



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MEMORANDUM FOR: Jacob Kastner, Chief
Environmental Standards Branch, SD

FROM: Michael Parsont
Environmental Standards Branch, SD

SUBJECT: SUMMARY OF SD STAFF ACTIVITIES CONCERNING MANCUSO,
STEWART, KNEALE FROM 1976 TO THE PRESENT TIME

This information is important in light of its use as part of the staff recommendations on the NRDC Petition to Lower the Occupational Dose Limit, the intense public interest involved and its use in making new health risk estimates.

From October 1976 until the present time, the NRC staff activities involving the Mancuso, Stewart, Kneale (MSK) analysis of Hanford Occupational mortality experience have fallen into two categories. The activities within these categories are as follows:

1. Reactive: This included receipt of the MSK paper in October 1976 organizing and publishing a staff analysis on November 16, 1976. In addition, a consultant was retained for an independent review, and other agencies such as BRH, NCRP, ERDA, and EPA were contacted to find out their activities with respect to the MSK paper and what, if any, their analyses of the paper indicated.

Dr. Mancuso was contacted several times between December 1976 and February 1977. He was requested to assist the staff in refining its review. It was hoped to meet with all of the authors to discuss their analysis. Initially, Dr. Mancuso agreed to meet with staff members, ~~initially~~, however, later he refused to meet or discuss the matter further with the staff without clarifying the reasons for changing his mind.

2. Creative: The staff committee which ^{reviewed} ~~analyzed~~ the MSK paper made several recommendations, one of which was for staff action to analyze MSK data. On November 24, 1976 other NRC offices were notified of possible approaches for future action in this area. Specifically recommended were five approaches as follows:

- a. Analysis of the data has the highest priority
- b. Any other pertinent data should be analyzed

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- c. Establish estimates of risk if possible
- d. Establish an ongoing NRC Program in radiation epidemiology
- e. Possible consideration of epidemiology studies of workers employed in NRC licensed facilities

In March 1977, A. Brodsky, OSHB, contacted Dr. Barkev Sanders, the statistician on the Health and Mortality Study for 11 years until discharged by Dr. Mancuso, to find out what data and analyses were in his possession. This was followed in April by Drs. Brodsky's and Parsont's suggestions of various ways to analyze the MSK data. These suggestions included several options such as staff independent consultants, ORNL data tapes and possibly ORNL computer services analyses. It was also suggested by Dr. Parsont that the data be published in a NUREG document to give it wide visibility.

In June, a Proposal Request Outline (PRO) was sent to ORNL requesting that a 189 be submitted ~~from~~ NRC/OHSB for an analysis of the Health and Mortality Study data*. This analysis was to have used technical assistance funds. The draft 189 in response to the PRO was received in July 1977. It proposed an analysis of the entire Health and Mortality Study Data Base which included the Hanford Mortality Experience.

By decision of Roger Mattson, support of the ORNL project was transferred to RES as confirmatory assessment.

In July, discussions were held at ERDA and Oak Ridge about the scope of the proposal. ERDA did not allow the draft 189 to stand as written, but indicated that it would accept one covering a more limited scope of work--pointed at analyzing the Hanford data only.

Based on the above mentioned influence of ERDA as well as impressions gained by Dr. M. Parsont (ESB) in subsequent meetings with ERDA and ORAU representatives and among NRC staff in Rockville in August and September, questions were raised about the ability of ORNL to maintain its independence of ERDA and ORAU influence in an analysis of the MSK data. The staff began an investigation to determine if copies of the Health and Mortality Data and the Hanford portion of the data could be obtained. This was done through RES. No data were obtained from this effort.

* The Health and Mortality Study data includes the Hanford data (that portion analyzed by MSK) and data on occupational exposures at ORNL and other AEC/ERDA/DOE contractors

In December the ORNL 189, written for specific analysis of the Hanford data, was resubmitted to the staff. A. Brodsky (OHSP) recommended immediate action to fund the proposal. In January 1978 M. Parsont raised some technical questions about the new proposal and also questions about the ability of ORNL to maintain its objectivity and independence of ORAU and DOE in this matter. Therefore, the decision about funding the project was delayed again.

