The Euphoria of "The Gadget"

An Inquiry into Ethics in the Nuclear Weapons Complex during the Cold War

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Abstract

In 1945-1947, at the end of World War II and at the start of the cold war, medical researchers who were involved in our Nation's nuclear weapons program secretly injected 18 citizens with trace amounts of plutonium to study the metabolism of plutonium in the human body. In this paper, I review the history of the events that led to these injections, develop a model for analyzing the ethics of these experiments, and discuss the root causes of the ethical failures. I also show that the huge environmental cleanup legacy that our nuclear weapons program left over at the end of the cold war resulted from similar root causes, which persisted throughout the entire cold war era.

I. Introduction

During the past few years (1988-1994) there have been two very serious public scandals associated with our Nuclear Weapons Complex, the collection of nuclear weapons laboratories and production facilities that design, develop, and produce our country's nuclear weapons.

In its infancy during the Manhattan Project of World War II, this Nuclear Weapons Complex produced the nuclear materials (i.e., highly-enriched uranium, plutonium) that were fabricated at Los Alamos into the first crude atomic bombs -- "The Gadget" (Fig. 1) that was tested at Alamogordo, NM on July 16, 1945, and "Little Boy" and "Fat Man," which quickly brought an end to the war with Japan in August, 1945.

During the next five decades, the Nuclear Weapons Complex grew into a vast network of secret weapons facilities that produced our stockpile of tens of thousands of sophisticated nuclear weapons, which our military planners believed to be necessary to deter nuclear war between the superpowers. (Now that the cold war is over, a new major responsibility of the Nuclear Weapons Complex (Economist, 1994a) is to disassemble

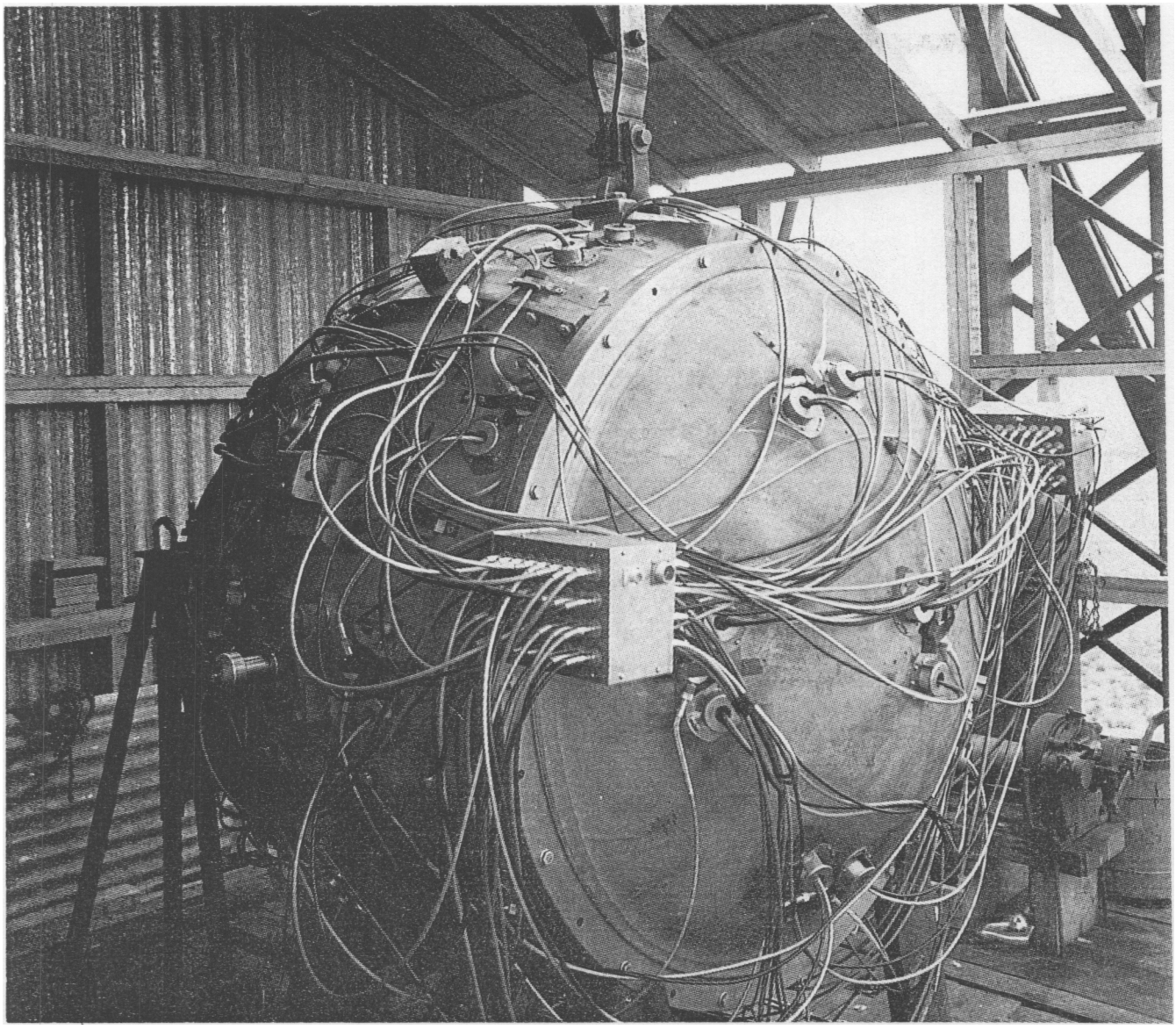

Fig. 1. The first atomic bomb, called "The Gadget," was a plutonium bomb, which was successfully tested at Alamogordo, NM on July 16, 1945. This bomb had a diameter of approximately 5 ft. (Hansen, 1988). Photo from the Los Alamos National Laboratory.

much of this huge stockpile -- which it built -- to meet new arms-control goals and to safely store and protect the salvaged nuclear materials.)

The first scandal involving the Nuclear Weapons Complex, which became publicly known in the fall of 1988, involves the environmental cleanup legacy left behind by these laboratories and production f acilities at the end of the cold war (Time, 1988; Newsweek, 1988). The magnitude of this environmental legacy is huge and cleanup costs may be as great as $300 billion over the next 30 years (GAO, 1994).

Much information has been published during the past few years about this legacy (OTA, 1991). As a result of recent comprehensive health, safety, and environmental audits and reviews at every facility in the Nuclear Weapons Complex by "tiger teams" (Watkins, 1989, p. 85), changes in procedures and operations have occurred to reduce the amount of future environmental contamination. Serious efforts have also been started in order to characterize and clean up these environmental messes, but many of the problems continue (U. S. News, 1994) and much remains to be done (GAO, 1994).

The second major scandal involving the production of nuclear weapons became publicly known in November, 1993, when *The Albuquerque Tribune* published a series of articles (Welsome, 1993) about radiation experiments performed on humans secretly -- i.e., without their knowledge or informed consent -- during the early days of the atomic bomb project, at the beginning of the cold war. These experiments, which involved intravenous injections of trace amounts of plutonium into humans, were done by medical scientists to obtain knowledge of the behavior of plutonium in the human body to protect the workers that were fabricating the first atomic bombs at Los Alamos in 1945. (Incidentally, *The Albuquerque Tribune,* was awarded in the spring of 1994 a Pulitzer Prize for this series of articles about the human plutonium experiments.)

As a result of the information revealed in the articles of *The Albuquerque Tribune,* Hazel O'Leary, the Secretary of the Department of Energy, launched in December 1993 an "Openness Initiative" to cause the Department of Energy to declassify and release to the public all documents related to these human plutonium experiments (Newsweek, 1993). O'Leary also released preliminary information related to many other human radiation experiments involving hundreds and hundreds of veterans, retarded children, and pregnant women.

The release of this preliminary information resulted in a flood of news reports concerning the unethical nature of these human experiments, such as lack of informed consent and experimentation on the more vulnerable and disadvantaged members of our society (New Mexican, 1994). The issue of informed consent is the focus of much of the concern and criticism.

These experiments were also compared to the grim medical tests of the Nazis, which were disclosed during the Nuremberg war crime trials (Udall, 1994) following World War II, and the victims of these experiments were described as "nuclear guinea pigs (Science, 1994)." Secretary O'Leary has "boldly promised compensation 'to make these people whole' (Time, 1994)."

