

WESTINGHOUSE MATERIALS COMPANY OF OHIOI. PURPOSE

This historical report is one of a series of reports covering the following major sites of the United States Department of Energy Health and Mortality Study of Nuclear Energy Workers:

Oak Ridge facilities

- 1) Oak Ridge Gaseous Diffusion Plant (K-25)
- 2) Oak Ridge National Laboratory (X-10)
- 3) Y-12

Feed Materials Production Centers

- 4) Westinghouse Materials Company of Ohio (Since this facility was established and operated for nearly its entire existence by the National Lead Company of Ohio, in the interests of consistency in this report, it has been termed NLO. This plant, located in Fernald, Ohio was occasionally referred to by HMS-Mancuso as a feed mill.)
- 5) Mallinckrodt Chemical Works
- 6) Linde Air Products

Gaseous Diffusion Plants

- 7) Portsmouth
- 8) Paducah

Others

- 9) Savannah River Plant
- 10) Lawrence Livermore National Laboratory

The purpose of these reports is to analyze methods used to generate and validate facility employment rosters for the Health and Mortality Study of Nuclear Energy Workers (HMS). Principal sources of data for this historical study were thirteen years of annual progress reports and other study documents generated by the early phase of the HMS under Dr. Thomas P. Mancuso (1964-1977), and subsequent files and research sources generated by the present Study at Oak Ridge Associated Universities (1977-present). All historical and study documents examined for these reports are stored at Oak Ridge Associated Universities Center for Epidemiologic Research (ORAU-CER), Oak Ridge, Tennessee. Complete references to all materials used in these reports are provided in the footnotes.

The major shortcoming of the HMS-Mancuso Progress Reports is the fact that it is generally difficult to ascertain actual developments for individual facilities because these reports were not organized by study site. In terms of roster assembly and validation, it cannot be determined in the HMS-Mancuso reports whether data collection for an individual plant posed special problems. This is particularly difficult in studying the Oak Ridge sites.

Brief individual reports were written for each of the ten (10) major study sites listed above. In most cases, where the complexity of the historical material dictated, a comprehensive report on a facility also was produced. In that the HMS-Mancuso Progress Reports lack specificity with respect to the Oak Ridge facilities, a general report on the Oak Ridge facilities (the Oak Ridge Gaseous Diffusion Plant [K-25], the Oak Ridge National Laboratory [X-10], and the Y-12 Plant) was written to

supplement the individual reports. For NLO, both a full report and a brief summary have been written.

II. BACKGROUND

Two important assumptions should be noted in reviewing roster assembly issues as they were addressed in the early phase of HMS-Mancuso.

A. General Roster Goals and Methods

It is important to note that from the outset HMS-Mancuso, for a variety of reasons, sought to include all employees with potential occupational exposure in their plant rosters for each facility. For all study sites including those at Oak Ridge, this included all production workers who actually operated the plants for the prime contractors but excluded construction workers and employees of subcontractors. Through this approach, it was felt that production workers or other plant populations presumed to have lesser exposure could serve as control populations, along with short term employees. The latter was considered as a suitable control population after attempts to exclude them from the study as a cost saving move found difficulties and uncertainties in separating them from other plant workers.

B. Personnel Record Retention

In addition, the issue of record retention was ever-present in HMS-Mancuso Progress Reports particularly in the later stages of the Study. Many of the facility contractors had routine records destruction cycles which ceased only on the direct orders of the Atomic Energy Commission (AEC), or its successor, the Energy Research and Development Administration (ERDA). In many cases, these Progress Reports suggest that these orders were not issued expeditiously or were not heeded until valuable data, particularly Personnel Security Questionnaires (PSQs), or medical records had been destroyed. Whenever this request made special reference to a plant or population, it will be mentioned in these reports. However, inasmuch as the general request was issued nearly every year, it is difficult to know which particular records were destroyed.

