SEC Petition Evaluation Report
Petition SEC-00044

Report Rev # 0 Report Submittal Date: 10-12-2005

Petition Administrative Summary			
Petition Under Evaluation			
Petition #	Petition Type	Submittal Date	DOE/AWE Facility Name
SEC-00044	83.14	09-29-2005	Linde Ceramics Plant, Tonawanda, New York

Feasible to Estimate Doses with Sufficient Accuracy?											
Single Class				Multiple Classes				Determination Established for All Classes			
Yes		No	X	Yes		No		Yes	X	No	

Proposed Class Definition **(Abbreviated)**
All Atomic Weapons Employees who worked at the Linde Ceramics Plant from October 1, 1942 through October 31, 1947.

Related Petition Summary Information			
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status
NA	NA	NA	NA

Related Evaluation Report Information	
Report Title	DOE/AWE Facility Name
NONE	

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Evaluation Summary

This evaluation report by the National Institute for Occupational Safety and Health (NIOSH) covers a class of employees proposed for addition to the Special Exposure Cohort (SEC) in Petition 00044. The petition was submitted by an EEOICPA claimant who had been employed at the Linde Ceramics Plant in Tonawanda, New York, whose dose reconstruction could not be completed by NIOSH because of a lack of sufficient information. As provided under HHS regulations covering this circumstance and type of SEC petition (42 CFR § 83.14), NIOSH has defined a class of employees subject to this evaluation. This class includes all Atomic Weapons Employees at the Linde Ceramics Plant from October 1, 1942 through October 31, 1947.

In this SEC Evaluation Report, NIOSH provides its findings on the feasibility of estimating radiation doses of members of this class with sufficient accuracy (i.e., the feasibility of dose reconstruction) and on related matters, as required for NIOSH evaluations of SEC petitions under the Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA) and 42 C.F.R. pt. 83. This report will be considered by the Advisory Board on Radiation and Worker Health and by the Secretary of Health and Human Services (HHS). The Secretary of HHS will make final decisions concerning whether or not to add one or more classes to the SEC in response to the petition addressed by this report.

Feasibility of Dose Reconstruction

The feasibility determination for the class of employees covered by this evaluation report is governed by the requirements of the Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA) and 42 C.F.R. §§ 83.13(c)(1) and 83.14(b). Section 83.13(c)(1) states that "Radiation doses can be estimated with sufficient accuracy if NIOSH has established that it has access to sufficient information to estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances by any member of the class, or if NIOSH has established that it has access to sufficient information to estimate the radiation doses of members of the class more precisely than an estimate of the maximum radiation dose." Section 83.14(b) states that HHS will consider the determination by NIOSH that there was insufficient information to complete a dose reconstruction, as indicated in this present case, "sufficient, without further consideration, to determine that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy."

NIOSH has documented in this evaluation that it could not complete the dose reconstruction related to this petition. The basis of this finding is specified in this report, which demonstrates that NIOSH lacks access to sufficient information to estimate either the maximum radiation dose incurred by any member of the class or to estimate such radiation doses more precisely than a maximum dose estimate. Members of this class at the Linde Ceramics Plant may have received internal and external radiation exposures from the uranium and uranium progeny in the ores received and processed at the plant. NIOSH lacks any biological monitoring data or sufficient air monitoring information or sufficient process and radiological source information to estimate the potential airborne concentrations to which the proposed class may have been exposed (i.e., internal exposures).

Health Endangerment

The health endangerment determination for the class of employees covered by this evaluation report is governed by EEOICPA and 42 C.F.R. § 83.13(c)(3). Under these requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must also make a determination whether or not there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class. The regulation requires NIOSH to assume that any duration of unprotected exposure may have endangered the health of members of a class when it has been established that the class may have been exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents.

