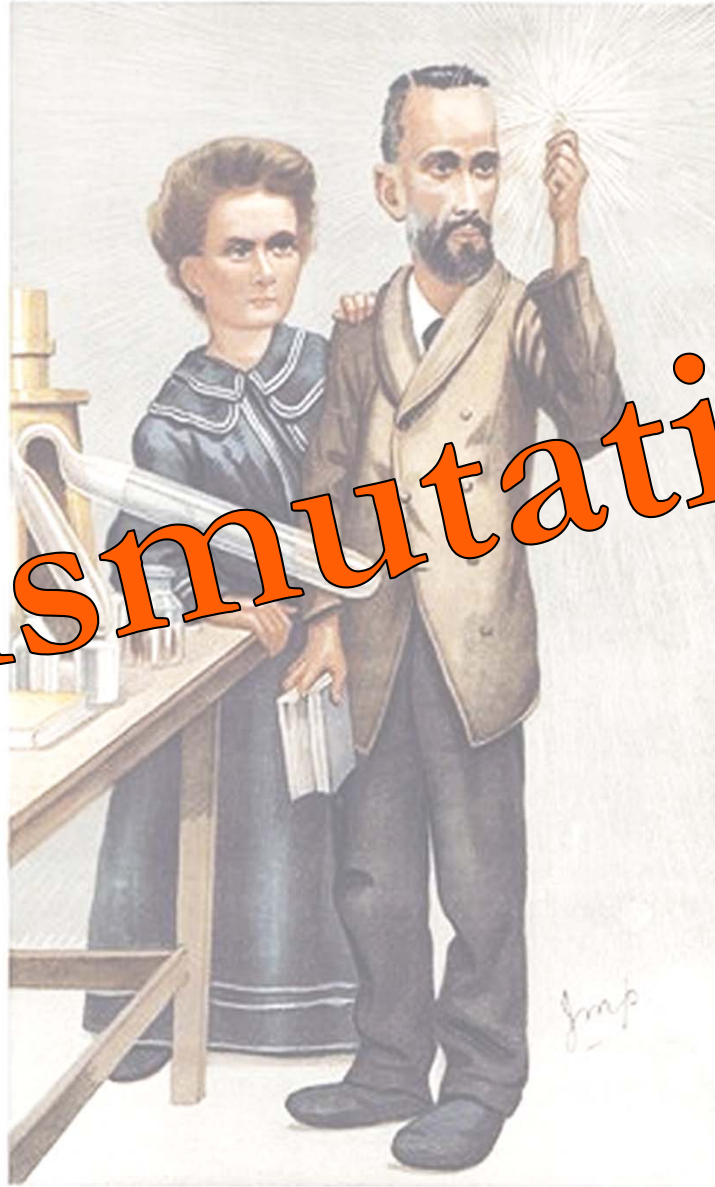
Science Pressing Forward.

In almost any large power house at any time there may be seen a single machine doing the work of perhaps ten thousand horses or of a considerable army of laborers, envisaging possibly a whole city, under the absolute guidance and control of a single artisan. Physical force, we are still sometimes told, is the ultimate arbiter of all human affairs, the final court beyond which no appeal even yet is possible. We spend well over a third of our revenue yearly on our war services in the attempt to maintain this archaic political philosophy in face of the limitless resources of inanimate energy which science is harnessing. In a very few years we shall be spending it all on this purpose if science continues to develop in the way it averily will.

The overwhelming march of science unaccompanied by any proportionate advance in the other departments of thought and philosophy, can only have one end. And as if to clinch the argument, there comes back the revelation from these distant horizons of science, to which our attention has been di-