On the other hand, some medical and nuclear scientists defended these human experiments as justifiable in the context of World War II and the urgent cold war situation following the war. This urgency "drove investigators to expedite their experiments with humans, *even* though it meant that 'informed consent' would be abridged . . . (Rosen, 1994)."

The differences in views of the defenders and those of the critics of these experiments is great and is reminiscent of the differences in the cultures of scientists and of non-scientists, which was described 35 years ago by the British physicists/writer C. P. Snow in his classic book, *The Two Cultures.* These differences indicate the two groups have difficulties in communicating with each other, and there seems "to be no place where the cultures meet . . . (Snow, 1959, p. 17)."

This scandal surrounding the human radiation experiments still commands considerable news coverage today, and the debate *over* the ethics of the experiments continues.

The 50 year history of the Nuclear Weapons Complex during the cold war era thus has the odd characteristic of being bracketed on each end by huge public scandals; i.e., the beginning of the era by the secret human plutonium experiments, and the end by the enormous environmental clean-up legacy.

I. Unique Research Opportunity

As a result of the new Openness Initiative of the Department of Energy, the Los Alamos National Laboratory (LANL) announced on January 10, 1994 the establishment of a "Human Studies Project Team" that would search for and release to the public copies of all records located at the Los

Alamos National Laboratory concerning the human plutonium experiments (and other radiation experiments aff ecting humans).

This team has released over 1600 documents consisting of technical reports and papers, memoranda, telegrams, and letters dating from the early days of the Manhattan Project (i.e., 1943) to the present.

The release at Los Alamos of this large quantity of copies of original documents (i.e., original source materials) provides a unique opportunity to investigate the values and beliefs prevalent in our nuclear weapons program -- at Los Alamos and elsewhere -- at the beginning of the cold war (related the second scandal) -- and to compare them with the values and beliefs at its end (related to the first scandal).

In this paper, I'll discuss the events surrounding the human plutonium experiments at the beginning of the cold war (Section 111), develop a general ethical model that will be useful in evaluating the activities related to these experiments (Section IV), identify major values and beliefs that characterized these activities (Section V), and make a brief comparison of these values and beliefs with those illustrated by the environmental cleanup legacy at the end of the cold war (Section VI)

III. The Human Plutonium Experiments

The development of the atomic bomb in World War 11 required the processing and handling of kilogram quantities of plutonium, which is a radioactive element that was suspected to behaved like radium in the human body. An atomic bomb could contain less than 6 to 8 kilograms of plutonium (Serber, 1992; Grace, 1994; Broad, 1994). By the late 1920's, it was well known that radium was toxic to humans; for example, as little as 2 to 1O micrograms absorbed in the human skeleton had been determined to be fatal (Evans, 1933, p. 903). An understanding of the very damaging effects of radium on humans had been obtained from studies of individuals (mostly women) who painted luminous watch and instrument dials using radium from World War I until about 1925.

In order to paint the small numerals on dials, the dial painters obtained a fine point on their brushes by drawing the brush between their lips. In doing so, they swallowed small quantities of the luminous paint, which was a mixture of zinc sulfide and enough radium to give the required fluorescence -- about 1 part of radium to 40,000 of paint (Evans, 1933, p.

901). A significant fraction of the dial painters died of cancer from the radium they ingested (Stannard, 1988, Chapter 1).

The study of the tragic deaths of the dial painters, and other individuals exposed to radium, such as those that took radium "activated" waters for health, allowed (fortunately) the establishment in 1941 of 0.1 microgram of radium fixed in the body as the tolerance value f or humans (Langham, 1945, p. 2).

By knowing this tolerance value of radium, and knowing something about how plutonium is metabolized in animals, it was possible for medical scientists of the Manhattan Project to make reasonable estimates of the tolerance level of the human body to plutonium. By the spring, 1945, the value was established as 1.0 microgram of plutonium (Langham, 1945, p 2). In 1950, this level was reduced to 0.5 microgram (LA-1151, p. 9).

A. Concerns about Health and Safety

The concerns over the health and safety of workers that would be handling significant quantities of plutonium in fabricating the atomic bombs at Los Alamos are found in the documents released in the past few months by the Human Studies Project Team. Even though many of these documents had been declassified earlier, they were not readily available to members of the public until now. (The fact that a document has been declassified does not mean that its existence becomes known -- i.e., what has been secret tends to remain secret.)

Below I give excerpts from these documents to illustrate the concerns for health and the sequence of events that led to the human plutonium experiments.

• The concern over the possible health effects of plutonium was first raised in January 1944, only 18 months prior to the testing of the first bomb (Fig. 1). On January 5, 1944, Glenn Seaborg, who in 1941 discovered the artificially produced element plutonium (and who was co-winner of the Nobel prize in chemistry in 1951), wrote a memo (HSPT-365) to R. Stone, General Medical Director of the Metallurgical Laboratory at Chicago, in which he expressed his concerns that:

> "the physiological hazards of working with plutonium and its compound may be very great. Due to the alpha radiation and long life it may be that the permanent location in the body of even very small amounts, say one milligram or less, may be very harmful. . In the

handling of the relatively large amounts soon to begin here and at Site Y [i.e., Los Alamos], there are many conceivable methods by which amounts of this order might be taken in unless the greatest care is exercised."

- On Feb. 11, 1944, Robert Oppenheimer, the Director of the Los Alamos Laboratory sent a telegram (HSPT-897) to Arthur Compton at Chicago:

> "WE ARE CONCERNED ABOUT IMMEDIATE BIOLOGICAL PROGRAM ON HAZARDS OF FORTY NINE [i.e., plutonium] AS THEY AFFECT PROCEDURES IN THIS LABORATORY. SHOULD LIKE TO HAVE HEMPELMANN DISCUSS PROGRAM AND PROBLEMS WITH HAMILTON UNLESS YOU HAVE OBJECTION TO THIS AND UNLESS THERE ARE OTHER WORKERS OR LABORATORIES WHO WOULD BE MORE APPROPRIATE FOR THE UNDERTAKING . . . WE ARE NOT EQUIPPED FOR BIOLOGICAL EXPERIMENTS."

Dr. Louis H. Hempelmann, mentioned in the above telegram, was the leader of the Health Group at Los Alamos, and Dr. Joseph Hamilton, also mentioned, was a medical researcher at the Radiation Laboratory of the University of California at Berkeley, who was studying the effects of plutonium on animals, such as rats.

- On Feb. 15, 1944, Oppenheimer sent a memorandum (HSPT-880) to General Groves, head of the Army's Manhattan Engineer District (M.E.D.):

> "SHOULD LIKE AUTHORIZATION TO SEND HEMPELMANN TO BERKELEY FOR CONSULTATION WITH HAMILTON ON BIOLOGICAL RESEARCH PROGRAM ON RADIOACTIVE EFFECTS OF X10 [i.e., Oak Ridge Laboratory] PRODUCTS AND OF POLONIUM. BECAUSE OF THE NATURE OF TESTS WHICH WE WILL BE CARRYING OUT HERE WE ARE PARTICULARLY CONCERNED ABOUT INHALATION OF THESE MATERIALS."

- By August 1944, workers at Los Alamos had become very concerned about the potential hazards of working with plutonium because of an accident involving the explosion (chemical, not nuclear) of ten milligrams of plutonium in an employee's face with the subsequent ingestion of an unknown amount, and about the lack of a method of detecting plutonium in the human body. On August 16, 1944 Hempelmann wrote Oppenheimer (HSPT-174).

"The present medical knowledge of the hazards of plutonium is derived entirely from tracer studies of the metabolism of this element in the rat and from calculation of tissue ionization produced by alpha radiation. Interpretation of Dr. Hamilton's data on rats in terms of humans indicates that 50-100 micrograms of plutonium in the skeletal system is the lethal dose. . . Dangerous amounts of plutonium in the body should be detectable by finding plutonium in the excreta. . . As yet no satisfactory method of assaying excreta has been devised. . .

". . . we have discussed the advisability of giving a higher priority to the medical problems related to plutonium. . . It seemed to us that the following medical problems are the ones to which answers are urgently needed:

"1. Development of methods of detection of plutonium in the excreta.

"2. **Determination of the factor by which the amount of plutonium in the excreta must be multiplied to ascertain the amount in the body** [emphasis added].

"3. Development of methods of detection of plutonium in the lung.

"4. Further and more complete animal experimentation."