The staff received copies of the Final Report of the Health and Mortality Study in November and the staff committee began its analysis of the document. A. Brodsky provided his input on January 12, 1978

During December 1977 and January 1978 further options were explored to get the Hanford data. Possible sources considered were Pacific Northwest Laboratories, DOE, Dr. Barkev Sanders, and Dr. Mancuso. Dr. Mancuso was contacted again to see if he would be disposed to meet with the staff and/or supply his data. On January 26, 1978, Dr. Mancuso responded to the staff request. He asked for NRC funding of the mortality study project, he ignored the question about supplying data and he wrote about meeting with the staff only from the standpoint of an adjudicatory hearing on the NRDC Petition.

Also in January 1978, Dr. Rothman, a staff consultant epidemiologist, proposed performing a limited analysis of the Hanford data. He contacted Dr. Marks, PNL, to try to obtain these data. Dr. Walter Weyzen, ERDA, agreed that Dr. Rothman could contact Marks for the data. It is the current view of the OSD staff that analysis of the Hanford data should be performed by OSD with technical assistance funds. An RFP is being prepared for analysis of the MSK data. Three to five independent analyses will be sought. ~~We~~ have requested that Dr. Liverman, DOE, provide us with the MSK data. Such an approach would be independent of NRC and DOE influence in its analysis.

In an effort to obtain additional data and assistance in analysis of the MSK data, Dr. Mancuso was contacted once more by telephone in February 1978. He stated that he was too busy to talk with Dr. Parsont. Attachment 1 contains an account of the conversation.

On February 10, 1978, Dr. Kastner spoke with Dr. Mancuso at the ESC Conference on Low Level Radiation but was unsuccessful in arranging a meeting or obtaining the MSK data. Dr. Mancuso desired that NRC try to influence DOE to reinstate his contract.

Kastner
R. B. Minogue

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Attachment 2 is a chronology of major events in the staff involvement with the Mancuso, Stewart, Kneale paper and the Hanford data.

Michael Parson
Michael Parson
Environmental Standards Branch
Office of Standards Development

Attachments:

1. Memo - "Telephone Conversation
with Dr. T. Mancuso"
2. Chronology of Major Events

CHRONOLOGY OF EVENTS - MANCUSO, STEWART, KNEALE

October 13, 1976	Presentation of MSK analysis-Hanford Mortality Experience at Health Physics Society
October	Copy of presentation obtained by staff
October 27	Staff Committee established to analyze paper
October 28	Requested analysis and delivered paper to NCRP for its review
November 9	Telephone conversation with Dr. Ney, NCRP, about results of analysis
November 16	Staff Committee Report published on MSK
November 24	Letter Minogue to NRC Offices setting out further actions to be considered
	<ul style="list-style-type: none"> A - Analysis of data highest priority B - Any other pertinent data should be analyzed C - Establish estimates of risk if possible D - Establish ongoing NRC program in radiation epidemiology E - Consideration of epidemiologic studies of workers employed in NRC licensed facilities
Nov. - Dec.	Mattson contacts consultant Kleitman to analyze MSK paper
December 2	Letter Mattson to Mancuso transmitting staff analysis requesting meeting to discuss analysis
December	Letter Mattson or Minogue to W. Mills (EPA) transmitting staff analysis and requesting what action EPA is taking in this matter
December 8	Letter Mattson to Bross transmitting MSK analyses
December 13	Letter Mancuso to Mattson acknowledging receipt of Staff analysis, making some comments and inviting NRC staff members to meeting in Pittsburgh (which was never held).
December 23	Letter Kastner to Kleitman requesting meeting in Bethesda to present his MSK analysis (copy of MSK was sent to Kleitman by Mattson; copy not in file)
December 29	Memo Parsont to Gotchy (RAB) transmitting staff analysis for use in GESMO hearings

