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New Total Rewrite Revision Page Change

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Heald Machine Company

BD.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.

BD.2 Site Description

The Heald Machine Company located in Worcester, Massachusetts was subcontracted in June 1959 by National Lead of Ohio (NLO) to produce 1 precision drilling machine to perform centerless grinding of uranium slugs. The contract included a performance test of the drilling machine before delivery to NLO, the test to be performed at Heald Machine Company. This acceptance test occurred on one occasion over 4 days.

BD.2.1 Site Activities

In May, 1960 an engineering acceptance test was conducted at Heald Machine Company to demonstrate the capability of a "multi-bore" drilling machine to drill four uranium slugs at a time. 100 solid uranium cylinder test pieces were contracted to be run, provided by NLO, along with the drill bits. There are no records of the actual number tested. There also are no records of any other work involving uranium at this site other than the May 1960 period. The actual test dates where uranium was processed are May 17-19, 1960. Decontamination was conducted from May 19-20, 1960, and is described as having no contamination above background level.

Campaign Process Details

Weeks prior to the tests with uranium, an engineer from NLO visited Heald Machine and observed the operation of the precision drilling machine, confirming its proper operation using cast iron slugs.

March 16, 1960: Background air sampling was also performed on this date.

May 17-19, 1960: The slug drilling test commenced and continued until noon on Thursday, May 19. Air samples were collected on May 18 during the test. The drilling machine was partially decontaminated and the floor vacuumed at the end of each working period. The drilling machine was located in an unventilated enclosure. Air monitoring results were essentially the same as the background samples collected prior to these tests.

May 19-20, 1960: Full decontamination of the area and equipment was performed. All coolant with chips was collected and sealed in 30 gallon drums which were packed into 55 gal drums and returned to NLO. A survey of the area and equipment was performed to confirm no radiation levels above background. This work was completed at 3 PM on the 20th. All materials associated with the test were under the control of NLO and returned to NLO.

BD.2.2 Job Categories

Each claim will be evaluated to determine the most appropriate Job Category from the list below.

MACHINING – Centerless Grinding (1960)

Plant Floor High	(Involved directly in operations—dose based on site specific data)
Plant Floor Low	(Involved in support of operations—dose based on 50% of plant floor high above)
Supervisor	(Assumed to spend some time in the production areas—internal dose based on 25% of plant floor high above)
Clerk	(Assumed to have minimal exposure—dose based on exposure to 2.5% of plant floor high above)
Employed after AWE period	Assumed to have no exposure based upon FUSRAP surveys.

BD.3 Occupational Medical Dose

No information regarding occupational medical dose specific to Heald Machine Company was found. 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.

BD.4 Occupational Internal Dose

Air monitoring data are available from two air sampling campaigns, pre- and post-engineering acceptance test. Samples were collected by National Lead of Ohio. All samples were general area samples. There is a summary report which discusses the engineering test and the results of the air monitoring. The conclusions of the report state that the air monitoring results were not significantly different from the background levels measured two months previously when no uranium was present and that after decontamination and a radiation survey there was no residual radiation contamination above background levels. The background-corrected geometric mean air concentration during the machining test was 0.42 dpm/m³.

The operation occurred in an enclosure with no ventilation. Metalworking fluids were employed.

These values were used to derive the inhalation values presented in Table BD.1. The values in the table present these values as a pCi per calendar day inhalation. These values were used to determine an ingestion intake in accordance with this TBD. Those values are presented as a pCi per calendar day ingestion in Table BD.2.

BD.5 Occupational External Dose

No data were found in the Site Research database related to occupational external dose during AWE work. The work performed at Heald Machine Company involved a 3-day

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centerless grinder engineering performance test and 1 day of decontamination. Therefore, the external dose values in the TBD for centerless grinding should be used.

Tables BD.4 and BD.5 present these values as a mrem per calendar day value to be used for each calendar year listed.

BD.6 Residual Contamination

On May 19 & 20, 1960, after the engineering performance test had been completed a complete decontamination of the machine and surrounding area was performed. A radiation survey showed no radiation present above background levels. In 1990, the Department of Energy formally eliminated Heald Machine Company from the list of FUSRAP sites. It was deemed unlikely that any significant residual contamination was present due to the small quantities handled and the documented decontamination efforts, therefore there was little potential for exposure to residual contamination².

BD.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. 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>

Table BD.1 INTERNAL DOSE PATHWAYS - Inhalation of Airborne Radionuclides**Assumptions:**Operational Period Daily Weighted Average Air Concentration, Plant Floor High: 0.42 dpm/m³Residual Period Daily Weighted Average Air Concentration: 0 dpm/m³

Conversion Factor: 2.22 dpm/pCi

Breathing Rate: 1.2 m³/hour

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

Total intake values represent 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	1960	Operations	40	U234	9.01E+00	2.8	Measured air samples
Plant Floor Low	1960	Operations	40	U234	4.50E+00	2.8	Measured air samples
Supervisor	1960	Operations	40	U234	2.25E+00	2.8	Measured air samples
Clerical	1960	Operations	40	U234	2.25E-01	2.8	Measured air samples

Table BD.2 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: $1.00E-06 1/m$

Total intake values represent 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	1960	Operations	40	U234	2.30E-04	2.8	Measured air samples
Plant Floor Low	1960	Operations	40	U234	1.15E-04	2.8	Measured air samples
Supervisor	1960	Operations	40	U234	5.75E-05	2.8	Measured air samples
Clerical	1960	Operations	40	U234	5.75E-06	2.8	Measured air samples

Table BD.3 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	1960	Operations	40	U234	2.10E+00	5	Generic Metal TBD, Section 6.3
Plant Floor Low	1960	Operations	40	U234	1.05E+00	5	Generic Metal TBD, Section 6.3
Supervisor	1960	Operations	40	U234	1.05E-01	5	Generic Metal TBD, Section 6.3
Clerical	1960	Operations	40	U234	2.63E-08	5	Generic Metal TBD, Section 6.3

Table BD.4 EXTERNAL DOSE PATHWAYS - Skin

Assumptions:

All assumptions from TBD-6000 Section 6.3

Operational Period: Non-penetrating dose to skin 115 mR/hour (hands and forearms) 10.4 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	1960	Operations	40	U234	4.60E+03	4.16E+02	5	Generic Metal TBD, Section 6.3
Plant Floor Low	1960	Operations	40	U234	2.30E+03	2.08E+02	5	Generic Metal TBD, Section 6.3
Supervisor	1960	Operations	40	U234	2.30E+02	2.08E+01	5	Generic Metal TBD, Section 6.3
Clerical	1960	Operations	40	U234	0.00E+00	0.00E+00	5	Generic Metal TBD, Section 6.3