

The Risks of Making Nuclear Weapons

By

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Introduction

When I first met Dr. Thomas F. Mancuso in the fall of 1977, he was poring over computer print-outs in his small, cluttered L-shaped office at the University of Pittsburgh. Spry, with a trim mustache and horn-rimmed glasses, Mancuso's passion for data collection often compelled him to bring his work home. Despite his efforts to transform his large spacious home into a research archive, Mancuso's wife Rae, kept the place spotless. Occasionally, data would be strewn on the dining room table, but most of the records were kept in dozens of filing cabinets in the basement like a highly guarded treasure.

Since 1945, he had mastered the art of assembling millions of bits of information into groundbreaking studies to determine long-term workplace health hazards. Before his pioneering research, "the major focus on workplace health dealt with on-the-job injuries," said, Bernard Goldstein, Dean of the Pittsburgh University School of Public Health in 2004. Mancuso "developed techniques to look at the long-term health effects of working." ¹

Having given away his car to one of his children several years before, the bespeckled physician walked every day to his office in the somber Graduate School building, often stopping first to attend Catholic Mass. In contrast to his contemplative side, Mancuso's temper was legendary. But his stubborn quest for perfection was more than offset by his loyalty and kind generosity. These qualities had served him well over the years, but now they were being sorely tested in a struggle over the effects of ionizing radiation on nuclear workers.

Conflict over his studies was nothing new. But it was the unprecedented ferocity of this assault against his research that surprised him. Now as he approached the closing years of his illustrious career, Mancuso had not expected that his tedious sorting of statistics would put him at odds with the U.S. nuclear weapons program, one of the most powerful scientific establishments in the world.

¹ Michael Taylor, Dr. Thomas Mancuso, long-time advocate for worker's health, Obituary, San Francisco, Chronicle, July 9, 2004. <http://www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2004/07/09/BAGRN7IPGL1.DTL>

Early Radiation Exposure Problems

Since World War II, the amassing of nuclear arms resulted in the creation of one of the largest and potentially most dangerous industrial enterprises in the nation. At the outset, the hazardous magnitude of nuclear weapons work was recognized by the scientific members of the Manhattan Project. These concerns led to the creation of the Health Division of the Manhattan Project led by Dr. Robert Stone, chairman of the Radiology Department at the University of California Medical School in San Francisco. According to Stone:

It was estimated that the pieces of uranium that would have to be removed from the pile [reactor] after fission had occurred would contain materials far more radioactive than any that had been encountered in the radium industry. The chemical process of separating the plutonium from other extremely radioactive elements was recognized as another tremendously hazardous procedure. The effect that plutonium itself might have on workers was unknown.²

During the war, Stone concluded that, “the whole clinical study of the personnel is one vast experiment.”³ Like Stone, other officials, such as John Wirth Medical Director at the Oak Ridge, TN recognized that the health consequences to workers could result in “the unexpected appearance of dangerous changes months or years after exposure.”⁴ Wirth recounted problems where “minute invisible fragments might make an entire building uninhabitable. . . . It always amazing what widespread contamination can be caused by a minute quantity of hot material once it has been allowed to get out of a container.”⁵

The Manhattan Project had standard worker compensation insurance, which only covered illnesses or disabilities that appeared within 90 days of an accident or 30 days after leaving the project. But Cyril Stanley Smith, chief metallurgical chemist at Los Alamos, denounced it as “inhuman, unethical and unfair,” as he and his fellow chemists refused to work without extra insurance. Bending to their wishes, the U.S. government set up a secret one million dollar fund for the plutonium chemists at Los Alamos.⁶ Ordinary workers in the Manhattan Project fared less well. Ted Lombard was an enlisted man in the U.S. Army assigned to work at the Los Alamos Laboratory during the war who recalled less-than-ideal working conditions:

We used to go to Fort Douglas, Utah in ambulances, [to] pick up uranium and plutonium. We carried dosimeter badges in our pockets because you couldn't display them. . . . Then [after the badges were turned over to an officer] we would

² Stone, Robert S., “Health Protection Activities of the Manhattan Project,” *Proceedings of the American Philosophy Society*,” Vol. 90, no. 1, January 1948, pp-11-19. (Hereafter known as Stone 1948).

³ Stone 1948, p. 14.

⁴ Hacker 1987, p.55.

⁵ Hacker 1987 p. 44-5.

⁶ Hacker p. 62.

proceed to unload uranium and plutonium barehanded . . . the fumes and dust were constantly in the air; there was no ventilation system. The dust was on the floor. Uranium chips would be in your shoes that you continued to wear. You went to eat with the same clothes on. You went to the barracks with the same clothes and sat on the beds. . . .⁷

Given widespread exposure problems, concerns over financial and legal liabilities also influenced radiation protection decisions. An overriding concern according to Stafford Warren, medical advisor to General Leslie Groves, military chief of the Manhattan Project, was to protect “the government interests” against legal claims.⁸

By 1980, Ted Lombard was suffering from fibrosis of the lungs, severe bone marrow and blood forming organ damage. Four of his five children born after working at Los Alamos had severe medical problems, including neuromuscular and blood disorders. When Lombard filed a claim with the U.S. Department of Veterans Affairs, he was denied repeatedly on the grounds that his medical and exposure records were missing.

Shortly after World War II and through the early 1960's, senior ranks of DOE and its predecessors were informed that large numbers of workers were being over exposed. at federal nuclear sites in New Mexico, Washington, New York, Kentucky, Ohio, Colorado and Tennessee. In 1948, the Atomic Energy Commission Advisory Committee on Biology and Medicine (ACBM) was provided data and analysis regarding large occupational doses to radiation from leaking radiochemical facilities at the Hanford site in Washington. According to Hanford's chief health physicist, radioactive particles that deposited in areas containing thousands of construction workers on the site “can produce radiation damage” and that “the theoretical possibility of injury developing 10 to 15 years from now poses a serious problem.”⁹

That same year, the AEC manager of the Oak Ridge site “submitted a report on radiation history of employees,” which recommend that a terminating employee be informed if he or she was exposed to levels above official limits; and that medical assistance be provided if that person believes he or she was made ill or injured by radiation.^{10 11}

⁷ Invisible Violence, Proceedings of the National Hearing on Radiation Victims, April 26, 1980.