December 29	Letter Parsont to Ney (NCRP) transmitting staff analysis
December 29	Letter Parsont to M. Goldman (Univ. of CA) transmitting staff analysis
December 29	Letter Parsont to V. Bond (Univ. of PA) transmitting staff analysis
December 29	Letter Senator Brooke to Mattson requestion information on NRC action regarding MSK
January 1977	Meeting: Kastner, Parsont, Shore, Silverman, Lundin, Chiacchierni (BRH) to discuss MSK material
January 5	Letter Mattson to Mancuso acknowledging receipt of December 13 letter
January 6	Letter Mattson to L. Taylor (NCRP) acknowledging receipt of December 9 letter.
January 7	Meeting in Bethesda where Kleitman gave presentation on his analysis of MSK
January 12	Letter Parsont to Ney (NCRP) transmitting further material
January 19	Letter Kastner to M. Shore (BRH) thanking about meeting with Drs. Silverman, Lundin, and Chiacchierni
January 31	Letter Mattson to Bross responding to January 3 Bross letter commenting on MSK material
February 2	Letter Mattson to Senator Brooke transmitting information on staff action on MSK
February 15	Telephone conversation Parsont-Mancuso - meeting between Mancuso and staff indef postponed - no reasons given by Mancuso
March 3	Letter Minogue to J. Liverman (ERDA) transmitting staff analysis and requesting to be informed about ERDA activities in this area
March	Letter Minogue to Rowe (EPA) requesting EPA's activities in this matter and EPA's overall activities in radiobiological research and NRDC petition
March 30	Memo to file of Brodsky comments on meeting with Barker Sanders - description of other data available on MSK material plus Sanders analysis.

April 4 Memo Brodsky to B. Smith (ELD) regarding testimony of Tamplin, Bertell, Caldicott (Boston Edison Company Docket no. 50-471)

April 5 Letter Weyzen (ERDA) to Parsont abstracting NCI analysis of MSK data. Increased incidence of cancer of pancreas and multiple myeloma - possibility of statistical flukes

April 11 Memo - Brodsky to distribution transmitting March 1977 draft of MSK ✓

April 15 Memo Brodsky to Parsont suggesting various ways for analysis of MSK data - staff, independent consultants and ORNL computer services as possibilities

May 10 Memo Parsont to Roberts thru Kastner commenting on Brodsky's April 15 memo - Parsont suggested NUREG document publishing data, 1st order of business to examine availability of data and arrange for ORNL computer center to clean up, recommends staff and independent analysis.

May Commission briefing Mattson and Minogue on staff activities in low level effects of ionizing radiation

May 20 Meeting Mattson, Parsont, Kastner with reps of New England Liability Property Association - Mutual Atomic Energy Underwriters on 3rd party risks

May 31 Letter Mattson to Kleitman requesting analysis of March draft of MSK

June Proposal Request Outline to ORNL on MSK data analysis

July Kleitman analysis of March 77 MSK draft received

July 15 ORNL 189 for analysis of Health and Mortality Data received

July 19 Memo Minogue to Levine recommending analysis of most complete MSK data obtainable at ORNL - independent assessment of mortality and morbidity data - prospective analysis

August 20 Meeting at ERDA Parsont, Brodsky with Weyzen - discussion of state of Health and Mortality Study data and time necessary for clean up - NRC interest in analyzing occupational exposure data as they were used in Mancuso, Stewart, Kneale Study as well as further investigation of the entire Hanford data base. NCI analysis will not be published until after MSK final is published.