In explaining the urgent medical problem stated in item (2.) above determination of the factor by which the amount of plutonium in the excreta must be multiplied to establish the amount in the body --Hempelmann comes very close to suggesting a human experiment, but hedoes not explicitly state it. It is hard to imagine how this factor could be obtained other than through experiments on human beings.

• Hempelmann wrote a history of the Health Group in April 1946, and in this history he reiterated the reason that Los Alamos started its own biological research program in August 1944 was because it was not getting the help it needed elsewhere (HSPT-105):

"The original policy of this project toward biologic and physics research related to health problems required us to depend entirely on information gained from health research groups elsewhere. As it became obvious that reliance on other research groups did not always give us the proper data in time to establish safe operating procedures . . . in August of 1944 . . . biologic research was started by a section of the Health Group."

• Oppenheimer responded (HSPT-176) to Hempelmann's concerns (i.e., HSPT- 174) about the lack of appropriate biological information by authorizing health related research at Los Alamos:

> "In answer to your memorandum on the health hazards of plutonium and in confirmation of our conversation, I should like herewith to authorize you to undertake two programs: (a) the development of methods of detection of plutonium in the excreta; (b) the development of methods of detection of plutonium in the lung.
>
> "We both agree that if this program is to be effective it must be prosecuted with rather high priority.
>
> "As for the biological sides of the work, which may involve animal or **even human experimentation** [emphasis added], I f eel that it is desirable if these can in any way be handled elsewhere not to undertake them here."

This is the earliest mention that I found in the information released by the Human Studies Project Team of the possibility of plutonium experiments on humans. Oppenheimer's desire of doing the experiments somewhere other than Los Alamos comes from his concerns that "we are not equipped for biological experiments (HSPT-897)," probably because of the lack of adequate medical f acilities and personnel at Los Alamos.

• Hempelmann immediately started a medical research program at Los Alamos. In a memorandum (HSPT-177) dated August 23, 1944, probably written by Hempelmann, but the name of the author is obliterated by security declassification markings (circa 1959), the author writes:

> "Following Dr. Oppenheimer's directive of 16 August 1944, we have launched upon the two programs mentioned therein:
>
> "a. The development of methods of detection of plutonium in the excreta.
> "b. The development of methods of detection of plutonium in the lung.
>
> "At present we have four people working on item (a). "

• On August 29, 1944, Hempelmann summarized the directions and goals of the new medical research program of Los Alamos for Oppenheimer(HSPT-178).

> "Colonel Warren has suggested that I summarize the biological research program which was agreed upon in our conf erence with you and Mr. Kennedy on 25 August 1944. This program which will be pursued with a relatively high priority will consist of three parts:
>
> "1. The development of chemical methods of determining plutonium in the excreta and in tissues and of ionization methods of detecting plutonium in the lungs.
> "2. Animal experimentation to check the methods described above.
> "3. **Tracer experiments on humans to determine the percentage of plutonium excreted daily.** [emphasis added]
>
> "When satisfactory analytical methods have been developed in this laboratory the problem of carrying out further metabolic studies will be turned over to another medical group, presumably the Rochester group."

Thus, by the end of August, 1944, tracer experiments on humans using plutonium had become a priority for Los Alamos, and these experiments would be carried out for Los Alamos at medical facilities outside Los Alamos. As mentioned in the above memorandum, the human experiment was needed to allow medical scientists to calculate the amount of plutonium in the body from the measurements of the amount of plutonium found in the urine.

The term "tracer" in the context of the proposed human experiments in the above memorandum suggests the use of very small amounts of plutonium, just enough to allow the experiments to be done adequately, but small enough to put the individual in as low a risk as practical.

Colonel Warren, mentioned in this summary, was Dr. Stafford L. Warren, who was Chief of the Medical Section of the Manhattan Engineer District. Mr. J. W. Kennedy was head of the plutonium recovery group at Los Alamos.

• On December 2, 1944, Colonel Warren, wrote a memorandum to file (HSPT-373) discussing the priorities of the experimental medical program on plutonium,

"The following data are urgently needed in order to get for the M.E.D. operating program which is based on something more than the present assumptions and calculations:

> "a. An acute (within 30 days) LO 50 for radium and product following a single intravenous injection in rats (to be done by Dr. Cole of the Chicago Area, and Dr. Bale of the Rochester Area).
>
> "b. The establishment of the ratios of blood level to urine and fecal excretion following a single intravenous injection of radium and product [i.e., plutonium] in rats (Dr. Cole, Dr. Bale, Dr Hamilton (tracer) and Dr. Hempelmann.)
>
> "c. **Tracer experiments on humans like b. above so that the comparison . . . can be made between the rat data and human data** (Dr. Bale, **Dr. Hempelmann,** and Dr. Cole)." [emphasis added]

In addition, in this memorandum, Colonel Warren also emphasized that a "correlation of all these data should be made and a practical working tolerance level set as soon as possible (March 1945)." This date of March 1945 for the completion of the correlation of all the data and setting a tolerance level for humans to plutonium was important because kilogram quantities of plutonium would begin to become available from the nuclear production reactors at Hanford, Washington for fabrication at Los Alamos into bomb components by the spring, 1945.

Dr. Bale, mentioned in the above memorandum, was a medical researcher at the University of Chicago, and Dr. Cole was a researcher at Rochester It is clear from this memorandum that Dr. Hempelmann of Los Alamos is a major player in the tracer experiments on humans using plutonium.

• On March 26, 1945, Hempelmann wrote Oppenheimer (HSPT-188) a memorandum summarizing a meeting on March 23, 1945 with Lt. Colonel Hymer Friedel! from Oak Ridge, who was the deputy to Colonel Warren, to discuss the medical concerns associated with the handling of plutonium at Los Alamos. Los Alamos requested consideration of the following help from the Manhattan Engineer District:

> "The Manhattan District is asked to help make arrangements for **a human tracer experiment to determine the percentage of plutonium excreted daily in the urine and feces.** It is suggested that **a hospital patient at either Rochester or Ch icago** be chosen for injection of from one to ten micrograms of

material and that **the excreta be sent to this laboratory for analysis."** [emphasis added]

In addition, Hempelmann also expresses in this memorandum his desire that Los Alamos establish a more satisfactory relationship "with the Medical Program of the Manhattan District so that the facilities of the Manhattan District be available for the solution of our problems."

• Three days later, on March 29, 1945, Oppenheimer wrote to Colonel Warren (HSPT-189) at Oak Ridge and expressed his support for the requests to Colonel Friedel! detailed by Hempelmann in the above memorandum:

> "We are inclosing (sic) a record of discussions held here a few days ago during the visit of Colonel Friedel!.
>
> "I **should like to add my personal indorsement** (sic) **to the requests outlined in the accompanying memorandum.** We all have the feeling that at the present time the hazards of workers at Site Y [i.e., Los Alamos] are probably very much more serious than those at any other branch of the Project, and that it would be appropriate that the medical program of the Manhattan District consider some of our problems rather more intensively than they have in the past. [emphasis added]
>
> "I believe that the order of priority outlined in the accompanying memorandum is a wise one. Although we would have some ideas of how to pursue all of the topics mentioned, we have, as you know, neither the personnel nor the facilities which would be involved in this .
>
> "It was our impression that if other workers on the medical program were better informed about what was important from our point of view they would probably be glad to help us out."

It is clear from this letter that Oppenheimer is supporting the need for the trace experiments on humans, and he is also not happy with the lack of help Los Alamos had been getting from the medical program of the Manhattan District.

B. The Experiments

• The first human plutonium tracer experiment was initiated less than two weeks later at the U. S Army's Manhattan Engineer District Hospital in Oak Ridge, Tenn.

Dr. Joseph W. Howland, who did the actual injection of the plutonium into the first patient at Oak Ridge, was interviewed in 1974 about this experiment. Dr. Howland was an army medical doctor who reported to Colonel Hymer Friedel! (see the previous two quotations concerning Colonel Friedel! and his agreement with Los Alamos to arrange the human plutonium experiments). A summary of the interview with Dr. Howland stated that:

> "In April 1945, a patient . . . was admitted to the Oak Ridge Hospital with multiple fractures resulting from an automobile accident. Dr. Hymer Friedel! informed Dr. Howland that he considered the patient to be a suitable candidate for the human plutonium experiment. Dr Howland indicated that he did not agree with Dr. Friedel!. Subsequently, Friedel! ordered Dr. Howland to inject the patient with plutonium. Howland complies after receiving a written military form stating that he (Friedel!) ordered Howland to inject the patient.
>
> "Dr Howland emphatically stated that no consent was obtained from the patient at any time . . . (Weyzen, 1974)."