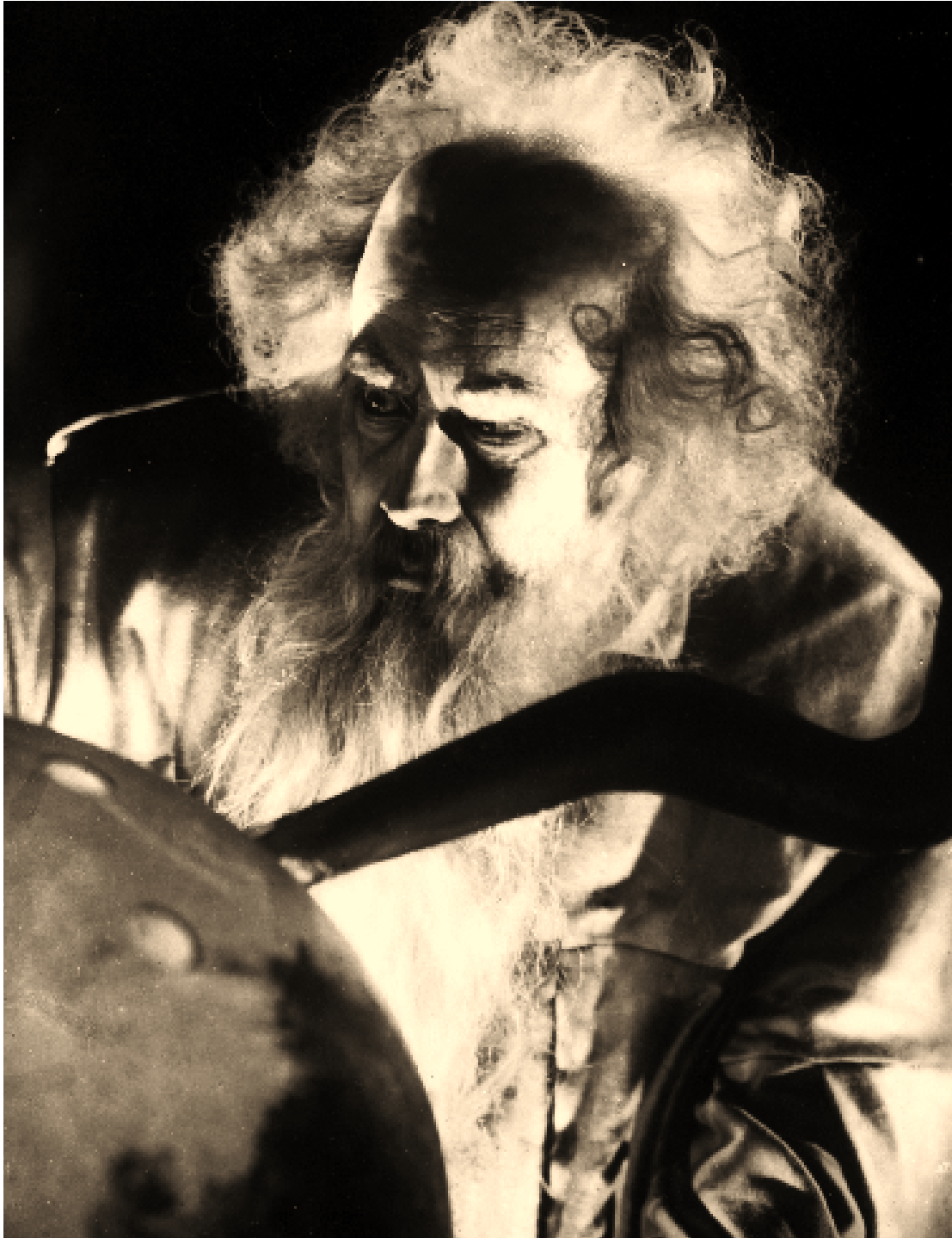
COMPANY
Denver, Colo

Transmutation!

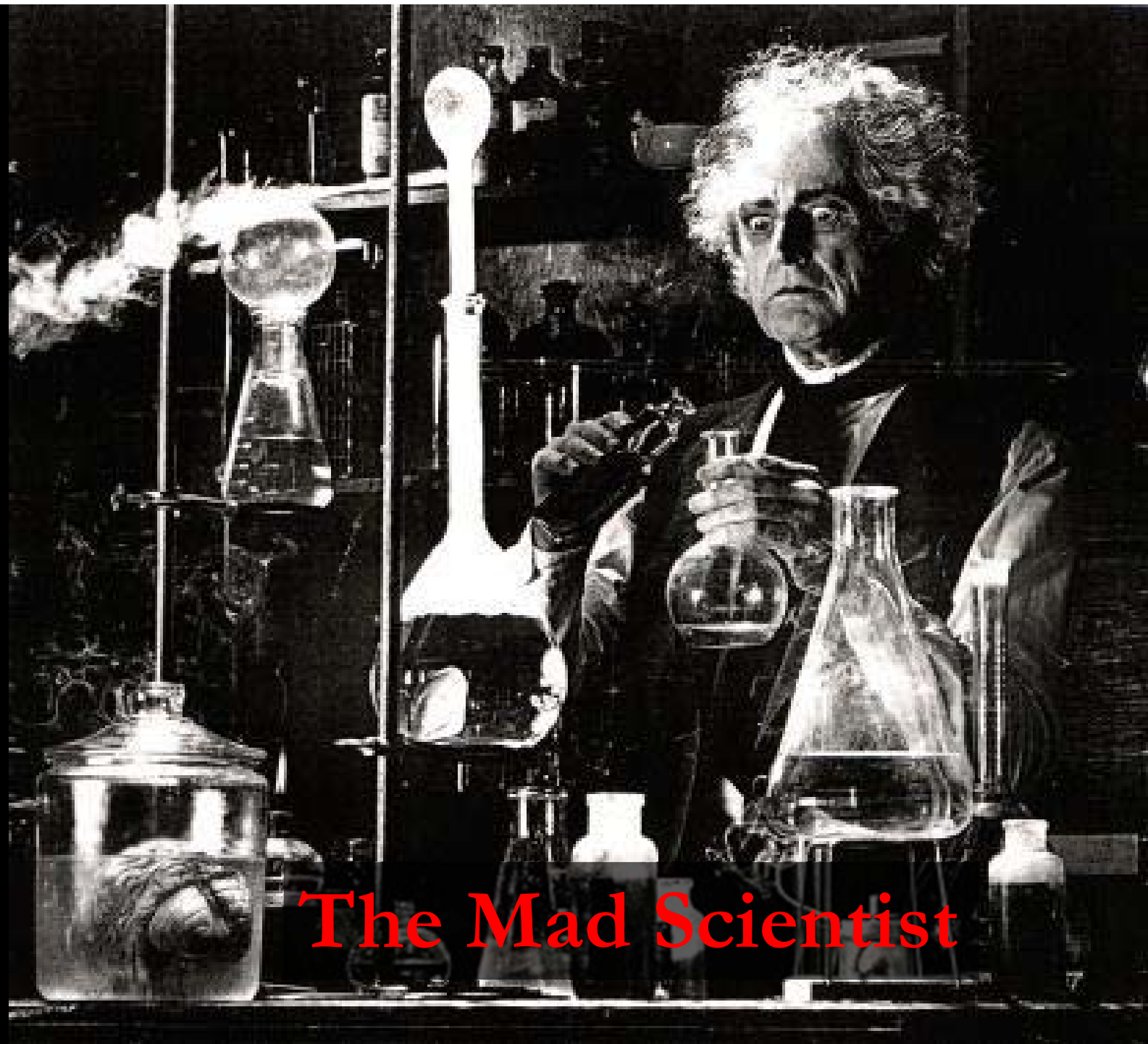




The Alchemist



The Sorcerer (Faust)



The Mad Scientist



MAMMO

Albert **DEKKER**
Janice **LOGAN**
Thomas **COLEY**

Regia:
ERNEST B. SCHOEDSACK

Dr. CYCLOPS

IN TECHNICOLOR



ATKINS: RTHA



DESTRUCTION TO ALL HE
TOUCHED
OR LOOKED
UPON!