August 23 Site visit to ORNL Parsont, Brodsky, Swanberg, Foulke - ORNL reps - discussion of 189 - redesign focus of 189 concentrate on MSK data for resubmission because ERDA would not permit broader study

August 30 Meeting at ERDA Parsont - Weyzen and Burr (ERDA), Tompkins and Lushbaugh (ORAU), Bibb (ORNL) - July 15 ORNL 189 not acceptable because of incompleteness of data - ORAU doing same sort of analysis, therefore, work would be duplicative--any analysis could not be independent of ORAU influence - recommendation that panel of epidemiologic and statistical consultants to jointly design analytical effort might be acceptable - new ORNL 189 (an interaction of ORAU and ORNL) would follow meeting on Health and Mortality Study status on September 27, 1977 at ERDA.

September 1 Meeting at Bethesda Parsont, Kastner, Alexander, Brodsky discussion ranging from dealing directly with ORAU and not using ORNL to trying to get current data tapes of Hanford Mortality Experience and arranging for NRC analysis.

September 27 Meeting at ERDA Yaniv (SAFER); Parsont with representatives ERDA, ORAU, OROO, BNL, National Lead, Malinkrodt, Mound Laboratories, Union Carbide - discussions of where Health and Mortality Data are located, what organizations have been collecting and processing data, what is ORAU doing with data - conclusion by Parsont and Yaniv - unproductive for NRC to fund analytical study of entire data base - If effort is to be made to establish radiation epidemiology expertise - the Hanford data are the ones to use. It is questionable as to whether or not this should be done at all in light of all the analyses already performed.

October 9 Telephone conversation Parsont with T. Cochran (NRDC) about staff action on MSK

October 14 Letter Parsont to Cochran (NRDC) transmitting information on staff analyses to MSK and others

December 6 Memo Kastner to staff committee Yaniv (SAFER), Rubinstein (EDO), and Brodsky (CHSB) - transmitting final of Health and Mortality Study - requesting analysis

December NRDC Petition Supplement

December 19 Memo Brodsky to Alexander - recommending funding of ORNL 189 (December 12, 1977)

Dec. - Jan. 1978 Staff discussions (Minogue, Alexander Roberts, Kastner, Parsont) about how and whom to make analysis - from whom to get data (BNL, ERDA, Mancuso as possibilities) becoming stronger that ORNL may not be independent. Roberts contacts Davis (RES) to try to get data - suggestion to get data from Barkev Sanders.

January 9 Memo Parsont to Alexander - raising questions about the ORNL 189 (December 12, 1977) objectivity and independence questions raised about ORAU and ORNL plus some technical questions

January Dr. Rothman requests to do special analysis on MSK data

 Telephone call Parsont to Walter Weyzen (DOE) to request availability of special data - Weyzen suggested contact with S. Marks (BNL) to find out about data

January 12 Brodsky input to committee review

January 20 Letter Parsont to Mancuso requesting reopening of contact - a meeting - Hanford data as analyzed by MSK

January 26 Letter Mancuso to Parsont requesting funding of Mortality Study. Does not respond to questions about availability of data, agrees to meeting with staff in context of adjudicatory hearing on NRDC Petition only

February Telephone call Parsont to Mancuso. Mancuso too busy to talk

February Conversation Kastner (ESB) with Mancuso - will not meet with staff until NRC recommends reinstatement of his contract neither will he provide any data

March RFP initiation with request to Dr. Liverman, DOE for MSK data tapes.

MANCUSO HEALTH AND MORTALITY STUDY

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Part II

Annotated Chronology

- 1964 Feasibility Study for Health and Mortality of AEC Employees approved for funding. Thomas Mancuso as principal investigator.
- Survey AEC installations to assess adequacy of information and design of study
- 1965 Contract renewed as a five-year pilot study
- To develop data collection, processing, coding and retrieval
 - Assess criteria of longevity and mortality
- 1967 Independent reviewer (Epidemiologist, Statistician) points out methodological limitations of study
- Great deal of data put on tape
 - Have not tested in any way the accessibility of the information for epidemiological study
 - Best type of test would be actual utilization of data
 - Value of study may be outweighed by the possibility of deriving misleading information
 - Do not expand study beyond Hanford and Oak Ridge populations and start analysis
 - Goals of study and value of occupational surveillance merit support
- Nov. 1971 Preliminary analysis of Health and Mortality Study presented at Health Physics Symposium
- No indication of adverse health effect in Hanford worker population, but cautions that data are incomplete for firm conclusions
- June 1972 Letter from AEC staff to Mancuso warning that deficiencies in performance may lead to change in the administration of the contract
- Slow progress in study
 - Diffuse objectives
 - Requests focus on Hanford workers cause of death analysis
- July 1972 Memo from AEC staff to AEC Commission projects peer review of Mancuso and possibility of replacing principal investigator