This patient was injected intravenously with 4.7 microgram of plutonium on April 10, 1945.

The purpose of this test was to determine the "relation between the amount of plutonium in the human system and that excreted in the urine per 24 hours (HSPT- 206, pp. 28-29)". Excreta (urinary and fecal) were collected from this individual f or a period of 58 days (HSPT-013, or LA-1151, or HP-1980).

The results for the first 18 days of this human plutonium experiment were reported by Wright H. Langham of Los Alamos at the Conference on Plutonium, held May 15 -16, 1945 (two months before the first atomic bomb test at Alamogordo) in Chicago (HSPT- 206, p. 29):

> "The subject was an elderly male [53 years old] whose age and general health was such that there is little or no possibility that the injection can have any effect on the normal course of his life. The

patient might not have been an ideal subject in that his kidney function may not have been completely normal at the time of injection as indicated by slight albuminuria and a low urine specific gravity ."

In this experiment, Langham established a preliminary relationship between the amount of plutonium in the 24 hour excretion (urine) rate of humans and the total amount of plutonium in the body (HSPT- 206, p. 29)·

". . . the leveling off point seems to be about 0.02 per cent . . ."

A copy of the original graph showing this excretion rate as given in the report of the Conference on Plutonium (HSPT-206) is shown in Fig. 2. The identity of the patient was given in Fig. 2 as "E. C." In all other documents related to the human plutonium experiments, this patient was identified as "HP-12."

Within the past year, information about this patient was established by *The Albuquerque Tribune* -- he was Ebeneezer Cade, who had been injured in a head-on traffic accident (Albq. Journal, 1994). Cade died in April 1953 -- eight years after the injection.

By measuring the amount of plutonium in the urine, one could then determine the amount of plutonium in the body. Langham established that a human excretes about 0.02%, or 1/5000, of the plutonium contained in the body each day. This number was the conversion factor that was so desperately needed to protect the plutonium workers at Los Alamos. This conversion factor was soon changed to 0.01% per day (Langham, 1945, p. 2), and eventually (i.e., 1950) described by a mathematical expression that related the urinary excretion rate to the time in days after exposure (HSPT-013).

• The second human plutonium experiment (identified as "CHl-1") was started at the University of Chicago on April 26, 1945, and the results were also presented at the Conference on Plutonium in Chicago on May 15-16, 1945 by E. R. Russell (HSPT-206, pp. 34-45). This patient was injected with 6.5 µg (micrograms) of plutonium. The urinary excretion rate of plutonium found in this experiment was similar to that found in the first experiment reported by Langham.

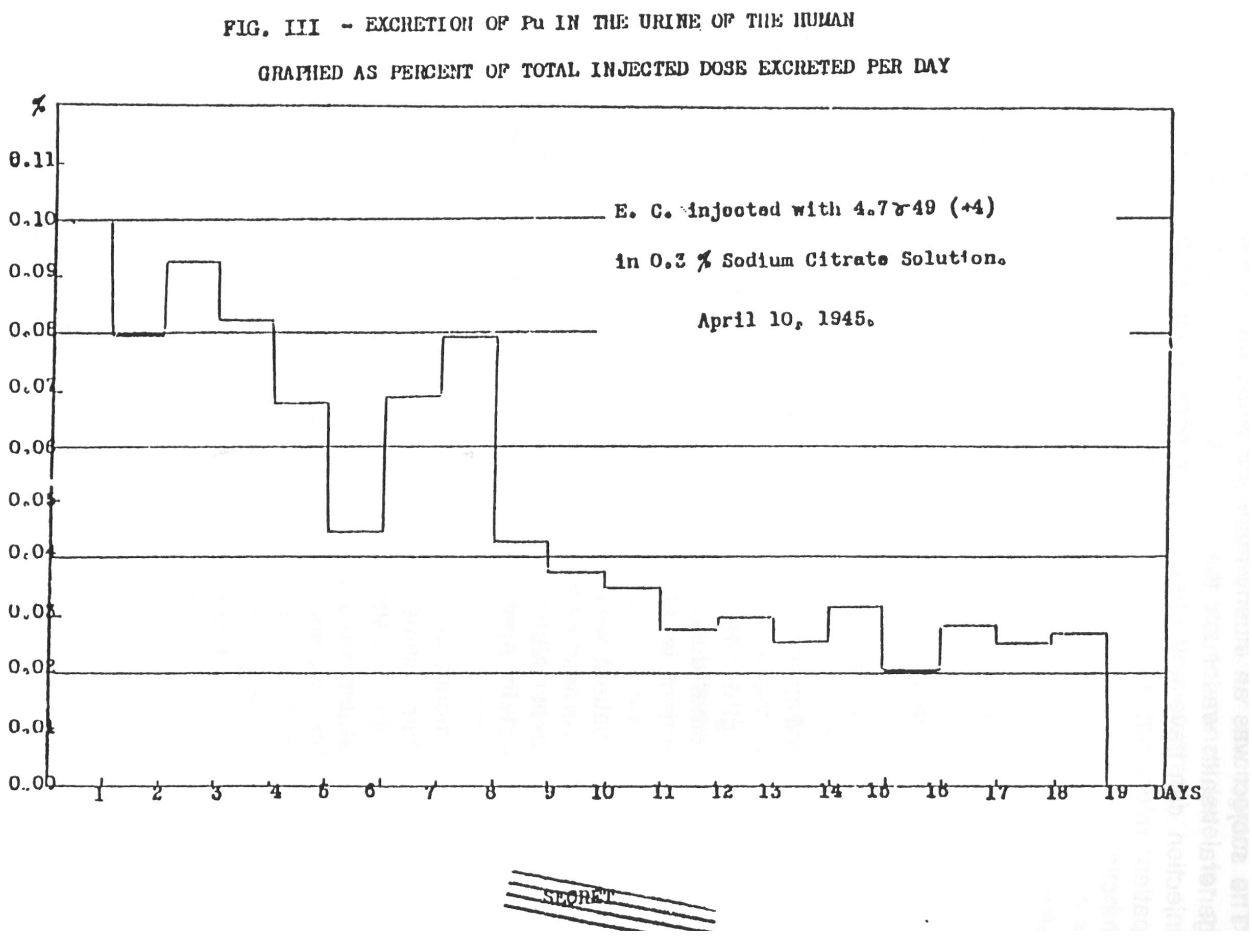

Fig. 2. The measured excretion rate of plutonium from the first human experiment. The vertical axis is the perent of the amount of plutonium in the individuals body that is excreted in urine per day. This is a copy of the original graph given by Langham at the Conference on Plutonium in Chicago, May 15-16, 1945.

- The third experiment ("CAL-1") was started at the University of California Hospital at San Francisco on May 14, 1945 (Crowley, 1946).
- These three human plutonium experiments were the only ones done before the test of the first atomic bomb, "The Gadget" -- which was a plutonium bomb -- at Alamogordo, NM on July 16, 1945, and the Hiroshima (uranium bomb) and Nagasaki (plutonium bomb) bombings on August 6 and August 9, 1945, respectively.

- The remaining human plutonium experiments began again on October 16, 1945, i.e., two months after the end of the war with Japan Eleven more experiments were done -- cases "HP-1" through "HP-11" -- as a "joint project [which also included the first experiment, "HP-12"] of the Los Alamos Scientific Laboratory of the University of California and the Atomic Energy Project of the University of Rochester School of Medicine and Dentistry (HSPT-013, p. 10) " The final human experiment in this joint project between Wright Langham at Los Alamos and Samuel H. Bassett of Rochester began on July 16, 1946 (HSPT-013, p. 15), and the patient was followed for 30 days.

All of the human experiments in the joint Los Alamos-Rochester project were done using injections of 4.6 to 6.5 micrograms of plutonium (HSPT-013, p. 15), which were about five times larger than the human tolerance standard of the time of 1.0 microgram. However, there had been discussions among the researchers of doing a human experiment using a much larger dose, particularly 50 micrograms, which would be 50 times larger than the tolerance standard. Bassett suggests that such an experiment could be done "if a suitable opportunity occurred," which implied, I believe, that it would only be done on an individual that was acutely ill and near death (Bassett, 1946).

- Two more human experiments were done at Chicago, and two more at San Francisco (HSPT-011), for a grand total of 18 human experiments.

