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Landis Machine Tool Company

BP.1 Introduction

This document serves as an appendix to Battelle-TBD-6000, Site Profiles for Atomic Weapons Employers that Worked Uranium and Thorium Metals. This appendix describes the results of document research specific to this site. Where specific information is lacking, research into similar facilities described in the body of this Site Profile is used.

According to information found in the DOE facility database¹, the work performed at Landis Machine Tool, was undertaken by National Lead of Ohio (Fernald) personnel. It appears that these individuals used Landis equipment for two days in 1952 to perform tests involving the machining of uranium slugs.

BP.2 Site Description

In 1952, National Lead of Ohio (Fernald) personnel performed tests involving the machining of uranium slugs at Landis Machine Tool Company. The tests were performed over a two day period.¹

BP.2.1 Site Activities

National Lead of Ohio (Fernald) personnel performed tests involving the machining of uranium slugs at Landis Machine Tool Company. The tests were performed over a two day period in 1952. Based on the sample data sheets found in the site research database, it appears the work took place on September 18 and 19 and involved centerless grinding of uranium slugs.

Although there is no information regarding the specifics of the work performed at Landis Machine Tool, the following quote from the Bethlehem Steel Technical Basis Document describes the process as performed at Bethlehem Steel during this approximate time period (1949-52):

The canning process required a precision ground uranium piece. AEC 1949f describes the process of centerless grinding using a No. 3 Cincinnati Centerless Grinder using initial (rough) pass removing 0.005"-0.010" with finishing passes removing 0.001"-0.002". The basic principle was for the cutting pressure of the grinding wheel to keep the rod in contact with the rest blade and the regulating wheel. The rotation of the regulating wheel axis causes the rod to rotate at a constant peripheral speed and the inclination of the regulating wheel axis moves the work from the front to the rear of the machine. The operation of grinding uranium required the use of a constant flow of water to prevent the uranium from burning and sparking which in turn significantly reduces the airborne hazard as evidenced by the air monitoring data.²

We were unable to find any specific information as to the number of uranium slugs processed at Landis Machine Tool, but given the 2-day work period, the number is likely to be relatively small.

BP.2.2 Job Categories

Table BP.1 assigns Landis Machine Tool Company claimants' job titles as of the effective date of this appendix to the Job Category listed in **Bold Text** below. The claimant had a support job (Inspector). As such, he may have had occasion to be in the work area during the machining tests, but would not have been directly involved in handling the slugs or operating the grinder. As such, his work location during the grinding would likely not have placed him in the area where dust concentrations were greatest (as with plant floor high job titles).

Plant Floor High	(Involved directly in operations)
Plant Floor Low	(Involved in support of operations)
Supervisor	(Assumed to spend some time in the production areas)
Clerk	(Assumed to have minimal exposure)

Claims forwarded to NIOSH by the Department of Labor after the effective date of this appendix will be evaluated during the dose reconstruction process to determine the most appropriate of the four Job Categories.

BP.3 Occupational Medical Dose

No information regarding occupational medical dose specific to Landis Machine Tool Company was found. Given the short-term nature of the AWE work at this site, it is unlikely that medical X-rays would have been required. Nevertheless, information to be used in dose reconstructions for which no specific information is available is provided in ORAUT-OTIB-0006, the dose reconstruction project technical information bulletin covering diagnostic x-ray procedures.

BP.4 Occupational Internal Dose

Air sampling was conducted during the performance of the tests on April 18-19, 1952. There is reference to handling 2-3 slugs at a time in various processes during the monitoring, it must be assumed that the measurements are representative of the conditions throughout the 2-day operation period. It is favorable to assume that centerless grinding was performed continuously during the two-day period and that the breathing zone air sampling data collected represents the exposure of personnel performing the grinding operations. The exposures for other personnel, such as inspectors, supervisors and clerical, are calculated by multiplying the grinders' exposures adjusting the grinders' exposures accordingly:

- **Plant floor low:** 0.5. This category includes inspectors, helpers, tool repair, and other ancillary job titles in which employees may be in the work area, but not directly involved in the grinding operation;
- **Supervisors:** 0.25. This category includes managers, foremen, observers, etc.
- **Clerical:** 0.025. This category includes office personnel. Those who spend minimal time in the work area.

To estimate the hours per year of exposure, it is assumed that grinding tests took place throughout the two-day testing period (April 18-19, 1952). There is no information in the file regarding how many shifts operated at this facility. Absent any information to the contrary, assume grinding tests occurred on all shifts.

Tables BP.2 and BP.3 contain inhalation and ingestion intakes in terms of total pCi for the entire exposure period, compiled for each job category and each year.

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BP.5 Occupational External Dose

There was no information in the site research database with respect to external exposures. No radiation surveys were performed during or after the tests. Therefore, external doses must be calculated based on airborne contamination levels (the results of the breathing zone samples). This Battelle TBD provides guidance for calculating external doses associated with submersion and surface loading based on airborne contamination levels. Beta radiation doses are based on direct handling of natural uranium metal slugs as shown on table 3.4 in the TBD.

Tables BP.4 and BP.5 contain external doses, in terms of total mR for the duration of the exposure period.