If the occurrence of such an exceptionally high level exposure has not been established, then NIOSH is required to specify that health was endangered for those workers who were employed for a number of work days aggregating at least 250 work days within the parameters established for the class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

The NIOSH evaluation did not identify evidence from the petitioner or from other resources that would establish that the class was exposed to radiation during a discrete incident likely to have involved exceptionally high level exposures as described above. The evidence reviewed in this evaluation indicates that some workers in the class may have accumulated substantial chronic exposures through episodic intakes of radionuclides. Consequently, NIOSH has specified that health was endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

Proposed Class Definition

This evaluation defines a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. This class includes Atomic Weapons Employees who worked at the Linde Ceramics Plant in Tonawanda, New York, for the period from October 1, 1942 through October 31, 1947, for a number of days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days of employment occurring within the parameters (excluding aggregate work day requirements) established for other classes of employees included in the SEC.

1.0 Purpose

The purpose of this report is to provide an evaluation of the feasibility of reconstructing the radiation dose for Atomic Weapons Employees who worked at the Linde Ceramics Plant in Tonawanda, New York, for the period from October 1, 1942, through October 31, 1947. The report completes the NIOSH evaluation in response to SEC Petition 00044.

This evaluation was conducted in accordance with 42 C.F.R. pt. 83 and the guidance contained in NIOSH's Internal Procedures for SEC evaluations, OCAS-PR-004. It provides information and analyses germane to considering a petition for adding a class of employees to the SEC. It does not provide any determinations concerning the feasibility of dose reconstruction that necessarily apply in the particular case of any individual energy employee who might require a dose reconstruction from NIOSH.

2.0 Introduction

Title 42 of the Code of Federal Regulations (C.F.R.) Part 83, *Procedures for Designating Classes of Employees as Members of the Special Exposure Cohort Under the Energy Employees Occupational Illness Compensation Program Act of 2000,* requires NIOSH to evaluate qualified petitions requesting HHS to add a class of employees to the SEC. The evaluation is intended to provide a fair, science-based determination of whether or not it is feasible to estimate with sufficient accuracy the radiation doses of the class of employees through NIOSH dose reconstructions.[1] If it is not feasible, the regulation requires NIOSH to make a determination with respect to the health endangerment of the class of employees. Specifically, § 83.14(b) states that HHS will consider the determination by NIOSH that there was insufficient information to complete a dose reconstruction, as indicated in this present case, "sufficient, without further consideration, to determine that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy."

NIOSH is required to document the evaluation in a report, which is provided to the petitioners and to the Advisory Board on Radiation and Worker Health (the Board). The Board will consider the NIOSH evaluation report, together with the petition, comments of the petitioner(s) and such other information as the Board considers appropriate, to make recommendations to the Secretary of HHS on whether or not to add one or more classes of employees to the SEC. Once NIOSH has received and considered the advice of the Board, the Director of NIOSH will propose decisions on behalf of HHS. The Secretary of HHS will make final decisions, taking into account the NIOSH evaluation, the advice of the Board, and the proposed decision issued by NIOSH. As part of this final decision process, the petitioner(s) may seek a review of certain types of proposed decisions issued by NIOSH.[2]

3.0 Proposed Class Definition and Petition Basis

[1] NIOSH dose reconstructions under EEOICPA are performed using the methods promulgated under 42 C.F.R. pt. 82 and the detailed implementation guidelines available at www.cdc.gov/niosh/ocas.

[2] See 42 C.F.R. pt. 83 for a full description of the procedures summarized here. Additional internal procedures are available at www.cdc.gov/niosh/ocas.

This NIOSH report provides a summary of the methods and findings of the NIOSH SEC evaluation for Atomic Weapons Employees who worked at the Linde Ceramics Plant for the period from October 1, 1942, through October 31, 1947. During this period, employees at this facility were involved in the chemical processing of uranium ore to produce U_3O_8 (Step I); conversion of U_3O_8 to UO_2 (Step II); and conversion of UO_2 to UF_4 (Step III). Linde Ceramics Plant was also involved in the research and development of processes that would be used for the processing of uranium ore into commercial quantities of U_3O_8, UO_2, and UF_4 (green salt).

The evaluation responds to a petition (SEC00044) submitted by an EEOICPA claimant who had been employed as a chemical operator at the facility during this period, whose dose reconstruction could not be completed by NIOSH because of a lack of sufficient dosimetry-related information. The determination by NIOSH that it is unable to complete a dose reconstruction for a EEOICPA claimant is a qualified basis for submitting an SEC petition pursuant to 42 C.F.R. § 83.9(b).