- The final human experiment began on July 18, 1947 at the University of California Hospital in San Francisco on a 36 year old man, who had bone cancer in his left knee. Trace amounts of plutonium were injected into his left leg, and the leg was later amputated to keep the bone cancer from spreading There is a handwritten record of informed consent on this patient (CHA , 1977; Welsome, 1993, p. 29)·

> "The experimental nature of the intramuscular injection of the radioactive tracer sample was explained to the patient, who agreed on the procedure. The pat. was in fully oriented and in sane mind."

The record was signed by the three medical doctors and the nurse that assisted in the injection procedure, but not by the patient. This is the only record of informed consent in the 18 human experiments.

This patient lived for 44 years after the injection, to the age of 80.

- In addition to these 18 intravenous injection experiments, six individuals orally ingested plutonium solutions in an experiment at the University of Chicago on May 13, 1946 (Russell, 1946):

> "In order that one might gain some idea as to the rate of intestinal elimination, it was thought advisable to conduct experiments with humans whereby approximately 400 alpha c/m were ingested and the elimination rate followed."

C. Follow Up

- Even though the patients of the plutonium experiments were selected "such that survival for ten years was highly improbable" (HSPT-618), seven of the 18 patients lived for more than 10 years. J. Newell Stannard, author of the massive 2000 page book, *Radioactivity and Health: A History,* stated that (Stannard, 1988, p. 350):

> "Since most patients were selected because they had a short life expectancy, some died moderately soon, and tissue samples were analyzed as were excreta. Others lived for many years, even long enough to cast doubt on the validity of the original medical opinion or to confirm the resiliency of the human organism."

- Curiously, there were very few follow up contacts with the 18 patients in later years -- either for additional data on the plutonium excretion rates at later times, or to see if any of the patients had any long-term health effects from the injections.

On the other hand, Los Alamos medical researchers have consistently followed for decades the health of 25 employees that had been exposed to plutonium during the construction of atomic bombs at Los Alamos before 1950. The estimates of the amounts of plutonium in the bodies of these employees ranged from 0.1 to 1.2 micrograms (Hempelmann, 1973; Voelz, 1979), about five to 50 times lower than the amounts in the bodies of the 18 patients.

In 1950, Wright Langham did try to get additional urine samples from the Rochester patients to strengthen the report on plutonium excretion that he was writing -- a report that he characterized as going to "be the last word on the plutonium situation (HSPT-868)." On March 20, 1950, Langham wrote (HSPT-867):

> "I have spent the last three months working over all of the human excretion data available. It is highly important that we get a few results at the end of a very long time. . . **I think this is sufficiently important that we should spare no effort to obtain additional samples."** [emphasis added]

Langham did get additional urine samples (HSPT-013) from two of the patients (HP-3 and HP-6); however, it is not clear that he actually made much use of this data (HSPT-046).

Apparently, these were the last samples obtained from any of the patients involved in the human plutonium experiments until the surviving few were "rediscovered" and remeasured almost three decades later (Rundo, 1979).

- Because of their failure to follow up on these patients, it is obvious that the medical researchers lost much valuable scientific data.

- In the mid-1970's, nearly 30 years after the secret injections, the Atomic Energy Commission did follow up with the patients that were still alive to inform them of the details of the experiments. In addition, the bodies of several of the patients that had died were exhumed for autoradiographic studies of plutonium distribution in bone (Welsome, 1993, pp. 44-45).

IV. Ethical Model

As I mentioned in the introduction, the ethical debate surrounding these human plutonium experiments has primarily concentrated on two issues: the critics of the experiments focus on the lack of informed consent, while the defenders focus on the urgency of ending the war with Japan and the subsequent urgency of the cold war. The critics are primarily concerned with how the experiments were done (i.e., the "means"); the defenders are concerned more with what the experiments (i.e., the "ends") accomplished.

The differences in views between these two groups are examples of the diff erences in the Western ethical traditions of utilitarianism (or consequentialism) and deontology. The utilitarian is generally more interested in the outcomes or "ends" of an activity and less interested in the "means" or how the activity is accomplished, while the deontologist is generally more interested in how the activity is accomplished, and less interested in what is accomplished.

The utilitarian tradition is found in the works of philosophers like Jeremy Bentham and John Stuart Mill, while the deontological tradition is generally identified with Immanuel Kant. Both utilitarian and deontological traditions express valid and important points of view (Nye, 1986, pp. 14-26), and thus, both the critics and the defenders of the human plutonium experiments have important things to say. Unfortunately, both focus too narrowly on only parts of the complex issue.

Both how you do something and w.at you do are important.

In addition, why you do something (i.e., the "motive") is also important.

There is a difference in assessing the ethics of only one or a few parts of an activity, and that of taking a broader or more holistic look at the entire activity. Looking primarily at informed consent, for example, as the critics tend to do, or at urgency, as the defenders do, leads to a deontological vs. utilitarian confrontation that results in very little understanding of the broader ethical issues of the human plutonium experiments.

A more useful way to examine the ethics of the human plutonium experiments so that a more balanced assessment can be made is to use a holistic, or eclectic, approach that considers motives, means, and ends from the points of view, or perspectives, of the various individuals and groups that have involvement or interests in the experiments, such as the patients, the scientists doing the experiments, members of society, etc. These various individuals and groups are frequently called "stakeholders "

The approach that I am suggesting to provide a more balanced view is a combination of the "three-dimensional" ethical model described by Joseph S. Nye, Jr. and the "veil of ignorance" concept of John Rawls.

Nye believes that a careful appraisal of all three dimensions of a decision or activity -- i.e., the motives, the means, and the ends -- is a prerequisite to good moral reasoning. He believes that we should "be

properly critical of 'one-dimensional' moral reasoning" -- i.e., reasoning that considers only motives, or means, or ends, but does not consider all three together (Nye, 1986, pp. 20-26).

John Rawls, in his concept of "the veil of ignorance," suggests that decisions should be made such that we could live with these decisions no matter which stakeholder we are -- i.e., whether we are, for example, the patient, or the scientist, or a member of society (Rawls, 1971, pp. 136-142). Rawls' approach requires us to (1) look at our decisions and actions from the points of view of the various stakeholders that are involved in or affected by our decision and (2) assume that we will not know which stakeholder we will be (i.e., we wear a veil of ignorance) once the decision has been made. In this way, impartiality in formulating the decision is encouraged.

A framework for such an eclectic approach that combines the ideas of Nye and Rawls is shown as Fig. 3. This N row x 3 column matrix allows consideration of the values, beliefs, and goals of N different individual or group stakeholders. In assessing the ethics of an activity, such as the human plutonium experiments, using this matrix, we first identify the major values, beliefs, and goals that are important to each stakeholder from the standpoint of their motives, means, and ends. Once these values, beliefs, and goals have been identified, we can then make ethical or moral judgments as to where the activity -- such as the human plutonium experiment -- succeeded in meeting these values, beliefs, and goals, and to where it did not meet them. The ethical analysis of a complex activity rarely gives a clean right or wrong answer -- it generally shows that some things are done well, some so-so, and others poorly.

Such an eclectic approach is, of course, very time consuming and much more difficult to do than the one-dimensional approach that considers only a single issue, such as informed consent, or urgency -- but the ethics of a complicated issue is not necessarily neat and tidy.

An example of using this holistic approach to analyzing the human plutonium experiments is illustrated in Fig. 4, in which I look at the motives, means, and ends of these experiments from the points of view of four important stakeholders -- i.e., (1) the patients, (2) the medical researchers involved in planning and performing the experiments, (3) the larger scientific community, and (4) society at large. In each element of this matrix (4 rows x 3 columns = 12 elements), I identify the values, beliefs, and goals that I think would be important to each of these stakeholders.