⁸ Hacker 1987, p.51.

⁹ U.S. Senate Committee on Governmental Affairs, Majority Staff Report, *Early Health Problems of the U.S. Nuclear Weapons Program and their Implications for Today*, December 1989.

¹⁰ U.S. Atomic Energy Commission, Advisory Committee For Biology and Medicine, Thirteenth Meeting, December 10-11, 1948, U.S. Department of Energy Archives, 1947-51 Secretariat Files, Box 1217, Folder 337, Germantown, MD. The report recommended:

- (1) a terminating employee be provided with a statement that he has not exceeded the permissible exposure to radiation, or **if he has exceeded the permissible exposure he be made aware of this fact by the physician giving the exit interview**; [Emphasis added]
- (2) that there be a clearer policy on release of information on radiation exposure records and other medical records to the contractor's insurance and life insurance companies;
- (3) that the terminating employee be advised that if he is to work with radiation in the future his new employer can make arrangements to procure his past radiation exposure history;
- (4) **that a group of qualified radiologists and**

However, the Committee rejected this recommendation, and proposed instead that “a terminating employee should be advised at the exit interview as to the care that the AEC utilizes in protecting each employee.”¹²

At the time, fears over liability and lack of public trust that might result from disclosure of workplace hazards was of dominant concern. In a memo regarding possible declassification of a study suggesting that occupational radiation exposure levels “may be too high,” the head of the Insurance Branch of the AEC declared:

We can see the possibility of a shattering effect on the morale of the employees if they become aware that there was substantial reason to question the standards of safety under which they are working. In the hands of labor unions the results of this study would add substance to demands for extra-hazardous pay . . . knowledge of the results of this study might increase the number of claims of occupational injury due to radiation.¹³

By June 1949, the ACBM was informed of excessive exposure to workers in uranium processing plants.¹⁴ Some workers were being exposed at levels 125 times greater than the default standard adopted in World War II.¹⁵ By this time it was recognized that this standard was not protective against radiation hazards.¹⁶

Dr Ernest Goodpasture, Vice Chairman of the ACBM made repeated efforts to convince the commission to conduct radiation-related cancer studies. In December 1951, he wrote to AEC Chairman, Gordon Dean stating that, “Cancer is a significant industrial hazard of the Atomic energy business. . . . the Committee recommends the cancer program be pursued as a humanitarian duty to the nation.”¹⁷ His plea went unheeded.

The Mancuso Study

Although high-ranking officials were aware of potentially serious health risks to workers and were urged by its advisors to conduct health studies, the Atomic Energy Commission did not initiate occupational epidemiological research until 1964. That year Dr. Thomas F. Mancuso, Professor of Occupational Medicine at the University of Pittsburgh, was

physicians be available for consultation by any person who feels that he has been damaged by radiation at an AEC installation. [emphasis added]¹⁰

¹¹ Ibid.

¹² Ibid.

¹³ Report of the President’s Advisory Committee on Human Radiation Experiments, Part II, Chapter 13, http://www.eh.doe.gov/ohre/roadmap/achre/chap13_3.html

¹⁴ U.S. Atomic Energy Commission, Advisory Committee for Biology and Medicine, 16th meeting, June 11, 1949, transcript, U.S. Department of Energy Archives, AEC Division of Biology and Medicine Collection, Box 3218, Folder ACBM Meeting, Germantown, MD.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Goodpasture, E.W., Letter to Gordon dean, Chairman of the Atomic Energy Commission, December 1, 1951 U.S. Department of Energy Archive, Germantown, MD.

approached by staff of the AEC's Division of Biology and Medicine in 1964 to undertake a feasibility study. According to Mancuso the AEC staff asked him if there were sufficient data to "answer a basic question, that is, whether there were or were not any effects of low-level ionizing radiation."¹⁸ Based on a review of records at 14 AEC facilities, Mancuso concluded it was possible, and was awarded a five-year research contract in 1965.

By that time, Mancuso had established himself as a highly respected figure in the field of occupational epidemiology. While serving as chief of the Ohio Division of Industrial Hygiene between 1945 and 1962, Mancuso published a series of ground-breaking studies showing the toxicological and carcinogenic effects of cadmium, manganese, mercury, hydrogen sulfide, asbestos, aromatic amines, and chromate.^{19 20 21} With the encouragement of his mentor, Wilhelm Huper, at the National Cancer Institute,²² Mancuso designed and published the first cohort mortality studies on occupational cohorts in the United States.²³ In doing so Mancuso invented a revolutionary methodology using Social Security death benefit claims that enabled researchers for the first time to follow exposed workers over the many years necessary to detect latent diseases such as cancer.²⁴ "In 1961 he had been given a career award by the National Cancer Institute for his impressive body of work.

Mancuso was also known for his honesty and fierce independence. In the 1950's, Phillip Carey Corp., a manufacturer of asbestos insulation hired Mancuso with the expectation that he would provide evidence refuting compensation claims by workers dying from respiratory diseases following exposure to asbestos. Instead Mancuso's research supported the worker's claims. He strongly advised the company that it had a responsibility to inform the workers of potential risks. Because Phillip Carey ignored

¹⁸ Statement of Thomas F. Mancuso Before the House Energy and Commerce Subcommittee on Health and the Environment, Hearings, Effect of Radiation on Human Health, U.S. Congress, House Committee on Interstate and Foreign Commerce, Subcommittee on Health and the Environment, *Effect of Radiation on Human Health*, 95th Cong., 2nd Sess., January 24-26, February 8, 9, 14, and 28, 1978, Serial No. 95-179, Vol. 1, p. 523. (Hereafter known as "Effect of Radiation on Human Health 1978.")