4.0 Feasibility

In the case of a petition submitted to NIOSH under 42 C.F.R. § 83.9(b), NIOSH has already completed research to determine that a dose reconstruction cannot be completed for an employee at the DOE or AWE facility. This determination by NIOSH provided the basis for the petition by the affected claimant. Further consideration by NIOSH is given to defining the extent of the class of employees who are similarly affected, as indicated by the completed research, and hence, for whom, as a class of employees, dose reconstruction is similarly not feasible. NIOSH also considers whether or not the completed research provides a basis for evaluating an additional class at the facility, for whom it might appear to NIOSH that dose reconstruction is unlikely to be feasible. If NIOSH were to identify such a basis, it would undertake a separate SEC evaluation to conduct necessary research on the additional class. This would allow NIOSH, the Board, and HHS to complete, without delay, their consideration of the class including a claimant for whom NIOSH has already determined a dose reconstruction cannot be completed and hence whose only possible remedy under EEOICPA would be through the addition of a class of employees to the SEC.

This section of this report provides a summary of research findings by which NIOSH determined that it lacked sufficient information to complete the relevant dose reconstruction and on which basis it has defined the class of employees for which dose reconstruction is not feasible. The determination relies on the same statutory and regulatory criteria that govern consideration of all SEC petitions. This determination has exceptional importance however, as explained under section 4.1 below. As in all SEC evaluation reports, this feasibility evaluation summarizes the radiological exposures of concern, the availability of information related to reconstructing radiation doses associated with the radiological exposures summarized, and analyzes separately and to the extent necessary the feasibility of reconstructing the radiation doses from internal and external exposures.

4.1 Statutory and Regulatory Criteria

The feasibility determination for the class of employees covered by this SEC Evaluation Report is governed by EEOICPA and 42 C.F.R. § 83.13(c) (1). Under the Act and rule, NIOSH must establish whether or not it has access to sufficient information to either estimate the maximum radiation dose that could have been incurred under plausible circumstances by any member of the class, or to estimate the radiation doses of members of the class more precisely than a maximum dose estimate. If NIOSH were to have access to the information sufficient for either case, then dose reconstruction would be considered feasible (NIOSH would consider it feasible to estimate radiation doses with sufficient accuracy).

In making the determination that a dose reconstruction cannot be completed, NIOSH systematically evaluates the sufficiency of all relevant data to this determination, which include the different types of monitoring data, process and source or source term data, which together or individually might assure NIOSH can estimate either the maximum dose the employee might have incurred, or a more precise estimate reflecting close monitoring of the employee's exposures or doses for part or all of the employee's career in nuclear weapons work.

The determination by NIOSH that a dose reconstruction cannot be completed, together with its substantive basis, are sufficient, in and of themselves, to support the determination by the Secretary of HHS that it is not feasible to estimate with sufficient accuracy the radiation dose potentially received by a class of employees, once the Board has provided the Secretary with a recommendation. As specified under Section 83.14(b), HHS will consider this determination "sufficient, without further consideration, to determine that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy." The remaining issues for consideration by NIOSH, the Board, and HHS are the appropriate scope of the determination (which is to be specified by the definition of the class of employees to which this determination is applied), and to the health endangerment determination.

4.2 Dose Reconstruction Findings

NIOSH determined, pursuant to 42 C.F.R. § 82.12, that a radiation dose reconstruction could not be completed for the employee identified in SEC Petition 00044, who was a chemical operator at the facility employed during a portion of the period from 1942 through 1947. Upon a review of all the available records concerning this facility, NIOSH has not obtained or located any personal monitoring records that could be used to estimate the amount of internal exposure to radiological materials the chemical operator may have incurred in processing the uranium ores. In addition, NIOSH found the available records, which include some area monitoring results and process and source term information, insufficient to estimate maximum internal radiation exposures to the chemical operator under plausible conditions. The research basis for these findings and other facility-specific research NIOSH completed concurrently are summarized in section 4.3 through 4.6 below.