Fig. 3

Eclectic Matrix -- A General Framework

	Motives (Why?)	Means (How?)	Ends (What?)
Stakeholder 1			
Stakeholder 2			
Stakeholder 3			
...			
Stakeholder N			

Fig. 4

Eclectic Matrix: Pu Tracer Experiments on Humans

	Motives (Why?)	Means (How?)	Ends (What?)
Patient	• Improved health • Benefit to others (i.e., altruism) • Help war effort	• Voluntary/Informed • Treated with respect/care • Follow up/treatment	• Wellness (for self and/or others) • End to the war
Medical researchers	• To protect the health of the plutonium workers at Los Alamos • Help war effort	• Comparison with radium • Animal experiments • Tracer experiments on humans • War time environment (secrecy, expediency)	• Human tolerance standard (1μg Pu) • Measurement method (urine analysis) • Conversion factor (0.02% per day) • Successful construction of bomb • End to the war
Scientific community	• Technical merit • Help war effort	• Experimental design • Peer review • Creativity • Professional standards/codes	• Technical excellence • Add to knowledge base • Robust results • Completeness (extract all info.) • End to the war
Society at large	• Impartiality (i.e., not self serving, no hidden agendas) • Social value/importance • Help war effort	• Minimize negative side effects of the activity • Ensure minimum standards of justice and human rights (i.e., rights of individuals) • Voluntary/Informed • Responsibility (follow through) • Consideration of alternate approaches? • Consistency • Openness (excessive secrecy)	• Enhance long term welfare of society • End to the war

I arrived at these values, beliefs, and goals by assuming that I was a member of a small group of people (i.e., a "Rawlsian committee") consisting of the four stakeholders described above who were openly and honestly discussing their interests in the human plutonium experiments, i.e., their motives, means, and ends. I tried to view the experiments from the point of view of each of these stakeholders.

In arriving at these values, beliefs, and goals, I used the works of various philosophers and ethicists -- such as Sissela Bok, Michael Josephson, Thomas Donaldson, Joseph S. Nye, Jr., and A. C. Ivy -- and a bit of common sense. The examples I show in Fig. 4 are, of course, not the only ones upon which wise men and women could agree (Kidder, 1994, pp. 309-324), but they are a useful, and maybe even a reasonable, set of values, beliefs, and goals.

The ethicist Sissela Bok, emphasizes that it is important for societies to put moral constraints on violence, deceit, and betrayal -- to preserve and restore "an atmosphere of a least minimal trust in any society. . . Whether expressed in religious or in secular form, these three values are shared by every civilization, past and present (Bok, 1989, p. 79)." She also defines a fourth important constraint,

> "because persons acting clandestinely easily bypass or ignore the three constraints, a fourth one is necessary: on excessive secrecy. While its roots are not as ancient as those of the first three . . it is as fundamental to the preservation of democratic traditions as the first three are to the survival of communities more generally (Bok, 1989, p. 82)."

Bok's four moral constraints can be thought of as the affirmative or positive values of non-violence (or non-dominance), honesty, promise-keeping, and openness.

Michael Josephson notes that trustworthiness, respect, responsibility, justice and fairness, caring, and civic virtue and citizenship are the foundations of a democratic society (Josephson, 1993).

Thomas Donaldson suggests that an organization (i.e., Manhattan Engineer District, Atomic Energy Commission, Department of Energy, etc.) has the moral obligation to enhance the long-term welfare of society, minimize the drawbacks associated with its operations, and refrain from violating minimum standards of justice and human rights (Donaldson, 1989, pp. 47-56) .

Joseph Nye emphasizes the importance of impartiality in ethics -- i.e., could an action or policy be accepted by anyone who did not know his or her particular circumstances? He also notes that we judge moral arguments in terms of their clarity, logic, consistency, and unnoticed negative consequences (Nye, 1986, p. 15-16).

A. C. Ivy notes that the "most important requirement for the ethical use of human beings as subjects in medical experiments is that they be *volunteers* (Ivy, 1948)."

In addition, scientists tend to value things such as technical excellence, creativity, self-regulation through peer review, freedom of thought, right of dissent, honesty, and loyalty to the truth (Barbour, 1993, pp. 27-29).

V. Ethical Analysis

When you begin to examine the human plutonium experiments from a broad eclectic framework, such as that illustrated by the matrix in Fig. 4, you start to understand the reasons for the differences in opinion between the critics and the defenders of the ethics of the experiments: both the critics and the defenders are concentrating on different parts of a very complex issue; i.e., each looks at different elements, or boxes, of the matrix, and thus each sees only a limited, incomplete, and unbalanced portion of this larger eclectic matrix.

A. Closed Politics Matrix

The medical researchers at Los Alamos were responsible for finding ways of protecting the health of the plutonium workers while the first atomic bombs were frantically being produced during the spring of 1945. The concerns of the medical researchers about the health of the plutonium workers who were trying to meet urgent war-time production schedules were described clearly by Louis Hempelmann (the head of the Health Group at Los Alamos) in June, 1945 in a memorandum to J. W. Kennedy, head of the plutonium recovery group at Los Alamos (HSPT-883):

> "This is to confirm our telephone conversation of 22 June 1945 during which we discussed the recent high exposure of personnel in the Recovery Group. . . the situation is extremely serious and seems to be getting completely out of hand. The probable exposure . . . is

> sufficiently alarming, in my opinion, to prompt me to advise that drastic steps be taken to reduce exposure. . . I can appreciate how difficult is the problem of reducing exposure yet meeting the increased schedule of processing 49 [i.e., plutonium]; nevertheless, it is my duty to bring officially to your attention what I regard as a very grave medical problem."

Years later, Hempelmann recalled his concerns for the health of these plutonium workers:

> "We were very concerned about the exposures of some of the workers during June and July of 1945. If it had not been that we had to get the bomb made as soon as possible all work would have stopped There was such urgency that we kept on going and doing everything we could to make it safe (HSPT-246, pp. 38-39)."

Clearly, in the development of the first atomic bombs, the urgency of production took precedence over health and safety, and the medical researchers who were responsible for health and safety had to scramble to make things as safe as possible under the difficult circumstances.

Instead of recognizing a broader, eclectic environment (Fig. 4), the medical researchers experienced an environment that would be described by a much more limited matrix, like that illustrated in Fig. 5. Given the urgent and secret nature of the atomic bomb project, this limited matrix contained basically the values, beliefs, and goals important to the medical researchers working on the health concerns, i.e., generally those found in the second row of the broader, eclectic matrix of Fig. 4.

I call this limited matrix of Fig. 5 a "closed politics" matrix because the choices involved in the building of the atomic bombs were made in a closed environment -- by a handful of men, in secret -- that did not permit input f rom other stakeholders, such as the patients or members of the public.

C. P. Snow, in 1960, coined the term "closed politics" to mean

> "any kind of politics in which there is no appeal to a larger assembly -- larger assembly in the sense of a group of opinion, or an electorate, or on an even bigger scale what we call loosely 'social forces' (Snow, 1961, p. 56)."

Fig. 5

"Closed Politics" Matrix of the Medical Researcher in the Human Plutonium Experiments

	Motives (Why?)	**Means (How?)**	**Ends (What?)**
Patient			
Medical researchers	• To protect the health of the plutonium workers at Los Alamos • Help war effort	• Comparison with radium • Animal experiments • Tracer experiments on humans • War time environment (secrecy, expediency)	• Human tolerance standard (1μg Pu) • Measurement method (urine analysis) • Conversion factor (0.02% per day) • Successful construction of bomb • End to the war
Scientific community		• Experimental design • Creativity	• Technical excellence
Society at large		• Minimize negative side effects of the activity	

The major difference between the closed politics environment of Fig 5 and that of the eclectic environment of Fig. 4 is -- because of urgency and secrecy -- the exclusion of the larger social forces (e.g., larger social values and beliefs) that could be provided by the additional stakeholders.

C. P. Snow stated that as with the atomic bomb project, "almost all the secret scientific choices are something like pure closed politics (Snow, 1961, p, 56),"

This limited matrix (Fig. 5) is, of course, heavily goal oriented, and the medical researchers of the Manhattan Project were extremely successful in achieving their short-term goals. For example, these researchers·

- established a reasonable tolerance standard of plutonium for humans (i.e., 1.0 microgram),
- developed a reliable method for measuring the amount of plutonium excreted by humans, and
- determined the conversion factor that related the amount of plutonium in the urine to the amount in the body (i.e., 0.02%/day)

And because of these achievements, the exposures of the workers at Los Alamos to plutonium were kept near or below the tolerance level

In addition, these medical researchers did pay attention to some of the deontological aspects of their work. For example, they used "trace" amounts of plutonium to minimize the negative side effects of the experiments on the patients, and they selected patients who would have little or no health effects because of short life expectancies (however, they did not do a good job on these selections).

On the other hand, the medical researchers did ignored some very important deontological aspects of their work. For example, they

- did not give their patients the choice to participate,
- did not inform their patients of the nature of the experiments, and
- did not follow up on the health of most of these patients.