¹⁹ Thomas F. Mancuso, Occupational Cancer Survey in Ohio, Proceeding of the Public Health Cancer Association of America, 1949, 50-60

²⁰ Michael Gochfeld, Chronologic History of Occupational Medicine, Journal of Occupational Medicine, Vol. 47, No. 2, February 2005. (Hereafter known as Gochfeld 2005)

²¹ David Michaels, Comings and Goings, Thomas Mancuso, NYCOSH, July 8, 2004, (Hereafter known as Michaels 2005) <http://www.nycosh.org/UPDATE/printableArticle.php?articleid=454>

²² Interview with Thomas F. Mancuso, September 6, 1980.

²³ Michaels 2005.

²⁴ Thomas F. Mancuso, "Methods of Study of the Relations of Employment and Long-term Illness by Cohort Analysis," *American Journal of Public Health*, 1959.

Mancuso's warning throughout the 1960's, his research was subsequently used by claimants.²⁵

What motivated the AEC officials to approach Mancuso? A key factor was that the national security imperative to exercise control over radiation health effects research was loosening as Cold war tensions reduced. Moreover, the AEC suffered a serious blow to its credibility in 1963, when the United States, Great Britain and the Soviet Union ratified the Limited Nuclear Test Ban Treaty, which prohibited atmospheric nuclear weapons tests.

Beginning in the 1950's a major and often contentious debate was sparked by scientists, such as Nobel Prize winners, Herman Mueller, and Linus Pauling who warned that radioactive fallout from testing was harming human health across the globe. The AEC and its scientists vigorously defended the tests claiming they posed little if no harm. "There developed what I consider to be a strange psychological frame of mind," Dr. Karl Z. Morgan, founder and director of the AEC's Oak Ridge Health Physics Lab reflected several years later. "It became unpatriotic and perhaps unscientific to suggest that atomic weapons testing might cause deaths throughout the world from fallout." Morgan found many of his AEC colleagues holding "onto untenable and extremely shallow arguments [and making] comparisons with medical and natural background exposures as if they were harmless."²⁶ Official repudiation of the AEC's claims about fallout came in 1997, when the National Cancer Institute (NCI) revealed that atmospheric nuclear weapons detonations at the Nevada Test Site resulted in significant radiological contamination of the nation's milk supplies. NCI researchers estimated that fallout exposure to Iodine -131 from Nevada tests might cause 11,000 to 212, 000 excess thyroid cancers in the United States.²⁷

Other factors included the curtailment of fissile material production for nuclear weapons and the emergence of the U.S. nuclear power industry. By 1964, the U.S. nuclear arsenal was shrinking as more accurate delivery systems were deployed. This in turn, significantly reduced demand for plutonium and highly enriched uranium – leading to the closure of several large production reactors and radiochemical processing facilities.

Concurrently, dozens of new power reactors were now planned for construction in the United States. The AEC, which was responsible for commercializing nuclear energy was gearing up to accommodate this major growth, while setting the stage for a new

²⁵ United States Congress, House of Representatives, 106th Congress, 2nd Session, House Report 106-782 – Asbestos Compensation Act of 2000, July 24, 2000. <http://thomas.loc.gov/cgi-bin/cpquery/T?&report=hr782&dbname=106&>

²⁶ Karl Z. Morgan, "History of Developments in Nuclear Safety and the Development of International Standards," unpublished article submitted to Energy Department's Office of Consumer Affairs, December 1980, p. 2.

²⁷ Steven L. Simon, Andre Bouville, and Charles E. Land, Fallout from nuclear weapons tests and cancer risks, American Scientist online, Vol. 94. No. 1 P. 48
<http://www.americanscientist.org/template/AssetDetail/assetid/48543?fulltext=true&print=yes>

generation of reactors that would use plutonium as fuel. To pave the way for these developments, the AEC needed to strengthen its credibility. In particular, the formalization of occupational radiation protection standards in 1959, which limited annual external exposure to 5 rem* per year, provided a necessary framework for both the continuation of civilian and military nuclear energy activities.

AEC managers received assurances from its scientific advisors that Mancuso's work would not lead to unpleasant surprises. In his 1980 paper about the Mancuso affair, Theodore D. Sterling, public health professor at Simon Fraser University in Canada, explores this concern and concludes: "It was firmly believed by all scientific advisors and by management that the study design was not adequate to lead to [findings of adverse effects]. Rather, the study was implemented and supported for frankly admitted *political* reasons" (original emphasis).²⁸ After initiating the study, some AEC officials referred to it as "Mancuso's folly" and openly viewed it as a public-relations sham.²⁹ The political need to have Mancuso continue this study is reflected in review comments made in November 1967, by Dr. Brian MacMahon an AEC consultant from Harvard University.

In my opinion this study does not have, and never (in any practical sense) will have any possibility of contributing to knowledge of radiation effects in man ___ I recognize that much of the motivation for starting this study arose from the 'political' need for assurances that AEC employees are not suffering harmful effect.³⁰

MacMahon was seconded in November 1967 by Dr. William Schull, a geneticist who had worked on the Japanese Atomic Bomb Survivor study. Like previous advisors, Schull was interested in protecting the AEC against compensation claims.

It seems highly improbable that if one went through the mechanics of calculating the kinds of radiation effects, which a study of the present magnitude might detect, one would be led to conclude that the undertaking is a hopeless one. However, as earlier recognized, it may have other merit in that it may provide a firmer basis for settlement of claims against the Atomic Energy Commission.³¹

During the 1960's and early 1970's, Mancuso compiled data on workers at several facilities. He focused on the Hanford site in Washington State and the Oak Ridge site in Tennessee because they were the oldest and largest federal nuclear facilities. Throughout

* Roentgen equivalent for man, a roentgen (an international unit of X- or gamma-radiation) adjusted for the atomic makeup of the human body.