III. NLO ROSTER ASSEMBLY

A. Important National Lead of Ohio Roster Decisions Made in the Early Phases of the Health and Mortality Study

Three potentially important decisions were made in the early phases of the NLO Study which may have affected quality control aspects of the NLO roster:

- ⌘ in 1966, it was noted that "[a]t one time we considered excluding persons who worked for a very short time in order to reduce project costs, but difficulties and uncertainties in separating out these individuals led us to abandon this idea. Furthermore, in some instances, we may be able to use short term employees to form one type of control population. *In studying the feed mills, all contractor employees will be included.*"¹
- ⌘ in 1972 to address errors resulting from the way in which the Social Security Administration (SSA) received and processed information on date of death, HMS-Mancuso in consultation with SSA decided to "deem all persons on our rosters who had reported a taxable earning in a given calendar quarter [to be alive] in that quarter."² HMS-Mancuso recognized that this assumption could introduce error into its dates of

death in that an individual who died just prior to a quarter could have earnings in that quarter. But it was felt that the savings to the project in clerical time would offset this underestimation of dates of death for the small number of exceptions.²

✕ in 1978, ORAU recognized that HMS-Mancuso chose to treat NLO workers who transferred to another nuclear energy contractor as a termination.³

B. Initial Feasibility Study

In 1962, a study conducted by Dr. Robert F. Bell at the Division of Industrial Medicine of the University of Colorado Medical Center concluded that an epidemiologic study of NLO workers using plant documents was feasible. A pilot study was proposed but neither it nor a full study was undertaken.⁴ The initial feasibility study of HMS-Mancuso began in 1964 with NLO roster assembly.⁵ Preliminary visits to NLO and thirteen other nuclear facilities were made to determine what types of personnel, medical and exposure records had been kept and maintained.⁵ Responses to these questions were recorded in notebooks tape transcriptions at ORAU;⁶ these notebooks and transcriptions are not present at ORAU-CER.

C. Data Obtained from National Lead of Ohio

1. HMS-Mancuso

The NLO study began in 1967 when a data collection and data entry plan for the NLO facility was developed utilizing the corporate personnel cardex and/or tape list.⁴ As discussed in the full report on NLO, a 95% completion rate was applied throughout the early years of the NLO Study to cohorts of various sizes.^{7,8} In 1976, it was noted that NLO supplied annual supplements to the existing files.⁹ It also was noted that personnel data sheets were in storage in the Oak Ridge office which had been prepared at NLO.¹⁰

2. HMS-ORAU

Incomplete documentation on the NLO segment of HMS-Mancuso became a concern immediately upon the transfer of the Health and Mortality Study to ORAU.¹¹ For example, in 1978 it was noted that a microfiche and its updates were not complete, especially those hired before 9/15/67.¹² In 1977, HMS-ORAU renegotiated continuation of the annual purchase order with NLO initiated by HMS-Mancuso to provide ORAU with annual updates of personnel data, specifically hiring and termination data for the facility.¹³

In June 1979, the first of a series of trips was made to the NLO facility in Fernald, Ohio to complete a personnel records profile for the NLO study initiated by Dr. Jerome Wilson, a doctoral student in epidemiology at the University of North Carolina at Chapel Hill.¹⁴ A formal purchase order was issued in 1983 to continue the update of the NLO master list of employees begun by HMS-Mancuso.¹⁵ This purchase order was renewed in 1985.¹⁶ NLO worked cooperatively with ORAU and Wilson in collecting data on terminated employees on file at Fernald.¹⁷ This type of interaction continued in later years of the study at HMS-ORAU. Other NLO data sources were used by ORAU, including payroll records. These data were undoubtedly of great value to roster generation and exposure classification efforts at ORAU.¹⁸

Records inventory took place in the Fall of 1984 as the NLO study resumed activity.¹⁹ In 1987, examination began of the original HMS-Mancuso computer coding sheets²⁰ in a major roster cross-check and validation procedure found to be necessary because of the discovery of systematic errors in data coding for the NLO segment of the HMS-Mancuso.^{10,219}

D. Other Source of Roster Data

1. Personnel Security Questionnaires

Since its inception NLO required that all workers complete a PSQ form before they can begin employment.²² Under HMS-Mancuso, NLO first provided assistance with PSQ abstraction, assessment of non-starts, and clarification regarding AEC personnel working at NLO.²³ Sources found in Oak Ridge were used to fill in gaps in the data.^{23,24}

Several sources of PSQ data independent from NLO files were used by HMS-Mancuso. In 1967, it was reported that missing name and social security number data for the feed mills are "available at other AEC offices... and facilities."²⁵ ORAU later identified the Dayton Federal Records Center as being the repository of NLO documents.^{26,27,28} A June 1983 memo acknowledged that DOE Personnel Security also may have file copies of PSQs for all NLO terminations after 1962.²⁹

In 1981 the Wilson protocol used facility data sources and PSQs to obtain missing data and to correct entries.³⁰ A 15% random sample of the facility roster was used for protocol planning purposes.³⁰ Wilson's doctoral dissertation also relied heavily on PSQs for demographic data.²²

2. Employees from the Manhattan Engineer District

The potential impact of Manhattan Engineer District (MED) and subcontractor participation in the early facilities was a concern to the HMS-Mancuso. However, since uranium processing at NLO started after the conclusion of World War II (and after termination of the MED), these data sources were used only to correct erroneous Social Security Numbers of the limited number of MED-period workers who found employment at the NLO facility.