Although they probably did not realize it at the time, these medical researchers who operated in this closed environment faced the risk of criticism at some time in the future because when the euphoria of the cns,s is over, when urgency and the need for secrecy fade, the more long-term, universal social values and beliefs of the excluded stakeholders

reemerge as the more important ones, and the short-term, narrower values, beliefs, and goals of the researchers are forgotten. Those values and beliefs of the excluded stakeholders that reemerge are the ones generally found in the fourth row (i.e., "Society at large") of the eclectic matrix (Fig. 4) -- i.e., important ones such as (1) enhancing the long term welfare of society, (2) minimizing the negative side effects of the activity, and (3) ensuring minimum standards of justice and human rights (including respect for the individual and the necessity for informed consent).

B. Euphoria of Gadgets

The medical researchers were not the only ones at Los Alamos that were working under a limited matrix. The scientists and engineers who were designing, building, and testing the bombs probably worked under an even more limited one -- a very utilitarian one that put narrow scientific goals and individual values and beliefs above broader societal values. For example, in 1980, Hempelmann recalled the following about the scientists who worked at Los Alamos during the war:

> "They all knew what the hazards were and what the dangers were. they would abide by the recommended procedures unless they were really very anxious to get the experiment done. . . Unfortunately, the more scholarly and inquisitive the person, the greater the tendency to ignore the recommended procedures. The janitors, I am sure, always did what we told them to do (HSPT-246, pp. 60-61)."

Hempelmann also recalled a similar preoccupation by the technical leaders (called "group leaders") of Los Alamos with technical goals and individual interests, which made accountability in health and saf ety difficult:

> "We had to depend upon the group leaders [to keep the Health Group informed about saf ety problems] because we didn't have a monitor that we could put with every person. So there is some problem there because the group leaders were mainly academic people who were used to operating on their own. . They didn't like to be regimented like that. They were pretty casual. . . Sometimes we didn't know where the radiation hazards were. We depended entirely on being informed by the group leaders, you see. But somebody would give a radium source to somebody else, and then not tell us. . . As I say, these group leaders were not organization men, really They had been individual chemists [and physicists], and they hated to be regimented or told what to do. So they were sort of casual

> sometimes. . . Also, if we did anything that interfered with their work, they didn't like that at all. They were used to operating completely on their own (HSPT-246, pp. 44-46)."

A similar preoccupation of scientists with utilitarian issues was described by C. P. Snow about British scientists in World War II in his book, *Science and Government* (Snow, 1961, pp. 68-84). Snow notes that judgments of many scientists are limited by a *self-deceiving* factor, which he calls the "euphoria of gadgets." Snow suggests that the single-minded preoccupation that many scientists have of their work -- i.e., their gadgets -- is a problem because it allows only a limited, utilitarian view of the world. The "gadgets" that Snow refers to are not just physical gadgets, such as scientific instruments or atomic bombs, but they could be anything that scientists are preoccupied with, including concepts, theories, and mathematical models.

This euphoria that scientists have for their work -- their gadgets is, of course, not necessarily all that bad, and, as Snow points out, it is probably a key ingredient to creative thinking (Snow, 1961, p. 72):

> "A great many scientists have a trace of the obsessional. Many kinds of creative science, perhaps most, could not do without it. To be any good, in his youth at least, a scientist has to think of one thing, deeply, and obsessively, for a long time. . . scientists in their creative periods do not easily get interested in administrative problems [i.e., broader issues] and are not likely to be much good at them."

The ultimate expression of the "euphoria of the gadget" in regards to nuclear weapons would be Robert Oppenheimer's famous characterization of the development of the hydrogen bomb, the super bomb that had been designed and tested in the early 1950's, "From a technical point of view it was a sweet and lovely and beautiful job (Dyson, 1979, p. 89)."

However, as discussed earlier in the context of the closed politics environment that permitted the urgency of production to take precedence over health and saf ety, the risk of criticism to the scientists from the "euphoria of the gadget" is that when the crisis is over, the more universal social values and beliefs (i.e., the fourth row of Fig. 4) again reemerge as the most important ones, and their more limited utilitarian values, beliefs, and goals fade and are forgotten by the larger society.

It is not surprising, then, that on issues such as the human plutonium experiments, scientists and non-scientists do not find much common ground -- because they see different parts of the eclectic matrix. It is as if they are in different cultures, i.e., the "two cultures," as discussed by C P. Snow (Snow, 1959).

Incidentally, given the urgency and the euphoria surrounding the production of the first atomic bombs, and given C. P. Snow's belief that scientists tend to be obsessed with gadgets, perhaps, in some strange way, it was fitting that the Los Alamos scientists called the first atomic bomb (Fig. 1), "The Gadget."

C. Euphoria of Secrecy

It is obvious that secrecy probably played a significant role in the lack of informed consent in the human plutonium experiments. For example, in its summary of the 1974 investigation of informed consent, the Atomic Energy Commission concluded that secrecy could have discouraged disclosure to the patients (Erlewine, 1974, p 4)·

> "Security considerations could have interfered with whatever disclosure the investigators in these plutonium studies may have considered at that time. The word plutonium was classified until the end of the war During wartime, investigators may have regarded any reference to the nature of the studies as a violation of security. Written statements would have constituted an additional breach of security. An atmosphere of secrecy for security reasons continued into the postwar period "

In the same summary (Erlewine, 1974, p. 7), the Atomic Energy Com- mission also reported that security was taken very seriously at Rochester·

> "Strict security precautions were observed in the AEP [atomic energy project] so that close associates were frequently unaware of details of each other's activities. The assistant to the chief of the metabolic ward said that the AEP was highly compartmentalized and that activities were conducted on a need-to-know basis. The assistant characterized the chief as . . . especially secretive about the MED [Manhattan Engineer District] programs."

Even if one accepts the argument of secrecy for not informing the patients before the end of the war, it is more difficult to accept the secrecy argument once the existence of the atomic bombs had become publicly

known, i.e., after August 6 or August 9, 1945. There was no reason for secrecy to continue into the postwar period.

But perhaps the reason that secrecy continued was because of a second *self-deceiving* euphoria that C. P. Snow also described in *Science and Government* -- i.e., the "euphoria of secrecy." This euphoria, like its twin the "euphoria of gadgets," is also a preoccupation of many scientists. Snow suggests that these two preoccupations "are usually, but not invariably, combined," and that the euphoria of secrecy "induces an unbalancing sense of power (Snow, 1961, pp. 68-73) "

As discussed earlier in the context of both closed politics and euphoria of gadgets, secrecy had the effect of collapsing the eclectic matrix (Fig. 4) into a more limited one, such as that shown in Fig. 5, with values, beliefs, and goals that were important primarily to the medical researchers. And the euphoria of secrecy allowed this limited view to persist in the minds of the researchers f ar into the postwar era. It induced a paralysis into their thinking that prevented them from rediscovering the broader social values and beliefs, such as respect for the individual and responsible follow up

The risk of criticism of the euphoria of secrecy is, of course, identical to that of the euphoria of gadgets and closed politics -- i.e., that when the euphoria of the crisis is over, the more general and more universal social values and beliefs of the larger society (Fig. 4) again reemerge, and the limited utilitarian ones of the medical researchers fade.

Additional concerns about the effects of secrecy were expressed in September, 1945 by David Lilienthal, who later became the first Chairman of the Atomic Energy Commission. At The Conference on Atomic Energy Control at the University of Chicago, held only a month after the end of the war, Lilienthal expressed his concerns about the effects of secrecy on the "spirit of the scientists." He feared that secrecy will "create a paralysis, a *creeping* paralysis. First, it will be mental. Then it will be ethical, moral. . . (Lilienthal, 1964)."

D. Urgency

As mentioned in the introduction to this paper, the defenders of the human plutonium experiments focus on the urgency of the war as the justification f or the way the experiments were done. However, arguments based on urgency are difficult to defend in light of the fact that 15 of the 18 human plutonium experiments were done after the war with Japan had

ended, and in only one of these experiments -- the final one that was initiated in July 1947 -- is there any evidence that informed consent was obtained

However, as with the above discussion concerning the arguments surrounding secrecy as justification for lack of informed consent, even if one accepts the argument of urgency for justification of the lack of informed consent in the three experiments that were started before the end of the war, it is more difficult to accept the urgency argument after the war had ended.

E. A Different Ethic?

Because the arguments of urgency or secrecy as justification for the lack of informed consent cannot withstand serious questioning, some defenders of the human experiments suggest that the standards of consent and understandings of ethics were "different" in 1945 from what they are today (Economist, 1994b).