²⁸ Theodore P. Sperling, The Health Effects of Low-Dose Radiation on Atomic Workers. A case study of Employer Directed Research, International Journal of Health Services, Vol 10, No. 1, 1980, PP 37-47.

²⁹ Thomas F. Mancuso, interview, October 1980

³⁰ Ibid.

³¹ Ibid.

this period, AEC officials were eager for him to publish. “Repeatedly . . . I had been urged by [the AEC and its successor the Energy Research and Development Administration—now the Department of Energy] to publish in scientific journals, the negative findings of the progress reports, and I refused to do so,” stated Mancuso. “I believed that the findings would be misleading, no matter how well qualified in the presentation and could be misused.”³²

By February 1973, Dr. Sidney Marks, Mancuso’s AEC worker study contract officer grew frustrated and suggested “early replacement of the contractor.”

Unless an immediate replacement [for Mancuso] is found, a public charge may be made that the AEC is stopping the program out of fear that positive findings may emerge. Overtures to possible candidates may be carried out in a clandestine atmosphere. . . .³³

Nonetheless, AEC officials tolerated Mancuso’s reluctance to publish until the situation was abruptly transformed in late June of 1974. This is when Dr. Samuel Milham, an epidemiologist with the Washington State Department of Social and Health Services, met with AEC officials to report findings of a study he had just completed. Encompassing 300,000 deaths from 1950 to 1974, Milham compared the mortality of different occupations in the state and found that:

Men who worked at the Atomic Energy Commission Hanford facility in Richland Washington showed increased mortality from cancer, especially in men under age 64 at death. An excess was seen for cancer of the tongue, mouth, and pharynx, colon, pancreas, lung and bone. Excess mortality was also seen for aplastic anemia and amyotrophophic sclerosis. . . .³⁴

He concluded that, “since the Hanford facility is involved in the handling, fabrication, processing and storage of an array of radioactive materials, most of which are of proven carcinogenicity, I suggest that these materials are the most likely source for the observed cancer excess.”³⁵ At the meeting in Richland Washington, Milham recalled that the atmosphere was “like a funeral, quiet, no smile. . . . The impression I got at the meeting with the AEC was that the release of my finding might cause concern and problems in the industry.”³⁶ After the meeting Milham decided to not to publish his findings, “because I was convinced that the appropriate population-based studies were in progress [under Mancuso’s direction]. I felt that publication of my findings at this time might disturb the continuity of the study in progress and might cause undue concern in workers.”³⁷

³² Statement of Dr. Thomas F. Mancuso, M.D. Effect of Radiation on Human Health 1978. p. 544

³³ Effect of Radiation on Human Health. P. 750.

³⁴ Statement of Samuel Milham, M.D. Effect of Radiation on Human Health 1978, p. 495.

³⁵ Ibid.

³⁶ Milham, Effect of Radiation on Human Health 1978, P. 495-496.

³⁷ Ibid.

Shortly after, Mancuso “was on the phone by the hour over a period of weeks” with AEC officials in the Division of Biology and Medicine. Dr. Sidney Marks, Mancuso’s AEC contract officer, urged Mancuso to endorse a draft press release which stated “there is no evidence of cancer or other deaths attributable to ionizing radiation occurring more often among Hanford workers.”³⁸ But Mancuso refused explaining to Marks that Milham’s findings could not be dismissed because they were based on more recent mortality data Mancuso had yet to obtain. Furthermore, Milham’s study included construction workers at the Hanford site, which were not part of the AEC-sponsored study. Hanford construction workers, according to Mancuso, were “acknowledged to have more exposure” than operators, and his repeated attempts to have this group incorporated into his study over the years were denied.³⁹

It was then that AEC officials started to end their relationship with Mancuso. In the summer of 1974, the AEC initiated a process to transfer a major portion of Mancuso’s study to Oak Ridge Associated Universities (ORAU) in Tennessee. For several years AEC, the National Aeronautics and Space Administration (NASA) and the Defense Department sponsored studies involving total body irradiation of animals and dozens of human patients in specially designed radiation chambers at ORAU, but funding for the research program was about to end. According to a 1975 report to NASA, ORAU study director, Dr. Clarence C. Lushbaugh, justified the experiments in part because, “unbiased clinical observations were sorely needed to defend existing environmental and occupational exposure constraints from attack by well-meaning but impractical theorists.”⁴⁰

Termination of this study was prompted in April 1974 by a critical extramural medical review, which gave it an “unfavorable rating.” The panel reported that “the clinical facilities were substandard with respect to licensing and accreditation guidelines.”⁴¹ In particular, the reviewers took issue with the clinical hematology program and sloppy research practices that may have endangered patients. Underneath the wood floor of one of the radiation chambers in which cancer patients were treated, researchers suspended cages of mice—creating sanitary hazards. According to the review:

. . . animal caretakers enter the area twice a week to change the cages and provide. Dirty cages are taken through the patient area to an elevator and on to the cage washer. . . This entire arrangement seems questionable because of the necessity of transporting animal, animal wastes and equipment through areas used by patients who frequently have compromised host defense mechanisms. Also this area would appear to be highly prone to severe infestations of vermin.⁴²

³⁸ Mancuso Statement, Effect of Radiation on Human Health, P. 559

³⁹ Mancuso Statement, Effect on Radiation on Human Health, P. 531.

⁴⁰ Studies Relative to Radiosensitivity of Man: Based on Retrospective Evaluations of Therapeutic and Accidental Total-Body Irradiation, Oak Ridge Associated Universities, (NASA-CR-144439), pp. 6-8.

⁴¹ U.S. Atomic Energy Commission, Extramural Reviews of Oak Ridge Associated Universities, Specific Comments on LETBI and METBI Programs, April 16, 1974.

⁴² Ibid.