BORIS
KARLOFF
BELA LUGOSI

THE INVISIBLE RAY

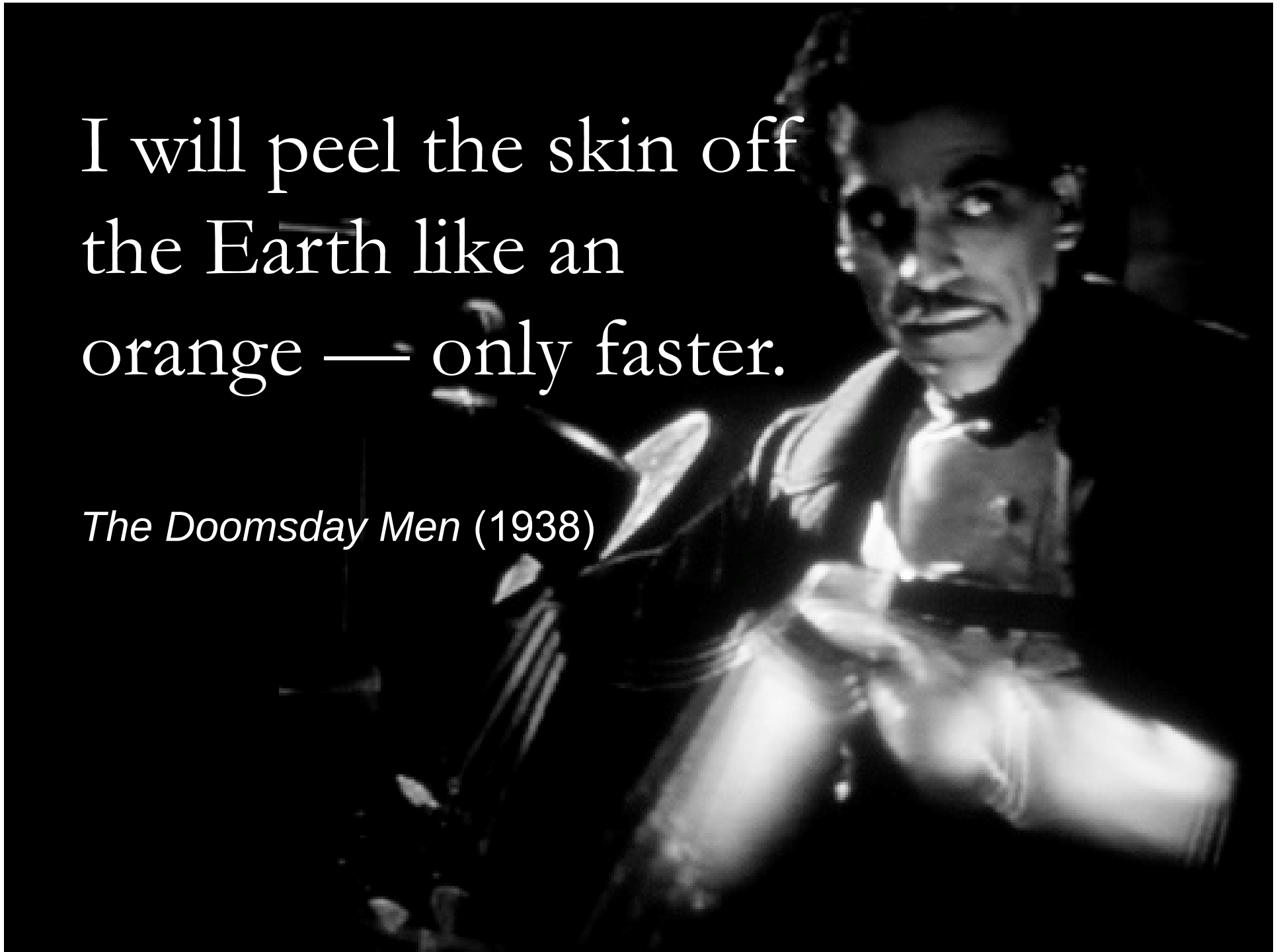
WITH
FRANCES DRAKE
Basil BONDY Frank LAWTON