4.3 Radiological Exposures

Linde Air Products Company performed work for the Manhattan Engineer District (MED) and its successor the U. S. Atomic Energy Commission (AEC) between 1942 and 1949. Tonawanda Laboratory performed research and development on uranium processing for the MED beginning

in late 1942 and probably ending in 1946. In early years, Linde Air Products Company operated pilot plants to develop procedures to be used at the ceramics plant. The ceramics plant produced uranium materials for the MED and AEC from 1943 to 1946 and from 1947 to 1949.

During this period, chemical operators and other employees involved in AWE operations at the Linde Ceramics Plant could have received internal and external radiation exposures from: the uranium and uranium progeny in the ores received and processed at the plant to produce U_3O_8 (Step I); conversion of U_3O_8 to UO_2 (Step II); and conversion of UO_2 to UF_4 (Step III). Linde Ceramics Plant was also involved in the research and development of processes that would be used for the processing of uranium ore into commercial quantities of U_3O_8, UO_2, and UF_4.

Step I Process and Radiological Exposures

Linde used two types of ores in the production of U_3O_8, "African ore" and "domestic ore." The African ore was not preprocessed before being shipped to Linde. The domestic ore included preprocessed domestic ores and byproducts of other uranium conversion processes.

The pre-processed domestic ore contained mainly Uranium 234, 235, and 238 and their short-lived progeny that had grown in after the extraction process. The primary radiological hazard from the domestic ore is alpha and beta emissions. The African ores were not pre-processed and contained significant radium concentrations. The radium and its progeny would produce significant gamma radiation and elevated levels of radon.

There were several activities during Step I that could produce significant internal radiological exposures. When the ore was sent to Linde, it was sent by railcar in burlap bags. The Technical Basis Document (TBD), ORAUT-TKBS-0025, *An Exposure Matrix for Linde Ceramics Plant (including Tonawanda Laboratory)* (ORAU 2005) indicates that the highest radon exposures occurred during the opening of the railcars, storage of the African ore, opening the burlap bags of African ore, and the sampling and the material handling of the African ore. Elevated air concentrations of radium dust were also likely, particularly in areas where the African ore was unloaded from the burlap bags and during the initial processing of dry ore.

The subsequent digestion process to produce U_3O_8 was mostly a wet process, which was likely to produce substantially lower airborne concentrations and internal exposures than would have occurred during the initial transfer of the ore and dry processing.

The highest external radiological exposures would have occurred during Step I from the gamma rays from the radium and radium progeny.

Step II Process and Radiological Exposures

Step II converted U_3O_8 to UO_2 (brown oxide) with UO_3 (orange oxide) as an intermediary product. U_3O_8 in buggies from Step I was weighed and hoisted to the second floor. It was then fed into nitric acid in digest tanks with scoops. The digest tanks were heated to 90°C. After digestion, insoluble impurities were filtered out using a filter press. Liquids were piped from one vessel to another. Frequent chemical analyses of samples were required in this process to

determine the progress of chemical reactions. The processing produced various liquors and some associated cakes that were designated "OK" or "NG" (LAPCCP 1946).

Step II was mostly a wet process. Therefore, airborne concentrations of radiological dusts would not have been as high as processes described above in Step I. Radium and other uranium progeny were removed in Step I. Frequent sampling, however, had potential to result in personnel contamination and area contamination, which might have produced substantial airborne activity.

Step III Process and Radiological Exposures

UO_2 was weighed and hand-troweled into shallow trays inside a hood with a dust collector operating. The oxide was furrowed when loaded to maximize surface area. The trays were transported on buggies and inserted into the furnace. After loading, the furnace was sealed, purged of air, and heated to the starting temperature, upon which the flow of HF gas was started. After the required number of hours, the heat and gas flow were stopped and the furnace was purged of HF gas, cooled, and opened. The trays were removed from the furnace and hand-placed onto buggies for transport to and placement inside an unloading hood with a dust collector. Good material (light green) was loaded into hoppers. Bad material (dark green) was placed in fiber-pack drums for later re-treatment. Good material was pulverized, blended, sampled, packaged, weighed, and shipped (LAPCCP 1946).

The handling of dry material and the pulverizing, blending, sampling of the dry material are likely to have produced the highest airborne activity and internal exposure to uranium.