“In view of accepted therapeutic modalities,” the reviewers reported, “*ethical questions were raised with respect to the protocol employed in these studies*” (emphasis added).⁴³

Despite these problems, AEC officials appeared more interested in shoring up ORAU with new work. This was underscored by its decision to award ORAU with a large contract without the benefit of peer review, scientific protocol, principal investigator, and to an institution which had not performed epidemiological research before.⁴⁴ According

⁴³ Ibid.

⁴⁴ Effect of Radiation on Human Health, p-783. Hearings before the U.S. House Energy and Subcommittee in February 1978 explored the process in which the contract Mancuso held was transferred. The questioning of DOE official, Dr. Walter Weyzen, and Dr. Sidney Marks, then at Battelle, by Subcommittee Chair, Rep. Paul Rogers is most revealing:

- Mr. Rogers: So you didn't know the person who was going to be charge of the study, but you transferred it anyway?
- Dr. Weyzen: It was transferred, yes, sir.
- Mr. Rogers: And you did not know who would be the chief investigator would be?
- Dr. Weyzen: Certainly, I didn't know at the time.
- Mr. Rogers: Did you, Dr. Marks?
- Dr. Marks: May I say that the decision to transfer would be contingent on proper staffing. The transfer was not made in March 1975. Discussions were held at the time in anticipation of the transfer on July 31, 1977 if proper staffing were developed.
- Mr. Rogers: Then you told me before that the judgment was made to transfer the study back then, but you didn't even have a chief investigator. And now you come and divide it up again, where you have Dr. Marks at the meeting who is beneficiary from his corporation and you have Lushbaugh, who is a beneficiary. That group gets together and divides up a study, without any peer review.
- Dr. Marks: Mr. Chairman, at the meeting of September of 1977?
- Mr. Rogers: Yes.
- Dr. Marks: The question of dividing up the study did not come up. The session was largely devoted to questions regarding the data base and the manner in which the study will be heard, carried forth in the future.
- Mr. Rogers: Well now I thought Dr. Weyzen told us that it was on that basis that he made the judgment for separating the study.
- Dr. Weyzen: That is correct, sir.

to a memorandum prepared by the division of Biology and Medicine in January 1976, "Since ORAU medical division has been informed that, *if they developed the necessary expertise*, the health and mortality study will be transferred to ORAU and is to be phased in during the last year of Mancuso's contract which would begin in August 1, 1976" (emphasis added).⁴⁵

The AEC also took steps to move Mancuso's research to Battelle, which ran the Hanford laboratory. Dr. Ethyl Gilbert, a statistician working for Battelle at Hanford's Pacific Northwest was first tasked review the Milham study. Around the summer of 1975, Gilbert submitted her analysis, in which she stated, "Our data exhibit no clear-cut relationship of death from cancer and radiation exposure"⁴⁶ A key table in her study, however, did show a relationship between radiation exposure and excess deaths.⁴⁷

Alex Fremling, the AEC Manager at the Hanford also reached a much different conclusion than Gilbert when he reported "there is a relationship between cancer as a cause of death and the total dose of external radiation received....the message is clear that Battelle's data suggests that Hanford has a higher proportion of cancer deaths for those under 65 than the U.S." ⁴⁸ ...even more disturbing from our standpoint" was that "the analysis tends to show a much higher incidence of certain types of cancer" at doses below official limits.⁴⁹ Fremling continued, "We hoped to get a good answer to the Milham report, and instead it looks like we have confirmed it." ⁵⁰ The Battelle study remained buried until it was submitted into the record by Dr. Milham at 1978 at a hearing of the U.S. Congress.⁵¹

In March 1975 the Energy Research and Development Administration (ERDA), the AEC's successor, informally notified Mancuso of its intentions when he was asked at a meeting by Marks "you don't want to continue on with his project do you."⁵² Mancuso replied "clearly and definitively" that he wanted to devote the rest of his professional career to this research. ⁵³ But, Mancuso knew the die was cast after his colleagues approached Dr. James Liverman, Director of AEC's Division of Biology and Medicine in 1975 and were told that an administrative decision to give the research to Oak Ridge Associated Universities and Battelle was already made. In January 1976, the University

⁴⁵ Effect on Radiation and Human Health. P. 533.

⁴⁶ Milham Statement, Effect on Radiation on Human Health, p. 514

⁴⁷ Millham Statement, Effect on Radiation on Human Health, p. 516 According to this table, Workers who received the highest dose of 2.14 rems or more ten years prior to death showed elevated death rates for all cancers (27%) colon cancer (200%), pancreas (52%), lymphosarcoma (334%) and other lymphatic cancers (783%).

⁴⁸ Draft AEC Memorandum, from Alex Fremling, Director, Atomic Energy Commission, Richland Operations Office, July 17, 1975.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ Effect of Radiation on Human Health pp. 515, 516.

⁵² Ibid

⁵³ Ibid.

of Pittsburgh was formally notified by the Department of Energy (DOE), which succeeded ERDA, that it would not renew Mancuso's contract when it expired in 1977.⁵⁴

In March of 1976, Mancuso asked Dr. Alice M. Stewart and George Kneale, her statistician from the University of Birmingham in England, to analyze his data. Dr. Stewart, a member of Mancuso's advisory committee, was internationally recognized as establishing the link between fetal x-rays and childhood cancers. Since 1955, when she and her colleagues first reported this finding, Stewart had constructed one of the world's largest epidemiological studies of low dose ionizing radiation, the Oxford Survey of Childhood Cancers.