BP.6 Residual Contamination

There were no tests performed to verify the site had been decontaminated after the tests, but given the fact that the grinding work at the site was performed by National Lead of Ohio personnel, it would be unlikely that clean-up would not have occurred. Further, given the short-term nature of the work at this site, NIOSH concluded that the potential for residual contamination at this site is minimal.³

BP.7 References

1. DOE Office of Health, Safety and Security, EEOICPA web site.
<http://www.hss.energy.gov/healthsafety/fwsp/advocacy/faclist/findfacility.cfm>
2. Technical Basis Document: Basis for Development of an Exposure Matrix for Bethlehem Steel Corporation, Lackawanna, NY. Period of Operation 1949-1952. p.6
<http://www.cdc.gov/niosh/ocas/pdfs/tbd/ocastbd3r0.pdf>
3. Report on Residual Radioactive and Beryllium Contamination at Atomic Weapons Employer Facilities and Beryllium Vender Facilities.
<http://www.cdc.gov/niosh/ocas/pdfs/tbd/rescon/rcontam1206.pdf>
<http://www.cdc.gov/niosh/ocas/pdfs/tbd/rescon/appen-a2.pdf>

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Table BP.1. Job Categories for all current claimants who worked at Landis Machine Tool Company

Job Title	Exposure Category
Service Department Mechanic	2
Electrical Assembler	2

Table BP.2 INTERNAL DOSE PATHWAYS - Inhalation of Airborne Radionuclides**Assumptions:**Operational Period Daily Weighted Average Air Concentration, Plant Floor High: 46 dpm/m³Residual Period Daily Weighted Average Air Concentration: 0 dpm/m³

GSD is 7.5

Conversion Factor: 2.22 dpm/pCi

Breathing Rate: 1.2 m³/hour

All intakes assume full-time employment for the exposure time period of two days.

Intake value is the geometric mean of a lognormal distribution

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Total Intake (pCi)	GSD	TBD Reference or Research Justification
Plant Floor High	1952	Operations	16	U234	3.98E+02	7.5	Based on Measured air samples, BZ & P
Plant Floor Low	1952	Operations	16	U234	1.99E+02	7.5	Based on Measured air samples, BZ & P
Supervisor	1952	Operations	16	U234	9.96E+01	7.5	Based on Measured air samples, BZ & P
Clerical	1952	Operations	16	U234	9.96E+00	7.5	Based on Measured air samples, BZ & P

Table BP.3 INTERNAL DOSE PATHWAYS - Ingestion of Airborne Radionuclides**Assumptions:**Air Concentration to Intake Conversion Factor: $3.06E-05 (M^3/d)/(hr/y)$ - see 7.1.6 TBD-6000

Deposition velocity: 0.00075 m/s

Resuspension Factor: $1.00E-06 1/m$

All intakes assume full-time employment for the exposure time period of two days.

Intake value is the geometric mean of a lognormal distribution

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Total Intake (pCi)	GSD	TBD Reference or Research Justification
Plant Floor High	1952	Operations	16	U234	1.02E-02	7.5	Based on Measured air samples, BZ & P
Plant Floor Low	1952	Operations	16	U234	5.08E-03	7.5	Based on Measured air samples, BZ & P
Supervisor	1952	Operations	16	U234	2.54E-03	7.5	Based on Measured air samples, BZ & P
Clerical	1952	Operations	16	U234	2.54E-04	7.5	Based on Measured air samples, BZ & P

Table BP.4 EXTERNAL DOSE PATHWAYS - Whole Body**Assumptions:**Submersion Dose Conversion Factor: 2.462E-09 mrem/h/dpm/m³

Deposition velocity: 0.00075 m/s

Contaminated Surface Dose Conversion Factor: 5.615E-10 mrem/h/dpm/m²

All external dose from estimated exposure to uranium slugs

Residual period: Assume no handling of U metal - only exposure is from residual contamination on floor and in air

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	External Whole Body Dose (mR)	GSD	TBD Reference or Research Justification
Plant Floor High	1952	Operations	16	U234	8.38E-01	5.0	Generic Metal TBD, Section 6.3
Plant Floor Low	1952	Operations	16	U234	4.19E-01	5.0	Generic Metal TBD, Section 6.3
Supervisor	1952	Operations	16	U234	4.19E-02	5.0	Generic Metal TBD, Section 6.3
Clerical	1952	Operations	16	U234	4.92E-07	5.0	Generic Metal TBD, Section 6.3

Table BP.5 EXTERNAL DOSE PATHWAYS - Skin**Assumptions:**

All assumptions from TBD-6000 Section 6.3

Operational Period: Non-penetrating dose to skin 230 mR/hour (hands and forearms) 20.8 mR/hour (other)

Plant Floor High: Assume hands in contact with metal 50% of time. Other skin is 100% of dose rate at 1-ft, 20.8 mrem/h

Plant Floor Low: 50% of Plant Floor High

Supervisor: assume 10% of Plant Floor Low for time in contact with metal

Clerical: assume no handling of U metal.

Residual Period: Non-penetrating dose to skin 3.9E-06 mr/hour

Assume no handling of U metal.

Assume 10x the photon whole body dose rate

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Skin Dose: Hands & Forearms (mR)	Skin Dose: Other (mR)	GSD	TBD Reference or Research Justification
Plant Floor High	1952	Operations	16	U234	1.84E+03	1.66E+02	5.0	Generic Metal TBD, Section 6.3
Plant Floor Low	1952	Operations	16	U234	9.20E+02	8.32E+01	5.0	Generic Metal TBD, Section 6.3
Supervisor	1952	Operations	16	U234	9.20E+01	8.32E+00	5.0	Generic Metal TBD, Section 6.3
Clerical	1952	Operations	16	U234	0.00E+00	0.00E+00	5.0	Generic Metal TBD, Section 6.3