IV. NLO ROSTER DATA EDITING AND VALIDATION

A. HMS-Mancuso

1. Cases

HMS-Mancuso first conducted a small scale internal cross-check of the accuracy of data abstracting by study personnel from 1966-67.³¹ These were repeated infrequently at several stages of the Study. In 1972 it was noted that "[n]o tests of completeness of the roster have been made."³² Reports written by Dr. Sanders were reported to identify procedures to follow for data discrepancies that may have been found in comparing the personnel, cardex, and medical files.⁴⁰ These documents are not at ORAU-CER.

2. Controls

Control groups for HMS-Mancuso were developed from five principal sources.³ HMS-Mancuso also used files of all prospective NLO employees who had been given medical examinations but who did not work to check on roster completeness and to develop an internal control population. Approximately 1,100 individuals who did not report to work were coded in the database as "non-starts" but the basic data was retained on the computer.^{3,9} No data sheets were found at ORAU.³ These individuals were reportedly planned for deletion from the study.^{9,33} On the other hand, "[t]hose groups of questionable value and kept separate included data sheets started from radiation card files, medical files, and security cards with only a name.³ Unfortunately, these were not found on the computer.³ HMS-ORAU attempted upon assumption of the HMS to verify and document these individuals for possible future deletion.³³

B. HMS-Wilson NLO Study

Persons not appearing on the Master Roster for various reasons were discussed in 1980.³⁴ In 1981, Wilson undertook both editing of historical NLO computer databases as well as data entry new personnel, occupational exposure, and medical data from NLO hard copy files. This study utilized five data sets from previous efforts.³⁵ At this point, the NLO cohort consisted of approximately 6,800 workers who were employed between January 1, 1952 and December 31, 1977, and the cohort was defined through a roster provided by the company and further defined with the use of plant personnel rosters.³⁶

Wilson concurred with other researchers in his assessment that there was an absence of documentation on data processing procedures used to develop these extant databases. A similar lack of historical information was noted regarding data editing. Data editing efforts undertaken by Wilson concentrated on three principal categories of error: outliers, transpositions, and repetitions. These are defined in his dissertation, along with data entry procedures used by this study.³⁷ In terms of primary data entry, double entry keypunching was used to minimize errors.

C. HMS-ORAU Current Phase

Refinement of analysis files continued through 1984. In addition, in 1984 NLO asked HMS-ORAU to eliminate from the ORAU master file some individuals who never were employed by the company.³⁸ NLO identification numbers were removed from the roster when the company realized that they worked for the "offsite parent" facility.³⁹ In 1985, HMS-ORAU requested that NLO correct a printout of employees using its hard copy records; in 1987, this was repeated.⁴⁰

In 1987, a new software system was developed to address three systematic problems with NLO data.²¹ All procedural steps relating to these programming changes were documented in the ORAU Chfile book under "Rules and Procedures for Manipulating Data". It is clear from the most recent master file changes that the time and fiscal constraints, and lack of continuity for the NLO study under HMS-Mancuso were potentially disruptive to the accuracy necessary for an epidemiologic study of plant employees.

V. Vital Status Searches

A. Social Security Administration

1. Exploratory Uses of Social Security Administration Capabilities: Disability, Retirement, and Summary Earnings Statements

In the period 1965-68, HMS-Mancuso initiated its first pilot studies through the SSA Bureau of Old Age, Survivors, and Disability Insurance (OASDI) for both the Oak Ridge sites and the feed materials plants. However, subsequent accounts in later reports indicate that this approach yielded little additional information for the study in terms of roster verification.