By the summer of 1976, Mancuso Stewart and Kneale produced a cohort analysis based on 3,710 deaths among Hanford workers collected up to 1973. They found a 5 to 7 percent excess in cancer deaths attributable to radiation. Workers exposed after the age of 45 showed higher sensitivity to cancer. Most significantly, the risk of dying from radiation-induced cancer appeared to be about ten times greater than current protection standards assumed. As soon as the analysis was finalized Mancuso and his colleagues briefed the Energy Department, in the October 1976.⁵⁵ "They were clearly unhappy," Mancuso said. "They urged us not to publish. . . . My job in their eyes was simply to transfer the data to them."⁵⁶ Present at the meeting was Sidney Marks. After helping to orchestrate Mancuso's firing, Marks left his government employment in June 1976 to administer the Hanford worker study at Battelle, where Ethyl Gilbert worked under his supervision.⁵⁷

By the fall of 1977 Mancuso's research funds had run out. In November he published his paper in *Health Physics*, creating a firestorm of controversy. Though he continued to draw a salary from the University of Pittsburgh, Mancuso had no funds with which to continue his research. Though it was a bare fraction of what was needed, Mancuso began

⁵⁴ Effect of Radiation on Human Health, p. 554

⁵⁵ Thomas F. Mancuso, Alice M. Stewart, and George W. Kneale, "Radiation Exposures of Hanford Workers Dying from Cancer and Other Causes," *Health Physics Journal* 33, No. 5 (November 1977)

⁵⁶ Mancuso Interview, September 10, 1980..

⁵⁷ Effect of Radiation on Human Health., P. 719

Hearing Excerpt: Questioning of Dr. Sidney Marks by Congressman Paul Rogers

Mr. Rogers: When did you leave ERDA, Dr. Marks?

Dr. Marks: I left in June 1976.

Mr. Rogers: When were you hired by Battelle?

Dr. Marks: June 1976.

Mr. Rogers: Are you now doing part of the work that was originally covered in its contract in your organization?

Dr. Marks: I am assisting Dr. Gilbert. She is the principal investigator.

Mr. Rogers: Is it under your supervision?

Dr. Marks: Only in the sense that all environmental health and safety work is under the supervision of ---

Mr. Rogers: That is all I am asking. Is it under your office, as I understand it in Battelle?

Dr. Marks: Yes it is.

cutting into his personal retirement money to continue working on the Hanford study. Meanwhile the federal government persisted in its attempts to take the data away from him and most disturbingly, to destroy data Mancuso had collected.

Upon assuming control over the DOE worker study, in 1977 Dr. Lushbaugh, Chief of radiation studies at ORAU, proceeded to shred and incinerate medical records from the Oak Ridge Hospital preserved by Mancuso.⁵⁸ All told, 21 out of 40 filing cabinets spanning the period 1952 to 1961 were destroyed. Mancuso took custody of the records after the old hospital, owned by the federal government, was transformed into the Methodist Medical Center. In November 1985, when allegations were made about the destruction, Lushbaugh claimed “we would never destroy these records.”⁵⁹ Several days later, ORAU officials conceded that the records were destroyed and they were unaware they had been set aside by Mancuso. In his final report to the DOE in November 1977, Mancuso had clearly identified these records as part of his research program.⁶⁰

But in early 1978, the Energy department had come under Congressional scrutiny for its handling of Mancuso’s contract. At the hearings before the House Energy and Commerce Subcommittee on Health and the Environment, it was brought out that the Energy department had not informed Mancuso of the ostensible reason for his termination—that being his “imminent retirement” at age 62 from the University of Pittsburgh. Mancuso only learned of this reason in September 1977 in a letter from James Liverman to Karl Z. Morgan.⁶¹ However, the AEC had not bothered to learn the university’s policy, which set the mandatory retirement age at 70 years.

In his testimony to the Subcommittee, Liverman backed away from the excuse of Mancuso’s “*imminent retirement*.” Instead he charged that early peer reviews of Mancuso’s work had been critical of him, when in fact they had lauded his capabilities and recommended that the study be continued under his control.⁶² In the course of the hearings, Subcommittee Chair Paul Rogers (D-FL) concluded:

It’s the most disordered, unstructured mess that I have looked into some time. If our research programs are being carried out in this manner, where you just take a study from one scientist and give it to another group without knowing who the principal investigator will be or his qualifications, this is a very inefficient, poor way of managing a research program and is not a competent way to spend tax dollars.⁶³

Congressmen Paul Rogers (D-FL.) and Tim Lee Carter (D-KY.) subsequently reported to Energy Secretary Schlesinger, that the justifications for the decision to fire Mancuso were

⁵⁸ Interview with Lushbaugh, June 3, 1989.

⁵⁹ Richard Powellson, DOE health data destroyed, probers told, Knoxville News- Sentinel, November 15, 1985.

⁶⁰ Richard Powellson, Agency destroyed OR health records, Knoxville News- Sentinel, November 21, 1985.

⁶¹ Letter from: James Liverman, Director of Division of Biology and Medicine, Atomic Energy, Commission, To: Karl Z. Morgan, Neeley Professor, Georgia Institute for Technology, September 8, 1977.

⁶² Ibid.

⁶³ Effect of Radiation on Human Health, p-783.

"not supported" and the decision to transfer Mancuso's study to Oak Ridge was "highly questionable at best." The whole process, they said, reflected "serious mismanagement and is of highly questionable legality."⁶⁴

In 1979, in response to Congressional hearings regarding the handling of Mancuso's contract and revelations about radiation exposure to military personnel and civilians from U.S. atmospheric nuclear weapons tests, a Federal Interagency Taskforce on Ionizing Radiation was convened by President Carter. The Taskforce, chaired by Health, Education and Welfare Secretary, Joseph Califano, reported in 1980 that the Energy department maintained a virtual monopoly over the funding of radiation health effects research; and that DOE had a potential conflict-of-interest between its missions of military and civilian nuclear energy development and assessing their health impacts. Califano proposed removing radiation health effects research from DOE's control and placing it in public health agencies.⁶⁵

Even so Mancuso continued to face opposition. He managed to continue the study through private donations and his retirement money until labor unions pressured the National Institute of Occupational Safety and Health to reinstate the study in August 1979. This lasted until the spring of 1981 when the Reagan administration informed Mancuso his funding would once again be terminated.