Even though I did not find any discussion of ethics concerning the human plutonium experiments in the early documents (1944-1947) released by the Human Studies Project Team, I did learn that medical researchers of the time had a clear understanding of the importance of l.e..ga1 issues related to the hazards of radioactive materials

For example, in his history of the Health Group at Los Alamos written in 1946, Hempelmann wrote that the primary function of the group was "protecting personnel against the unusual hazards of this project [HSPT-105, p. 1]," and

> **"The secondary function of the Health Group has been the protection of the legal interests of (a) the individual on this project (including those not involved in hazardous work) and (b) of the contractor** (1) by keeping records of hazards, exposures, accidents, tests for overexposure to the various toxic agents, etc. and (2) by obtaining pre-employment examinations on all employees and (3) by taking histories and performing complete examinations (including all necessary tests) on every person leaving the project [HSPT-105, p. 2]." [emphasis added]

Several times in this history, Hempelmann refers to criticisms that can be directed against the health program at Los Alamos because of poor records, which could cause legal problems in the future. For example:

> "The lack of records of non-exposure of persons not working with radiation or radioactive materials **means that we do not have important legal evidence in case of future claims against this project** [HSPT-105, p. 14]." [emphasis added]

Further evidence of legal understanding among the medical researchers is found in a December 18, 1950 letter from Dr Joseph Hamilton, who was the researcher at Berkeley that was involved in both animal and human plutonium experiments, to Wright Langham of Los Alamos in which he expresses his concern about testing a chemical -- calcium versenate -- on humans to possibly increase the excretion rate of plutonium. He wrote, "I am getting increasingly apprehensive about starting its experimental use in man." His concern related to possible degenerative effects on humans and, in addition, it **"would leave us open to a damage suit for malpractice** (HSPT-381)." [emphasis added]

In 1974, the Atomic Energy Commission investigated the issue of informed consent in these human plutonium experiments, including the 12 experiments done in the joint project between Los Alamos and Rochester. Physicians who had been associated with the project at Rochester were interviewed, and the interviewer wrote the following (Erlewine, 1974, p. 8).

> "None of the persons interviewed had knowledge that disclosure was or was not made . . . Two interviewed physicians said that they regarded the chief of the metabolic ward [who was deceased at the time of the interview] as a highly ethical physician and considered it almost inconceivable that he would not have provided disclosure to the patients. One scientist . . knew that **adequate disclosure to patients was made in another study conducted at Rochester at about the same time."** [emphasis added]

Thus, there is evidence that medical researchers of the time had a good understanding of the legal issues related to radiation hazards of the Manhattan Project, had an understanding of the importance of radiation exposure records, and had a sense of the need for adequate disclosure.

Given the above information, it is hard to believe that the standards of consent and understandings of ethics were drastically different in 1945 from what they are today -- or from what they were in 1974 when the Atomic Energy Commission investigated these issues.

F. Discussion

Even though the medical researchers of the Manhattan Project achieved their goals of protecting the health of the plutonium workers at Los Alamos during a time of war, they failed to recognize, or ignored, their broader ethical responsibilities. As discussed above, I believe the arguments that medical and nuclear scientists have put forward to justify the lack of informed consent on urgency, or secrecy, or a different ethic are neither adequate nor convincing.

These arguments also fail to explain the lack of medical follow up on most of the patients, and certainly fail to explain any justification for the loss of important scientific information that could have been obtained if the patients had been followed throughout their lives. The arguments also fail to explain why the Los Alamos workers who had been exposed to plutonium were conscientiously followed, but the patients were not.

The real reasons for the ethical failures in the human plutonium experiments are to be found, I think, in the differences between the broad eclectic matrix that reflects the views of many stakeholders (i.e., Fig 4) and the narrower, closed politics matrix of the research scientists (i.e., Fig. 5).

The combined effects of closed politics and the self-deceiving factors of the euphoria of gadgets and the euphoria of secrets contributed to a narrow world-view (i.e., the closed politics matrix of Fig. 5) that (1) let the urgency of production of the bomb take precedence over health and safety and (2) allowed the medical researchers to ignore broader societal values and beliefs. In addition, because of this narrow view, the medical researchers failed to appreciate that their interests were, in fact, primarily short term interests, and that the broader and more universal values and beliefs of society would prevail in the long run. Unfortunately, the combined effects of closed politics, euphoria of gadgets, and euphoria of secrecy led the medical researchers into a moral *cul-de-sac* that was both difficult to recognize and easy to rationalize a way out of using the convenient arguments of urgency and secrecy.

VI. **The Environmental Legacy -- The Other Scandal**

In the introduction to this paper, I mentioned (p. 4) that the 50 year history of the Nuclear Weapons Complex during the cold war era has the odd characteristic of being bracketed on each end by huge public scandals;

i.e., the beginning of the era by the secret human plutonium experiments, and the end of the era by the enormous environmental cleanup legacy.

I have discussed the human plutonium experiments in this paper, and will make a few brief comparisons with this environmental cleanup legacy.

A. Origins of the Environmental Legacy

In October 1989, Adm. James D. Watkins, Secretary of Energy, testified before the Senate Committee on Energy and Natural Resources about the causes of the huge environmental legacy left over in the Nuclear Weapons Complex at the end of the cold war. He said:

> "The problems have resulted from a 40-year culture cloaked in secrecy and inbued with a dedication to the production of nuclear weapons without a real sensitivity for protecting the environment (Watkins, 1989, p. 84)."

In 1991, the Office of Technology Assessment of the U. S. Congress identified the causes of this environmental legacy as:

> "a long history of emphasizing the urgency of weapons production in the interest of national security, to the neglect of environmental considerations . . . and an enterprise that has operated in secrecy for decades, without any independent oversight or meaningful public scrutiny (OTA, 1991, p. 4)."

In August, 1991, in preparation for a comprehensive environmental, safety and health (ES&H) audit by a Department of Energy "tiger team," which had been established as a result of this huge environmental legacy left over at the end of the cold war, the Los Alamos National Laboratory did a self-assessment to define its baseline with regards to compliance with ES&H regulations and practices. In this self-assessment, Los Alamos identified several root causes of their ES&H problems, which included:

> "The Laboratory's preoccupation with science and the tradition of placing scientific and individual values above institutional values have created a lack of institutional accountability (LA-12200-MS, p ES-1)."

B. *DeJa Vu*

What is interesting about these descriptions of the causes of the huge environmental legacy of the Nuclear Weapons Complex is that *they are nearly identical to the causes of the ethical failures in the human plutonium experiments that have been identified and discussed in this paper.*

A direct comparison of these causes is shown in Table 1. Thus, factors such as production taking precedence over health and safety (and now the environment), closed politics, the euphoria of gadgets, and the euphoria of secrecy are common -- the root causes -- to both of the scandals in the Nuclear Weapons Complex. What this implies, I think, is that these are thus the underlying values of the Nuclear Weapons Complex *throughout the entire period of the cold war.*

Table 1

Comparisons of **(1)** the causes of the ethical failures in the human plutonium experiments with the (2) causes of the environmental cleanup legacy.

Human Plutonium Experiments	**Environmental Legacy**
"urgency of production [of atomic bombs] took precedence over health and saf ety (this paper, p. 25)" "If it had not been that we had to get the bomb made as soon as possible all work would have stopped (p. 25)"	"a dedication to the production of nuclear weapons without a real sensitivity for protecting the environment (Watkins, 1989)" "a long history of emphasizing the urgency of weapons production in the interest of national security, to the neglect of environmental considerations (OTA, 1991)"
Closed politics -- "no appeal to a larger assembly . (p. 25)"	"without any independent oversight or meaningful public scrutiny {OTA, 1991) "
Euphoria of gadgets -- "the single-minded preoccupation that many scientists have with their work -- i.e., their gadgets . . . (p. 29)" "a very utilitarian one [matrix] that put narrow scientific goals and individual values and beliefs above broader societal values (p. 28) "	"The Laboratory's preoccupation with science and the tradition of placing scientific and individual values above institutional values have created a lack of institutional accountability (LA-12200-MS, 1991) "
Euphoria of secrecy -- "An atmosphere of secrecy f or security reasons continued into the postwar period (p. 30)"	"The problems have resulted from a 40-year culture cloaked in secrecy (Watkins, 1989)" "an enterprise that has operated in secrecy for decades (OTA, 1991)"

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