NIOSH has compiled and published a more complete summary of the information available to NIOSH on the feed materials, processes, radiation exposures, and monitoring practices at the Linde Ceramics Plant in Tonawanda, New York. This information is summarized in the TBD (ORAU 2005) and is available online from www.cdc.gov/niosh/ocas.

4.4 Summary of Data Resources and Limitations

The primary data used for determining internal exposures are from personal monitoring data, such as urinalysis, fecal samples, and whole body counting results. If these are unavailable, the air monitoring data from breathing zone and general area monitoring are used to estimate the potential internal exposure. If personal monitoring and breathing zone area monitoring are unavailable, internal exposures can sometimes be estimated using more general area monitoring, process information, and information characterizing and quantifying the source term.

The same hierarchy is used for determining the external exposures to the cancer site. Personal monitoring data from film badges or thermal luminescent detectors (TLD) are the primary data used for determining external exposures to the cancer site. If there are no personal monitoring data, exposure rate surveys, process, and source term modeling can sometimes be used to reconstruct the potential exposure.

A more detailed discussion of the information required for dose reconstruction can be found in OCAS-IG-001, *Internal Dose Reconstruction Implementation Guide* and OCAS-IG-002,

External Dose Reconstruction Implementation Guide. These documents are available at: http://www.cdc.gov/niosh/ocas/ocasdose.html.

Urinalysis for the purpose of internal dosimetry was not implemented at the Linde Ceramics Plant until November 1947. Medical urinalysis was conducted during the period. However, the samples were not analyzed for any radiological activity or uranium content. Other methods of bioassay were not fully developed before 1948 and, lacking evidence of any prior attempt at utilizing these other methods of determining internal monitoring, NIOSH assumes that these other methods (chest counting, fecal monitoring etc.) were not used at Linde prior to 1948. Section 3.2.1 of the Linde TBD (ORAU 2005) provides additional information concerning these matters.

A formal air monitoring program, including task analysis with measured air concentrations in breathing zone, general areas and process areas was not implemented until 1947. There are some measurement data for airborne radioactivity and some radon breath sample results. However, there are no breathing zone air samples. There are records of approximately 200 air samples taken to determine radon concentrations during pilot plant and production processing of African ore at Linde between 1942 and 1946.

NIOSH has access to information concerning the African and domestic ores, as well as other data concerning product materials and general information on processes. This information could be used to develop the source term for various operations and activities. More detailed information is available in Sections 2.2 and 4.1.3 of the Linde TBD (ORAU 2005).

4.5 Feasibility of Estimating Internal Exposures

As indicated in section 4.4, no bioassay records for members of this class are available, nor are there breathing zone area monitoring results from which internal exposures could be estimated. Although a formal air monitoring program was implemented subsequently, the results of which are available (AEC 1949), these later measurements are not sufficient for estimating earlier exposures. As indicated in the TBD, a general review of air concentration data, safety reports, and production and progress reports from the beginning of operation through 1946 indicates that there were significant reductions in exposures due to improved engineering, process, workplace and administrative controls brought into effect prior to the establishment of the formal monitoring program. Consequently, NIOSH is unable to estimate internal exposures based on the general air monitoring data available.

NIOSH also lacks sufficiently detailed process information to apply, in combination with the limited air monitoring and source term data, to estimate internal exposures. In order to develop the exposure matrix using process information, NIOSH needs information such as detailed process description, process layout, process equipment sizing, and worker locations. Although some of this information is available, there were significant changes in processes and controls during the time period that are only generally documented. NIOSH would require adequate specifics and comparable processes at this or another facility that were adequately monitored to estimate exposures during this period at the Linde Ceramics Plant. Lacking such, NIOSH finds

that it is not feasible to estimate with sufficient accuracy internal exposures and resulting doses for the class of employees covered by this evaluation.