Despite the difficulty in obtaining funding, Mancuso, Stewart and Kneale persisted in their research and publications in the scientific literature.^{66 67 68} By 1990, the Three Mile Island Public Health Fund, established as part of a legal settlement resulting from the Three-Mile Island nuclear accident in 1979, funded the continued work of Dr. Stewart and Kneale. While strongly supportive of their efforts, Dr. Mancuso had effectively withdrawn from the work, as a result of the difficult experience. However, in 1993, Mancuso published an analysis of Hanford workers, which clearly indicated that he had not given up the struggle.

The search for the biological effects among worker cohorts has been mostly in terms of mortality experience. Yet it is well known that the primary and secondary causes of death on a death certificate do not reflect the diseases or illnesses which may have occurred prior to death...The consequences have been the underestimation of the true nature and magnitude of occupational health effects when based solely on death certificates... The death certificate provides a

⁶⁴ U.S. Representatives Paul Rogers and Tim Lee Carter, letter to James Schlesinger, secretary, Department of Energy, May 4, 1978.

⁶⁵ U.S. Senate Committee Report 1989.

⁶⁶ Mancuso, et al., "A Reanalysis of Data Relating to the Hanford Study of the Cancer Risks of Radiation Workers," *International Atomic Agency Symposium Proceedings on the Late Biological Effects of Ionizing Radiation*, Vienna, Austria, 1978, IAEA-SM-224/510.

⁶⁷ Stewart, et al., "Hanford IIb, The Hanford Data--a Reply to Recent Criticisms," *Ambio* 9 (June 1980).

⁶⁸ "Hanford III, a Cohort Study of the Cancer Risks from Radiation to Workers at Hanford (1944 to 1977 deaths) by Method of Regression Models in Life-Tables," *British Journal of Industrial Medicine* summer 1981.

gross underestimate of the biological effects which may have occurred in that population.⁶⁹

The Aftermath of the Mancuso Affair

The contract with Dr. Mancuso was in a sense a failed experiment by the federal nuclear program to enter the mainstream of public health. Most importantly, the Mancuso contract deviated from standard practices established by the nuclear weapons program in which a system of “in-house” contractors whose existence depended primarily on the federal nuclear program was fostered deliberately. By terminating Mancuso’s study the Department of Energy returned to business as usual. But, as events unfolded, the federal nuclear program never truly recovered from the aftermath of this failed experiment.

In 1989, in response to Congressional pressure and a growing lack of public trust, Energy Secretary James Watkins convened the Secretarial Panel for the Evaluation of Epidemiologic Research Activities. The Panel reported that Energy’s research lacked coordination and suffered from lack of peer review and competition for funding.⁷⁰ In 1990 DOE entered into a formal agreement with the Department of Health and Human Services to manage and conduct DOE worker health studies paid for by the Department of Energy. Since that time, these studies were obscured from public attention and went unappreciated. This all changed when the Secretary of Energy, Bill Richardson, announced on July 14, 1999 that the Clinton Administration would seek to establish a federal compensation program for sick Energy Department contract employees.

In early 2000, the Department of Energy compiled a selected group of health studies of Department of Energy contractor employees from the most recent editions of published articles and unpublished technical reports. Additional recent published studies were obtained from peer-reviewed scientific journals. Based on the studies compiled, this author analyzed twenty-seven studies of workers at DOE sites and nuclear sites in the United Kingdom and Canada.

All told, workers at fourteen DOE facilities were found to have increased risks of dying from various cancers and nonmalignant diseases.^{71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91} They include:

⁶⁹ Thomas F. Mancuso, Methodology in Industrial Health Studies: Social Security Disability Data and the Medical Care System, *American Journal of Industrial Medicine*, 1993, 23:653-671.

⁷⁰ David Richardson, Low-Dose Radiation Exposure, Public Meeting on Worker Health, September 25, 1997, Transcript, <http://www.sea-us.org.au/roxstop97/tdave3.htm>

⁷¹ Thomas F. Mancuso, Alice M. Stewart and George W. Kneale, *Radiation exposures of Hanford workers dying from cancer and other causes*. *Health Physics* 1977, 33:369-385.

⁷² Ethyl S. Gilbert, Ellen Omohundro, Jeffery A. Buchanan, and Nancy A. Holter, *Mortality of Workers at the Hanford Site*, *Health Physics*, June 1993, 64:6:577-590.

⁷³ Alice M. Stewart and George W. Kneale, *Relations between age at occupational exposure to ionizing radiation and cancer risk*, *Occupational and Environmental Medicine*, 1996, 53:225-230.