Nov. 1972

Peer Review of Health and Mortality Study

- Could not reach consensus on continuing with Mancuso as principal investigator
- Project lacked overall direction due to minimal involvement of principal investigator
- Paucity of results after 9 years of study
- Lack of publications in refereed journals
- Questions of adequacy of statistical methodology
- One reviewer categorically recommended transfer of contract to other principal investigator
- Other reviewers felt that the advantage of continuity of contract outweighed criticisms of performance

Feb. 1973

Staff recommendations as result of peer review:

- Completion of two specific projects; Hanford and Oak Ridge analysis
- Set two to three year time limit for completion
- Extend study to other AEC facilities
- Solicit competing contract proposals from other investigators
- Consider splitting the current single into multiple contracts
- Termination of the open-ended, exclusive character of Mancuso's contract

March 1973

Mancuso submits research proposal to NCI "enlarge a portion of on-going research which is still being financed by AEC" to include disability (Social Security Administration) in assessing cancer in the work environment

- AEC approved and encouraged this submission in order to achieve wider utilization of data
- NCI review and evaluation mechanism would provide independent assessment

May 1973

NCI approves and funds Mancuso research grant with five-year projection

- This grant was terminated at the request of the principal investigator in the third year (1976)
- Progress peer review not available

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- In second progress report, May 1, 1973, "underlying cause of death and all causes of death from specific neoplasms, from all forms of neoplasms, or from other broad causes give no indication of differential causes of death between Hanford employees and identified siblings".
- May 1974 Milham, Washington State Department of Health, reports excess cancer mortality in Hanford project employees; paper sent to Mancuso
- June 1974 Sanders (Mancuso statistical consultant) meets with Milham to discuss data
- July 1974 Sanders and Mancuso requested to evaluate Milham study
- August 1974 Draft memo to Liverman (Asst. Adm. Env. & Safety) from Marks on projected ORAU program
 - Proposes transfer of Health and Mortality Study from Pittsburgh to ORAU at a time when "analyses will have been completed for the Hanford, Oak Ridge and Mound Laboratory plants"; suggests three year period to August 1, 1977
 - Proposes expansion of study to other major AEC contractor facilities and participation of other university epidemiology groups
- Dec. 2, 1974 Memo to Liverman from Marks recommending:
 - Terminate contract with U. of Pittsburgh on July 31, 1977
 - Transfer project to ORAU
 - Continue Mancuso as a consultant
 - Continue to make available AEC data base for use in Mancuso's NCI study on disability and mortality in Hanford workers
- Dec. 6, 1974 Mancuso transmits Sander's review of Milham data
 - "For all cancer deaths in Table B as in A we find no statistically significant excess of proportionate deaths among Hanford employees for any of the three sets of comparisons shown" (Based on Milham's data)
 - "This impression is not sustained, however, as far as cancers of select specific sites are concerned" (Based on Milham's data)

- "As far as a higher proportion of cancer deaths among Hanford employees is concerned our own analyses tend to support Dr. Milham's findings" (Based on Mancuso data)
 - The above interpretations appear to be inconsistent
- 1973 Progress Report

Mancuso Health and Mortality Study Progress Report summarized their findings - Page 5

 - "If it is true that certain diseases are induced by radiation, then the proportionate frequencies of such diseases as causes of death should be higher in the population that has had exposure to radiation; we found no evidence from our analyses that underlying cause of death or all causes of death showed significantly higher or lower frequency of certain causes as compared with deaths of their identified siblings." (control population)