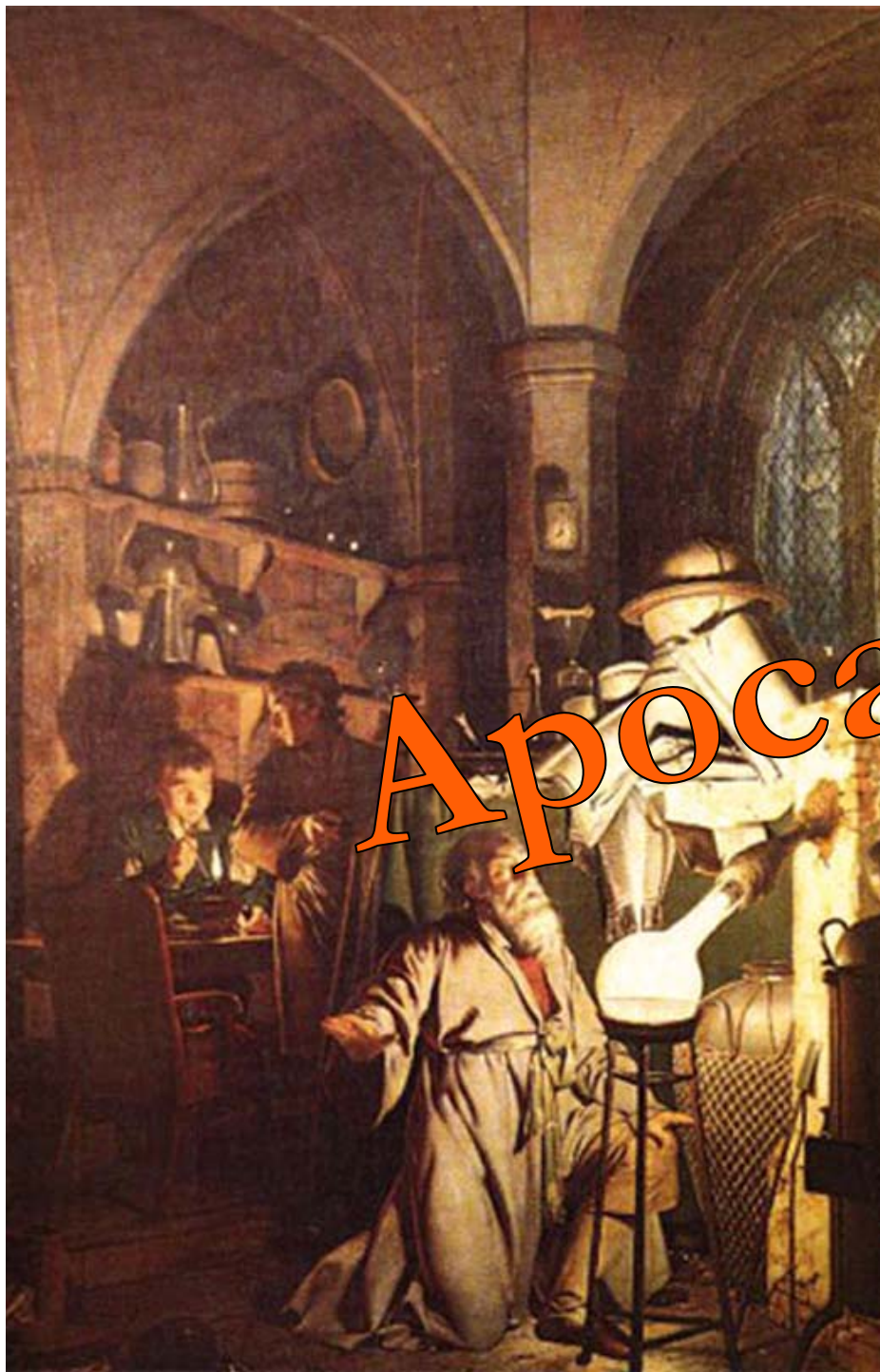


Things to Come – 1936

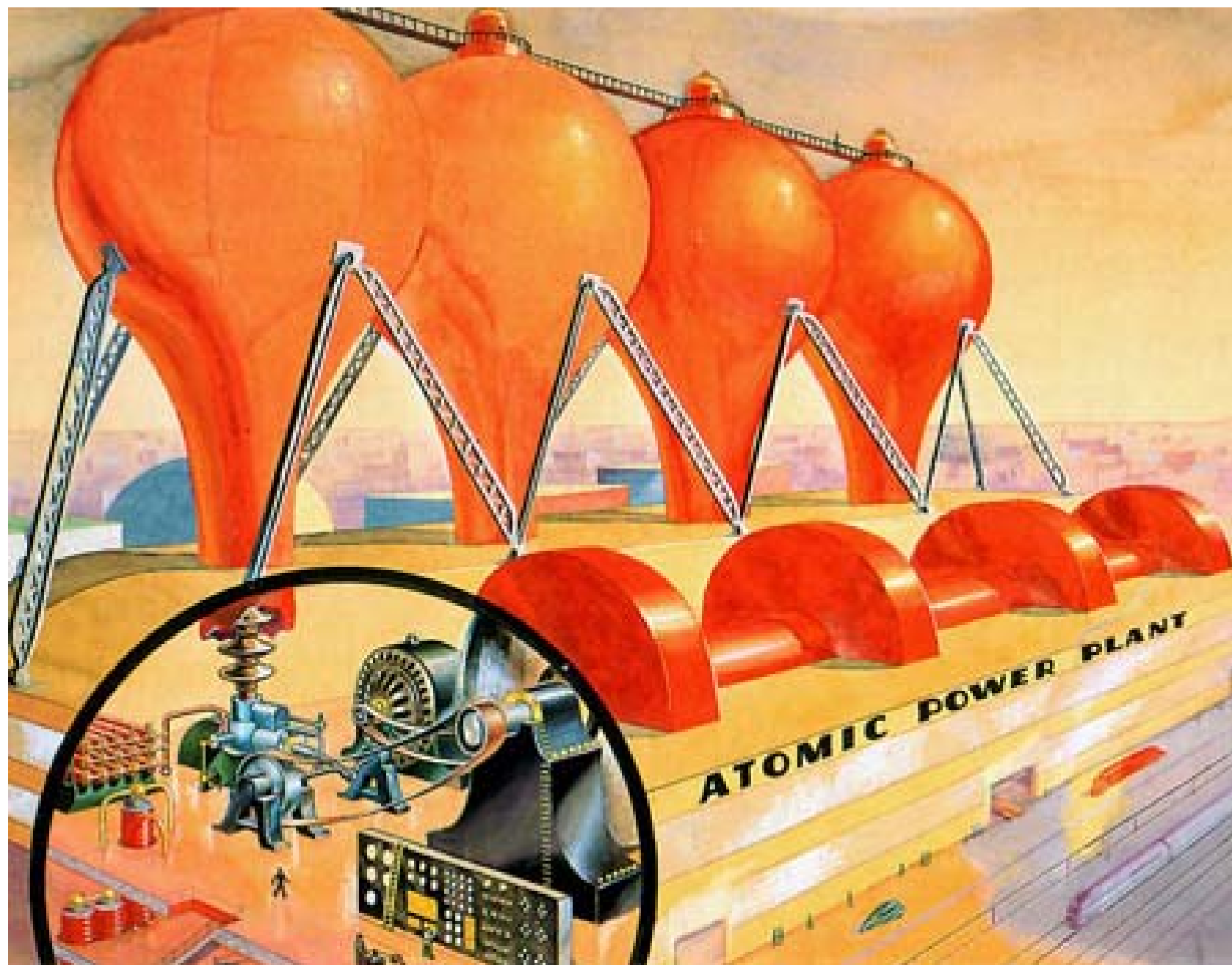
I will peel the skin off
the Earth like an
orange — only faster.

The Doomsday Men (1938)





Apocalypse!



What changed after 1945?





Atoms for Peace!