The initial class for which feasibility was considered by NIOSH in response to SEC Petition 00044 comprised chemical operators who worked at the Linde Ceramics Plant from 7/1/1943 to 9/30/1946. These would be considered process operations positions according to the job categorization in the Linde TBD (ORAU 2005). These workers were potentially exposed to a variety of uranium chemical forms and may have worked in multiple uranium process areas. While the exposure of these process operations workers would likely to have exceeded the exposures of other groups of workers, NIOSH has been unable to document controls to segregate process areas from other operations at the facility. The TBD indicates nurses, maintenance personnel, janitors, personnel who used locker rooms or the lunch room, and office personnel regularly may have had offices in or spent some time in the ceramics plant buildings. (Section 4.1.3.2.1). Consequently, without information regarding job duties and location, the feasibility findings above would apply to all employees at the facility, including but not limited to chemical control operators.

4.6 Feasibility of Estimating External Exposures

This evaluation responds to a petition based on NIOSH determining that internal radiation exposures could not be reconstructed for a dose reconstruction referred to NIOSH by the Department of Labor. As noted above, HHS will consider this determination to be sufficient without further consideration to determine that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy. Consequently, it is not necessary for NIOSH to evaluate the feasibility of reconstructing external radiation exposures in this case. NIOSH expects, however, that such exposures can be estimated with sufficient accuracy. Information on the data available to NIOSH for such purposes and limitations of such data are provided in several documents, including but not limited to: *An Exposure Matrix for Linde Ceramics Plant (including Tonawanda Laboratory)*, (ORAUT-TKBS-0025) and Technical Information Bulletin, *Dose Reconstruction from Occupationally Related Diagnostic X-ray Procedures* (TIB-0006). These documents are available online from www.cdc.gov/niosh/ocas.

4.7 Summary of Feasibility Findings

This report evaluated the feasibility for estimating the dose, with sufficient accuracy, for all Atomic Weapons Employees at the Linde Ceramics Plant from October 1, 1942, through October 31, 1947. NIOSH determined that it lacks biological monitoring data or sufficient air monitoring and processing information to reconstruct the internal exposures to radiological dusts at the facility during this time period. Consequently, NIOSH finds that it is not feasible estimate with sufficient accuracy the radiation doses resulting from internal exposures received by members of this class of employees.

5.0 Health Endangerment

The health endangerment determination for the class of employees covered by this SEC Evaluation Report is governed by EEOCIPA and 42 C.F.R. § 83.13(c)(3). Under these

requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must also make a determination whether or not there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class. The regulation requires NIOSH to assume that any duration of unprotected exposure may have endangered the health of members of a class when it has been established that the class may have been exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents.

If the occurrence of such an exceptionally high level exposure has not been established, then NIOSH is required to specify that health was endangered for those workers who were employed for a number of work days aggregating at least 250 work days within the parameters established for the class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

NIOSH has determined that it is not feasible to estimate with sufficient accuracy radiation doses from potential internal exposures, and that the health of the employees covered by the proposed class definition provided in section 6.0 of this evaluation may have been endangered.

The NIOSH evaluation did not identify any evidence from the petitioner or from other resources that would establish that the class was exposed to radiation during a discrete incident or similar conditions resulting from the failure of radiation exposure controls and likely to have produced levels of exposure similarly high to those occurring during nuclear criticality incidents. The evidence reviewed in this evaluation indicates that some workers in the class may have accumulated substantial chronic exposures through episodic intakes of radionuclides, combined with external exposures to gamma, beta, and neutron radiation. Consequently, NIOSH is specifying that health was endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class or in combination with work days (excluding aggregate work day requirements) within the parameters established for one or more other classes of employees in the SEC.

6.0 Class Definition

This evaluation defines a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. This class includes Atomic Weapons Employees who worked at the Linde Ceramics Plant for the period from October 1, 1942 through October 31, 1947, and whom were employed for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days of employment occurring within the parameters (excluding aggregate work day requirements) established for other classes of employees included in the SEC.

7.0 References

AEC 1949, Health Hazards in NYOO Facilities Producing and Processing Uranium: A status Report – April 1, 1949, "Prepared by the New York Operations Office Medical Division

LAPCCP 1946, Linde Air Products Company Ceramics Plant 1946, Step II Construction, Process and Operation Report

ORAU 2005, ORAUT-TKBS-0025, An Exposure Matrix for Linde Ceramics Plant (including Tonawanda Laboratory), May 31, 2005