"These findings very much strengthened the force of our earlier conclusions based solely on comparative longevity of Hanford employees with their identified siblings."
- 1974 Progress Report

Page 7

 - "The most important finding in the current analysis appears both as the absence (for either males or females) of any consistent statistically significant association between dose level and probability of death, and (for some very large male cohorts) as a strong negative association between low level and probability of death."
- Nov. 1974

Copy of letter from Sanders to Mancuso (provided by Sanders) indicates that in this period disagreement between Mancuso and Sanders is growing and that management coordination is falling apart

 - Sanders faults Mancuso for putting all the responsibility on him for managing the research, writing reports and proposals, and for analyzing data without providing necessary technical support functions
- March 1975

Burr and Marks meet with Mancuso to discuss transfer of the Health and Mortality Study to CRAU

July 1975

Preliminary analysis conducted by PNL of statistics in Milham study indicate sufficient validity in his finding to warrant further study

- Identifies limitation of proportionate mortality approach
- Defines biases in study which must be accounted for in analysis

July 1975

Progress Report No. 11 from Mancuso - Pgs. 31 & 36

- "The proportion of exposed employee deaths in ages 20-64 from a malignant tumor is higher than expected."
- "Many of our other findings are contrary to Dr. Milham's hypothesis as to what accounts for the proportionately higher deaths from malignancies."
- "These comparisons, first between exposed and unexposed employees and, second, between exposed and unexposed employees with their respective siblings, are incompatible with the idea that the longevity of exposed employees could have been reduced as a consequence of their exposure to radiation."

August 1975

Memo from Marks to Liverman summarizes uncertainties in current state of analysis of Milham report and recommends funding of expanded effort at PNL and ORAU in FY 76

Sept. 1975

Renewal proposal for Mancuso's Health and Mortality Study submitted for independent peer reviews

- "I regret that I am unable to recommend its support given its present staffing..."
- "Thus, for example, the effort to deal with the findings of Dr. Milham regarding the presumed excess of cancer of the colon among Hanford employees is not impressive."
- "The proposal appears to be more of an apology for work not done or a renewed call for additional funds for more data sources."
- "Although the need and importance of the proposed research are clear, the work done thus far and the confused manner in which it is presented tend to undermine its scientific merit."
- "...it is my recommendation that the study be turned over to another principal investigator."
- "I am not convinced that the study requires to be prosecuted as this contractor has done over the years. Evaluation of this material is difficult, and is not made easier by the excessively repetitious, garrulous and diffuse style in which it is written."

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- Jan. 8, 1976 Research Committee of Division of Biomedical and Environmental Research concurs unanimously with recommendation for transfer of the Health and Mortality Study to ORAU and funding for a terminal year, FY 76-77, the Mancuso project at Pittsburgh
- January 1976 Letter from Marks notifies Mancuso of termination of Pittsburgh contract on July 31, 1977, and the transfer to ORAU in accordance with March 1975 meeting
- February 1976 Letter from Mancuso to Sanders expressly forbids him to publish paper on effects of low-level ionizing radiation in the Hanford population
- Mancuso tells Sanders that there is probably an "artefact" in their data base
- July 1976 Memo from Mancuso to Advisory Committee states that Stewart and Kneale from England began an independent analysis of study data on May 27, 1976
- First finding is that an artefact exists in the data among the deceased and the survivors which has influenced prior statistical analysis. Because of this Dr. Stewart has recommended that no findings pertaining to this project be released until artefact is resolved.
 - Dr. Alice Stewart and George Kneale have been appointed as principal consultants for the statistical analysis of data, as of August 1, 1976, replacing Barkev Sanders.
- July 1976 Sanders' letter to Burr (Deputy Director, BER) complains of lack of cooperation and support from Mancuso, alleges misappropriation of ERDA and NCI funds, and protests inability to publish.
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- Aug. 1976 Contract renewal authorized with budget provision for consultant service for Dr. Alice Stewart and Mr. George Kneale. Mancuso requested \$78,000 and this was provided.
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- Sept. 1976 In a letter addressed "To Whom It May Concern" Sanders details an extensive accounting of his performance and findings and, in particular, rebuts charges of a systematic flaw in the data base.
- Sept. 1976 Mancuso memo to Advisory Group notifies that a meeting will be held in Germantown (ERDA) on Sept. 22. Stewart and Kneale have conducted an "independent analysis" which indicates there are some positive findings.
- Expect to publish paper in proceedings of Health Physics Society at October 1976 meeting.