Them! – 1954



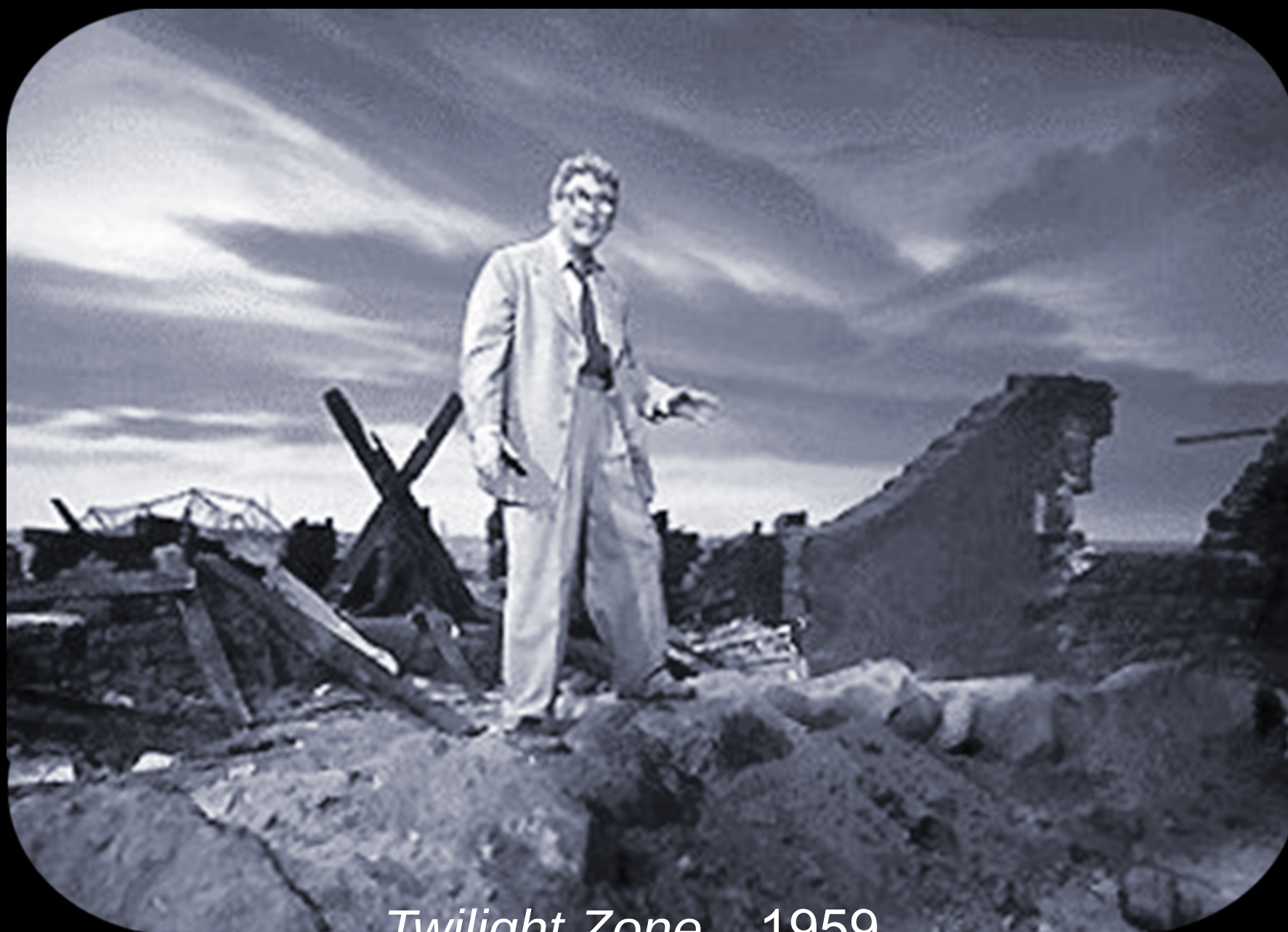
Figure 29-9. Fallout.



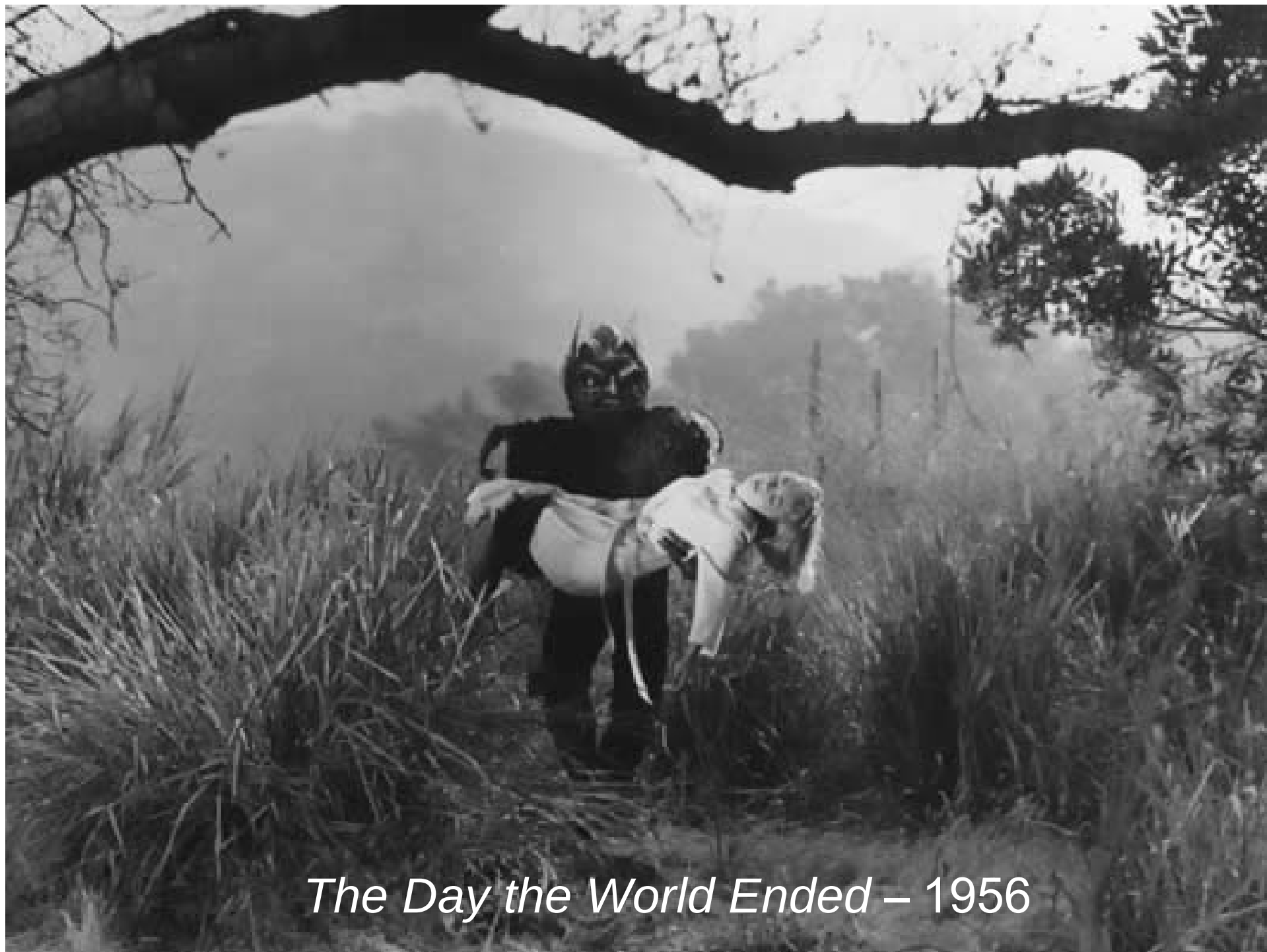
Figure 29-9. Fallout.