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- ⁷⁴ Thomas F. Mancuso, Methodology in Industrial Health Studies: Social Security Disability Data and the Medical Care System, *American Journal of Industrial Medicine*, 1993, 23:653-671.
- ⁷⁵ David Richardson and Steve Wing, Radiation and Mortality of Workers at Oak Ridge National Laboratory: Positive Associations for Doses Received at Older Ages, *Environmental Health Perspectives*, August, 1999. 107: 8 (Mortality study)
- ⁷⁶ Steve Wing, Cary M. Shy, Joy Wood, Susanne Wolf, Donna Cragle, and E.L. Frome, *Mortality Among Workers at Oak Ridge National Laboratory, Evidence of Radiation Effects in Follow-up Through 1984*, *Journal of the American Medical Association*, March 20, 1991, 265: 1397-1402. (Mortality study)
- ⁷⁷ Steve Wing, Carl M. Shy, Joy L. Wood, Susanne Wolf, Donna Cragle, William Tankersley, and E.L. Frome, *Job Factors, Radiation and Cancer Mortality at Oak Ridge National Laboratory: Follow-up through 1984*, *American Journal of Industrial Medicine*, 1993, 23:265-279.
- ⁷⁸ Dana P. Loomis and Susanne H. Wolfe, *Mortality of Workers at a Nuclear Materials Production Plant at Oak Ridge, Tennessee, 1947-1990*, *American Journal of Medicine*, 1996, 29:131-141.
- ⁷⁹ Harvey Checkoway, Neil Pierce, Douglas J. Crawford-Brown, and Donna Cragle, *Radiation Doses and Cause-Specific Mortality Among Workers at a Nuclear Materials Fabrication Plant*, *American Journal of Epidemiology*, 1998, 127:2:255-266.
- ⁸⁰ Elizabeth A. Dupree, Susan M. Wells, Janice P. Watkins, Phillip W. Wallace, Nancy C. Davis, *Mortality Among Workers Employed between 1945 and 1984 at a Uranium Gaseous Diffusion Facility*, Draft Report, Oak Ridge Institute for Science and Education. (no date)
- ⁸¹ Donna L. Cragle, Janice P. Watkins, J. Nicholas Ingle, Kathryn Robertson-Demers, William G. Tankersley, Charles M. West, *Mortality Among a Cohort of White Male Workers at a Uranium Processing Plant: Fernald Feed Materials Production Center [FMPC]*, *Radiation Research* (not sure if it is published)
- ⁸² Laurie D. Wiggs, Emily R. Johnson, Carol A. Cox-DeVore, and George L. Voelz, *Mortality through 1990 Among White Male Workers at the Los Alamos National Laboratory: Considering Exposures to Plutonium and External Ionizing Radiation*, *Health Physics*, December 1994, 67:6:557-586.
- ⁸³ Elizabeth A. DuPree, Donna Cragle, Richard, W. McLain, Douglas Crawford-Brown, M. Jane Teta, *Mortality among workers at a uranium processing facility, the Linde Air Products Company Ceramics Plant, 1943-49*, *Scandinavian Journal of Worker and Environmental Health*, 1987, 13:100-107.
- ⁸⁴ Elizabeth A. DuPree, Donna Cragle, Richard, W. McLain, Douglas Crawford-Brown, M. Jane Teta, *Mortality among workers at a uranium processing facility, the Linde Air Products Company Ceramics Plant, 1943-49*, *Scandinavian Journal of Worker and Environmental Health*, 1987, 13:100-107.
- ⁸⁵ E. DuPree Ellis, J.P. Watkins, J.N. Ingle, J.A. Phillips, *External Radiation Exposure and Mortality Among a Cohort of Uranium Processing Workers*, Oak Ridge Associated Universities, Oak Ridge TN, (unpublished report).
- ⁸⁶ Laurie D. Wiggs, Carol A. Cox-DeVore and George Voelz, *Mortality Among a Cohort of Workers Monitored for Polonium-210 Exposure: 1944-1972*, *Health Physics*, July 1991, 61:1:71-76.
- ⁸⁷ Wilkinson, G.S., G.L. Teitjen, L.D. Wiggs, W.A. Gaike, J.F. Aquavella, M. Reyes, G.L. Voelz and R.J. Waxweiler, *Mortality Among Plutonium and other Radiation Workers at a Plutonium Weapons Facility*, *American Journal of Epidemiology*, 1987, 125:2.

- The Hanford nuclear materials production site in Washington.
- The Oak Ridge National Laboratory in Tennessee.
- The Oak Ridge Tennessee Eastman Electromagnetic Separation facility (TEC).
- The Oak Ridge Y-12 weapons facility.
- The Oak Ridge K-25 Gaseous Diffusion Plant.
- The Feed Materials Production Center in Fernald, Ohio.
- The Los Alamos National Laboratory in New Mexico.
- The Linde Air Products uranium processing operation in New York.
- The Mallikrodt Chemical Works in Missouri.
- The Mound Laboratory in Ohio.
- The Rocky Flats facility in Colorado.
- The Savannah River Site in South Carolina.
- The Rocketdyne/Atomic International Facility in California.
- The Lawrence Livermore National Laboratory in California.

By the end of the 20th century, the Department of Energy (DOE) occupational epidemiological studies constituted one of the world's largest and most extensive follow ups of people exposed to low-level ionizing radiation and other substances. Dr. Mancuso had put in place a foundation that eventually provided a basis for the study of some 600,000 people who worked for federal contractors at industrial and research sites.

In December 2000 the United States enacted the Energy Employee Occupational Illness Compensation Act. The law represents the first time any nation has officially acknowledged that its workers were harmed from the production of nuclear weapons; and has established an entitlement program to compensate workers and their survivors. All told some 700,000 people who worked at over 300 facilities in the United States can file for compensation.

This unprecedented law would not have been possible without the pioneering work of Dr. Thomas F. Mancuso, who passed away on July 7, 2004 at the age of 92.

⁸⁸ Donna Cragle, Kathryn Robertson-Demeyers, and Janice P. Watkins, Mortality Among Workers at a Nuclear Fuels Production Facility: The Savannah River Site, 1952-1986, Oak Ridge Institute for Science and Education, (submitted manuscript).

⁸⁹ Beate Ritz, Hal Morgenstern, John Froines, and Bambi Batts, Effects to External Ionizing Radiation on Cancer Mortality in Nuclear Workers Monitored for Radiation at Rocketdyne/Atomics International, *American Journal of Industrial Medicine*, 1999, 35:21-31.

⁹⁰ DF, Reynolds PJ. Investigation of an excess of melanoma among employees of the Lawrence Livermore National Laboratory. *American Journal of Epidemiology* 1997; 145:524-531.

⁹¹ DF, Reynolds PJ. Investigation of an excess of melanoma among employees of the Lawrence Livermore National Laboratory. *American Journal of Epidemiology* 1997; 145:524-531.

The groundbreaking contributions to occupational cancer epidemiology that Mancuso left behind remain today as primary sources used to protect the public and workers, as well as for compensation for illness and injury. "He was for a half century a leading light in occupational epidemiology," wrote public health physician Michael Gochfeld in 2005.⁹² While Dr. Mancuso may be most remembered for the controversy surrounding his last struggle to bring the risks of radiation in the nuclear work-place to light, his quest for the truth and his deep respect for working people will serve as his lasting heritage.

⁹² Gochfeld 2005.