- Oct. 1976 Paper prepared by Mancuso, Stewart and Kneale for publication is sent to Burr and Mayzen for information.
- Nov. 1976 ERDA/BER convenes panel of four outside reviewers to evaluate Mancuso, Stewart and Kneale paper. Opinions indicated that at best the analysis was preliminary, the methodology was misleading and failed to address the hypothesis supposedly tested. Reanalysis of the data was warranted.
- Nov. 1976 Memo from Director, Office of Standards Development, NRC, states that a review of the Mancuso et al. paper does not warrant regulatory action at this time.
- March 1977 Draft of Analysis prepared by C. E. Land of NCI for other members of review committee, notes that two cancers appear to be significantly related to dose of external radiation in Hanford workers. States that it is somewhat surprising that evidence for a dose effect should not involve leukemia.
- March 1977 Copy of paper submitted by Mancuso, Stewart and Kneale to Health Physics received in ERDA/BER.
- May 1977 Letter from Carl Morgan, University of Georgia, to Secretary Schlesinger alleges that "when the Mancuso program, to which I am a consultant, indicated there was an increase of statistical significance in four types of cancer, Mancuso was informed shortly thereafter that his program would no longer be funded by ERDA."
- Oct. 1977 Outside peer reviewer evaluated Mancuso, Stewart and Kneale paper which had been submitted for publication. "My impression is that any observation that appears to support the thesis that low-level radiation exposure is remarkably carcinogenic has been included uncritically."
- Oct. 1977 Another reviewer stated "I would advise that this report has very little scientific merit and that therefore the findings have very little validity."
 "It is unfortunate that a reviewer feels motivated to such sweeping criticism; it is indeed unfortunate that many years of painstaking collection of data should be reflected publicly by an analysis which is at best incomplete and at worst misleads."

- Nov. 1977 Letter from the Environmental Policy Center to Secretary Schlesinger, DOE, strongly urges the suspension of James Liverman from his responsibilities pending a full Secretarial review.
- Nov. 1977 Liverman in a letter to Joseph Selzer, Acting Inspector General, requests an independent investigation of matters relating to the Environmental Policy Center allegations.
- Feb. 1978 Liverman appears before the House Committee on Interstate and Foreign Commerce, Subcommittee on Health and the Environment and presents Testimony on Biological Effects of Low Level Radiation. A historical accounting of the Mancuso Health and Mortality Study was reviewed.
- March 1978 Paper by Marks, Gilbert and Breitenstein on "Cancer Mortality in Hanford Workers" presented at IAEA Symposium in Vienna with publication in proceedings.
- Test for association of mortality with levels of radiation exposure revealed no correlation for all causes and all cancer.
 - A statistically significant test for trend was obtained for multiple myeloma and carcinoma of the pancreas.
 - There was an absence of correlation for diseases such as leukemia commonly associated with radiation exposure.
- March 1978 Publication of the proceedings in Great Britain known as "The Windscale Hearings" on nuclear safety contains extensive review and cross examination of the Stewart and Kneale findings on Hanford workers known as the Mancuso report.
- Statistical methodology was criticized.
 - Doubling dose for risk of cancer from exposure to low doses of radiation (approach cumulative natural background) were considered to be in serious doubt.
- Present The principal elements of the analysis of cancer mortality in the Hanford worker population are now in the arena of scientific publication where they should be.