Twilight Zone – 1959

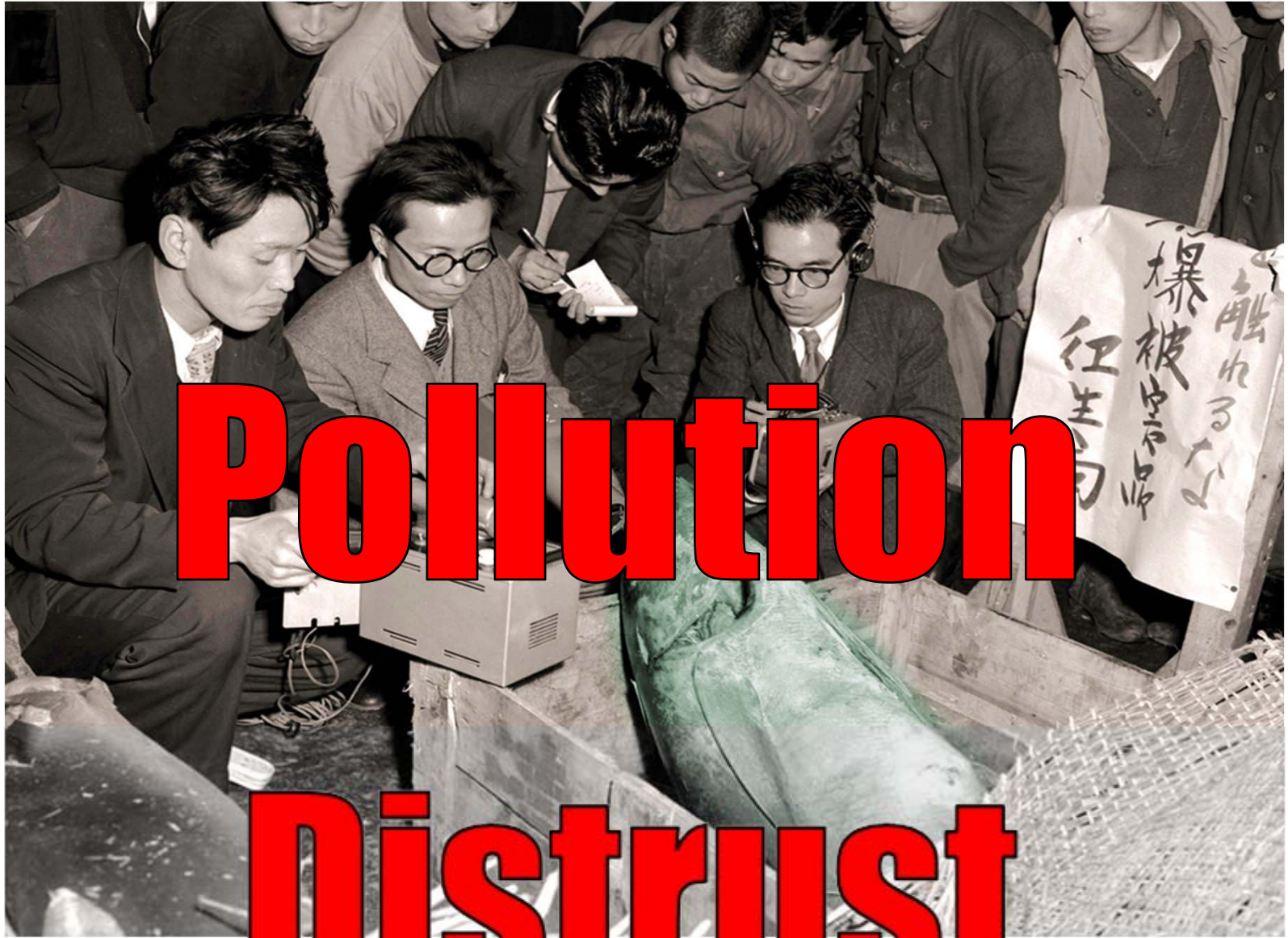


The Day the World Ended – 1956



On the Beach – 1959





Pollution

Distrust



















Pollution



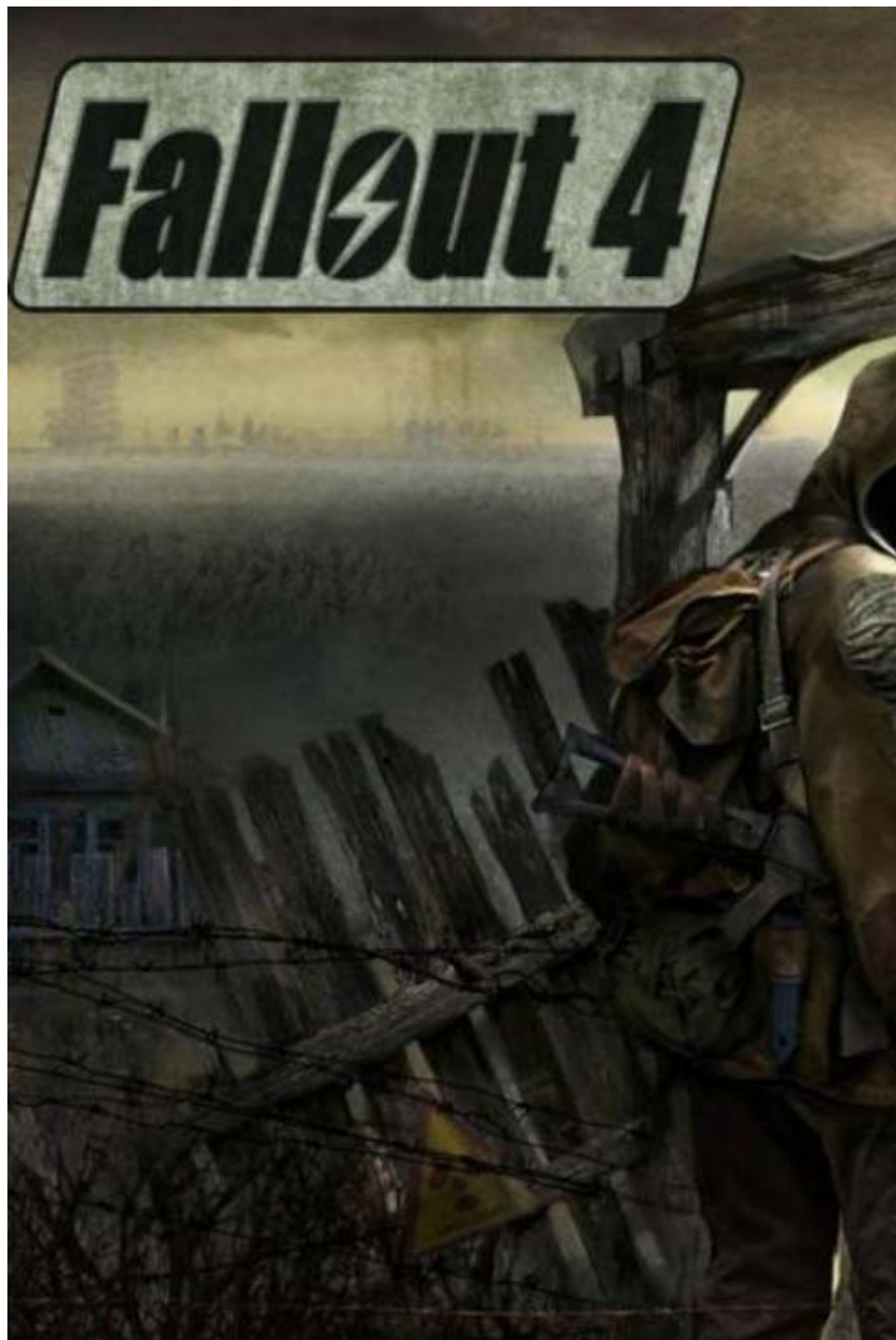
Distrust

Chernobyl