2. Social Security Administration Submissions

Comprehensive SSA searches were first planned for 1967 along with the recording of personal data,⁴¹ and in 1972 the general shortcomings and statistical errors inherent in compiling data from the SSA were discussed. As a result, HMS-Mancuso implemented a procedural change from earlier analyses (i.e. those performed before August 1971) which relied solely on the dates provided by the SSA.⁴² This activity notwithstanding, it was 1976 before HMS-Mancuso noted the first SSA submission for NLO employees which encompassed a cohort of 6,696.⁴³

The most recent check against SSA records for "unknowns" from the NLO cohort was discussed in a letter to the Department of Energy. In the Fall of 1987, NLO management proposed to compare a list of vested employees to a list of employees whose vital status was unknown to SSA as of the end of 1982.⁴⁴

B. Death Certificate Retrieval

The retrieval of death certificates for NLO employees was a responsibility jointly held by NLO itself, and HMS-Mancuso and HMS-ORAU. As death certificates arrived, updates for dates of death were entered into the master file of all nuclear workers.⁴⁵ Death certificates were first requested in 1977 based on the first SSA search received in December 1976.³³ In 1978, HMS-ORAU mentioned that "[t]here is a printout in our file dated March, 1977 of a request to the states containing NLO employees and siblings...As of 1/78, only eight states have not been heard from."³³

In 1979, the first death certificate request under HMS-ORAU was made.⁴⁵ In April 1983, the ORAU Death Certificate Retrieval Office (DCRO) noted 4,439 unique ID numbers and some problems with death certificates of a small subset of them.⁴⁶ In 1985, HMS-ORAU reported that through 1982 approximately 97% of death certificates had been retrieved.^{47,48} In 1986 NLO resumed sending quarterly facility death certificates to the ORAU DCRO, a practice which had stopped in 1982.^{49,50,51}

C. Other Potential Sources

In July 1987, HMS-ORAU proposed at a meeting with NLO to discuss "identification of alternative sources of vital status information to improve the completeness of the follow-up of the Fernald worker population."⁵² At the time the present report was compiled, no follow-up to this recommendation had taken place.

VI. ISSUES AFFECTING COMPLETION OF THE NATIONAL LEAD OF OHIO ROSTER

A. Intra-Facility Transfers

It is possible that transfers from other feed mills or other MED/AEC/ERDA/DOE facilities to NLO have taken place, however, the documents studied for the present report do not indicate that these occurred on a significant enough scale to pose a concern at any particular phase of the DOE Health and Mortality Studies.

B. Incomplete Plant Rosters

The 1968 Progress Report noted that missing data for NLO "is available at...facilities, and efforts are underway to fill in much of the missing data."²⁵ However, in 1972, it was noted that no tests of roster completeness had been done.³² The tenth project year (1973-74) noted that "numerous consistency checks had been run to assure that no confounding has occurred among males and females, between employees, nonstarts, siblings of employees, and siblings of nonstarts..."⁵³ Findings from these checks did not differ from earlier analyses done in 1972.

C. Delays in Roster Assembly, Social Security Administration Searches, and Death Certificate Retrieval

At the later stages of HMS-Mancuso, delays not related to study design complications also were encountered in a number of key areas affecting the development of plant rosters. Work history data completion, OASDI death list, and death certificate retrieval for the feed mills were all identified as factors that necessitated a time extension of the overall project. In addition, records destruction and the general errors found in plant employment records were identified continually as major problems by the researchers. However, a major factor in delays in completing the rosters and vital statistics searches for the NLO study was due to the fact that the Feed Mills portion of the early HMS (primarily National Lead of Ohio, and Mallinckrodt Chemical Works) was placed in the third tier of priority after Hanford (#1), and the Oak Ridge sites (#2).

Beginning in 1974, lack of progress on NLO due to project funding and changing priorities became apparent. In 1974, HMS-Mancuso requested to see the study of NLO reactivated⁵⁴ One year later, it was noted that "nothing had been done [on NLO] since [1967] because of lack of funds."⁵⁵ Mancuso added that "we consider the personnel records for the study to be incomplete."⁵⁶

VII. SUMMARY

Epidemiologic interest in NLO preceded the initiation of the HMS through a feasibility study of its workers by University of Colorado researchers in 1962. From the inception of the HMS, NLO has a high priority, due to a variety of reasons such as its long-term period of operation, cohort size, data quality, cooperation of facility management, etc. In 1966, HMS-Mancuso decided to include all contractor employees. To save clerical time, it also decided to regard employees with reported earnings by SSA in a given quarter as alive for that quarter. Under contract with NLO, data entry was regularly reported to be ~95% complete for segments of the population beginning in 1967. However, upon transfer to ORAU, concerns were raised about the adequacy of the documentation and verifiability of these early activities. In June 1979, Jerome Wilson, a Ph.D. candidate from the University of North Carolina at Chapel Hill, began a study of NLO; these activities continue at HMS-ORAU.

VIII. REFERENCES

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