How is nuclear imagery
being passed along
to the next generation?









NUCLEAR TERRORISM

Goes
Prime
Time

By Russ Wellen

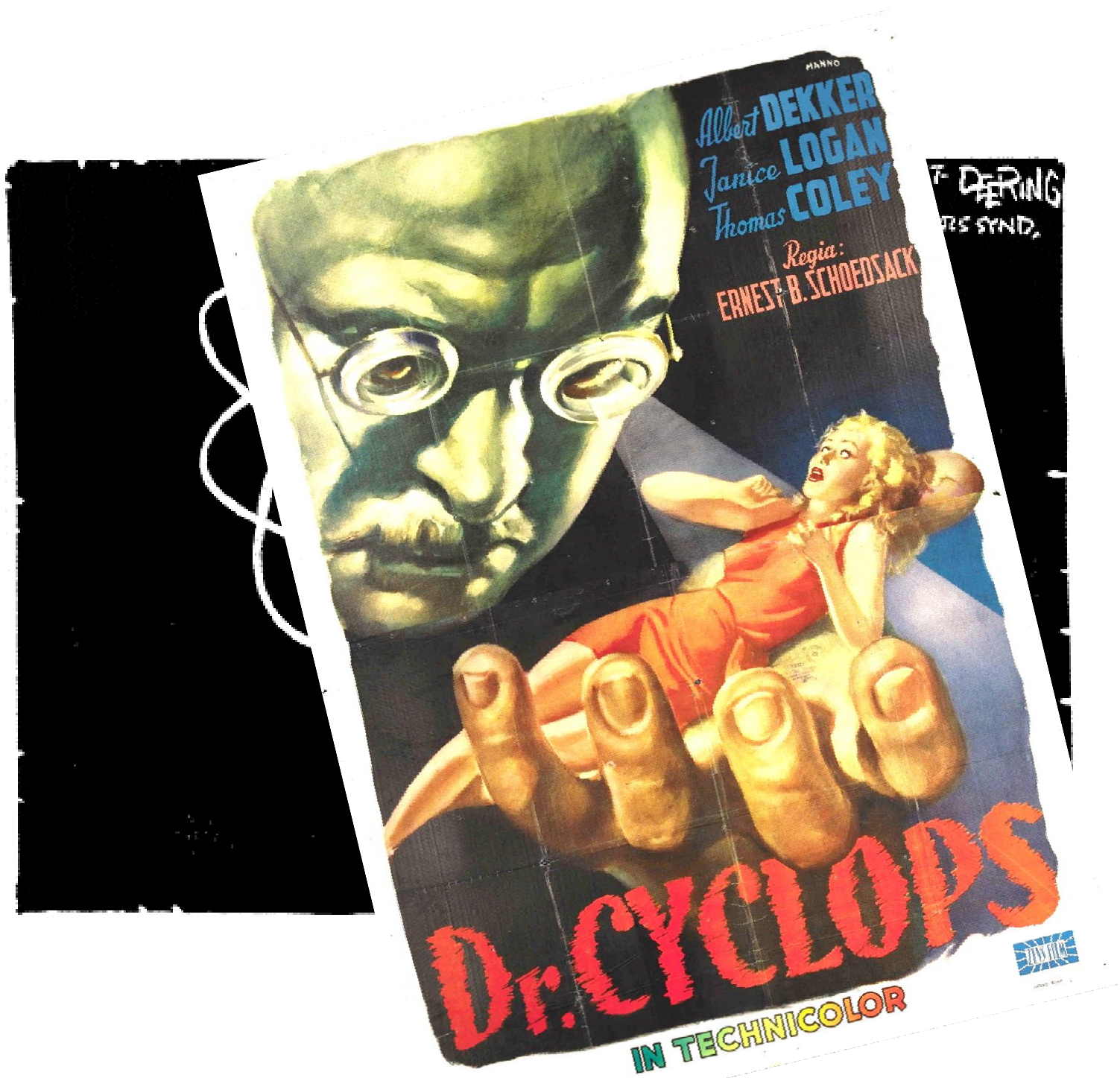
INSIDE:
REAL THREATS!
US GOV INACTION!
YOU'RE GOING TO DIE!

PLUS FAMILY TIES
Special Reunion



Osama's Revenge
(ABC Wednesday)





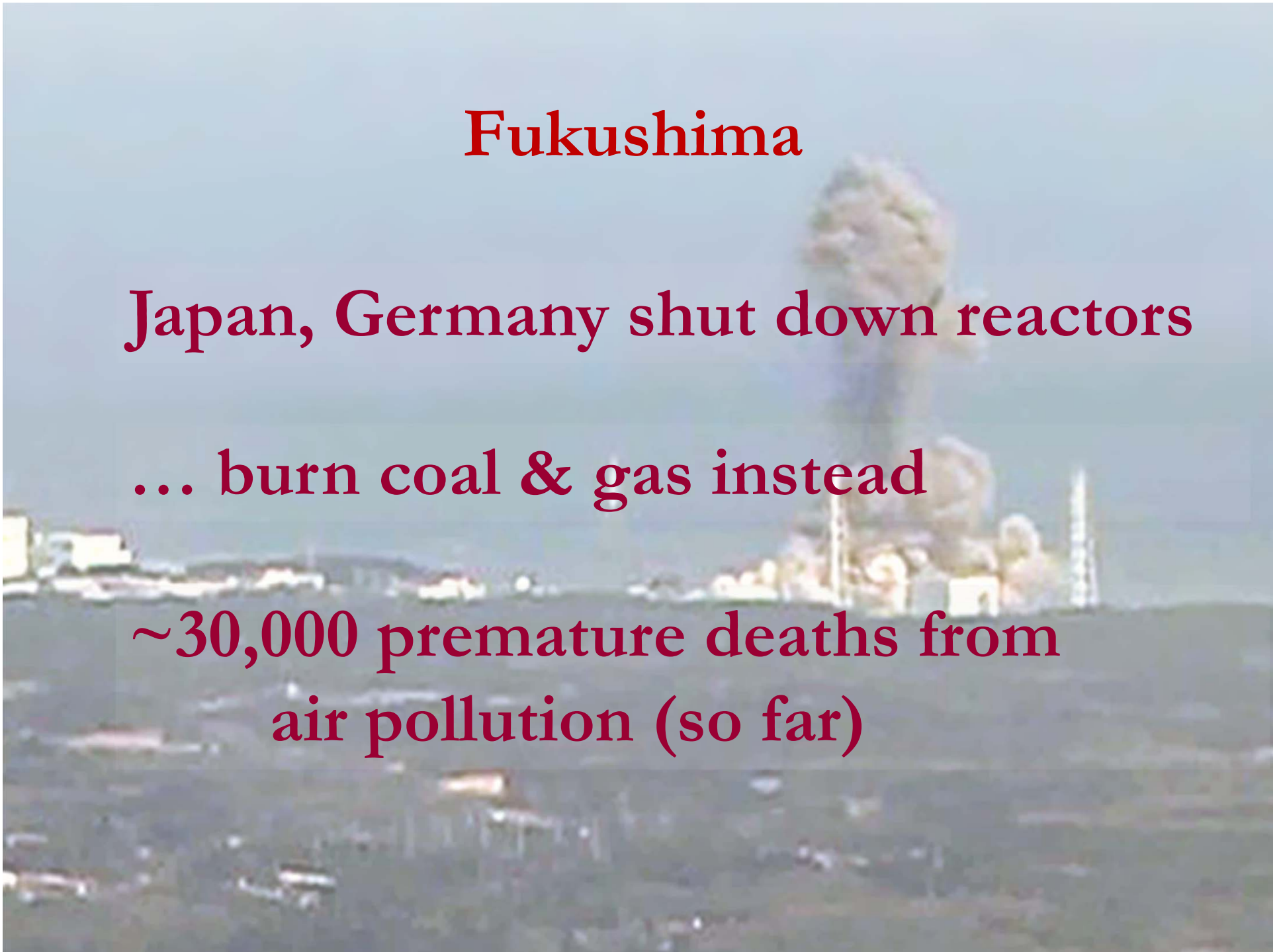
DERING
S'S SYND.

Fukushima

Japan, Germany shut down reactors

... burn coal & gas instead

~30,000 premature deaths from
air pollution (so far)



A photograph of an industrial facility with several tall smokestacks emitting thick, dark smoke that rises into a cloudy sky. The scene is captured during what appears to be dawn or dusk, with a low sun creating a hazy, orange-tinted glow on the left side of the frame. In the foreground, there are silhouettes of industrial structures and power lines. The overall mood is somber and industrial.

Global Warming



**Droughts,
floods,
heat waves...
So what?**

**The policy decisions we make
in this decade will determine
the planet's climate for the
next 10,000 years.**

THE RISE OF NUCLEAR FEAR

SPENCER R. WEART

