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Mitts & Merrel Company

CU.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, the Mitts & Merrel Company of Saginaw, Michigan. Where specific information is lacking, research into similar facilities described in the body of this Site Profile is used.

CU.2 Site Description

In 1956, the Mitts and Merrell Company conducted a test for National Lead of Ohio (Fernald) in which two pieces of thorium metal (a small piece and a 10-pound piece) were reduced to small particle-sized pieces in its Hog Grinder.¹

CU.2.1 Site Activities

The available documentation indicates that at least 10 pounds of thorium metal (no isotope specified) was ground into small particles in a hog grinder. Heavy dusting was described and confirmed with breathing zone and general area samples. The work was performed (the documentation makes it appear that the work took place on one day, June 28, 1956) in a building which was reportedly razed in 1960. No decontamination of equipment or work area was described. Therefore, assume residual contamination period from June 28, 1956 through December 31, 1960.

CU.2.2 Job Categories

Table CU.1 assigns Mitts & Merrel Company claimants' job titles as of the effective date of this appendix to the Job Categories listed in **Bold Text** below. The one claimant was a machinist/grinder. With no information found in any of the site documentation, it would be favorable to assume the claimant was the operator of the hog grinder involved in the test. His exposure is therefore characterized as "plant floor high."

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.

CU.3 Occupational Medical Dose

No information regarding occupational medical dose specific to Mitts & Merrel Company was found. The claimant indicated annual medical x-rays during the 1970's in his CATI interview. 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.

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CU.4 Occupational Internal Dose

Based upon all documentation in the file, it appears that AWE work at this facility consisted of a one-day test in which two pieces of thorium (a small piece and a 10-pound piece) were placed into a hog grinder and reduced to small thorium particles. Air sampling was performed during and for a few minutes after the test. The breathing zone (BZ) samples cover 1.75 minutes and the general area (GA) samples cover 19 minutes. To calculate a daily weighted average (DWA) exposure, a weighted average of the BZ samples and another weighted average of the GA samples was used. Since only 20.75 minutes were covered by the sampling, we assumed dust levels during the period that was not sampled to be 50% of the lowest GA sample result or 87 dpm/m³. The calculated DWA is 262.1 dpm/m³ for the day of the test. A lognormal distribution using this value as the mean and a geometric standard deviation of 3 would have a geometric mean of 143 dpm/m³. This represents “plant floor high” exposure levels. Assume one full day of exposure at this level for all employees on staff on June 28, 1956, the day of the test. Other job categories should be scaled as follows:

- Plant floor low—50% of plant floor high exposure
- Supervisor—25% of plant floor high exposure
- Clerical—10% of supervisor exposure (2.5% of plant floor high)

Tables CU.2 and CU.3 contain inhalation and ingestion intakes. For the operational period, the intakes are expressed in terms of pCi for the whole exposure period, for each job category and each year. For the residual periods, intakes are expressed as pCi/d averaged over a 365-day year.

CU.5 Occupational External Dose

There was no information in the site research database with respect to external exposures. No radiation surveys were performed during the tests.

Given the lack of contemporaneous survey data, external doses are calculated based on airborne contamination levels as described above. This Battelle TBD provides guidance for calculating external doses associated with submersion and surface loading based on airborne contamination levels.

Another source of external dose would be the handling of thorium metal. Assume storage of approximately 10 pounds on site for 2 days (this includes the two pieces prior to grinding) and the small particle-size pieces after grinding. Also assume the grinder handled the two pieces for a total of approximately 2 minutes during the tests and packaged the smaller pieces afterward.

Tables CU.4 and CU.5 contain external doses, associated with the work at this facility. For the operational period, the doses are expressed as total dose received during the operating day. For residual periods, the doses are expressed as mR/d averaged over a 365-day year.

CU.6 Residual Contamination

The NIOSH “Report on Residual Radioactive and Beryllium Contamination at Atomic Weapons Employer Facilities and Beryllium Vender Facilities” indicates that: “Without further documentation of follow-up decontamination actions taken at that time, and

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consideration of the assumption that no additional post-operations radiological survey documentation exists, it is determined that there is a significant potential for residual contamination after completion of this operation. The facility where this work was reportedly performed was referred to as the 'north' or 'riverside' facility. Based on an interview with a knowledgeable employee, this facility was demolished in 1959-1960 and replaced with a parking lot.² We assume the facility was demolished at the end of 1960 and employees were therefore potentially exposed to residual contamination from June 28, 1960 through December 31, 1960.”

CU.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>

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Table CU.1 Job Categories for all current claimants who worked at Mitts & Merrel Co.

Job Title	Exposure Category
Machinist/Grinder	1

Table CU.2 INTERNAL DOSE PATHWAYS - Inhalation of Airborne Radionuclides**Assumptions:**Operational Period Daily Weighted Average Air Concentration, Plant Floor High: 143 dpm/m³Residual Period Daily Weighted Average Air Concentration: 0.004 dpm/m³

GSD derived from measurement data

Conversion Factor: 2.22 dpm/pCi

Breathing Rate: 1.2 m³/hour

All intakes during the operational period are in total pCi for the operating period. For residual periods, it is pCi/d averaged over a calendar year.

Intake values are the geometric mean of a lognormal distribution

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Intake (pCi/d*)	GSD	TBD Reference or Research Justification
Plant Floor High	1956	Operations	10	Th	7.75E+02	3.0	Measured air samples
Plant Floor High	1956	Residual	1000	Th	5.73E-03	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor High	1957-60	Residual	2000	Th	1.15E-02	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor Low	1956	Operations	10	Th	3.87E+02	3.0	Measured air samples
Plant Floor Low	1956	Residual	1000	Th	5.73E-03	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor Low	1957-60	Residual	2000	Th	1.15E-02	3.0	Based on calculated deposition & resuspension of 1956 operation
Supervisor	1956	Operations	10	Th	1.94E+02	3.0	Measured air samples
Supervisor	1956	Residual	1000	Th	5.73E-03	3.0	Based on calculated deposition & resuspension of 1956 operation
Supervisor	1957-60	Residual	2000	Th	1.15E-02	3.0	Based on calculated deposition & resuspension of 1956 operation
Clerical	1956	Operations	10	Th	1.94E+01	3.0	Measured air samples
Clerical	1956	Residual	1000	Th	5.73E-03	3.0	Based on calculated deposition & resuspension of 1956 operation
Clerical	1957-60	Residual	2000	Th	1.15E-02	3.0	Based on calculated deposition & resuspension of 1956 operation

Table CU.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 during the operational period are in total pCi for the operating period. For residual periods, it is pCi/d averaged over a calendar year.

Intake values are the geometric mean of a lognormal distribution

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Intake (pCi/d*)	GSD	TBD Reference or Research Justification
Plant Floor High	1956	Operations	10	Th	1.98E-02	3.0	Measured air samples
Plant Floor High	1956	Residual	1000	Th	5.34E-05	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor High	1957-60	Residual	2000	Th	1.07E-04	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor Low	1956	Operations	10	Th	9.89E-03	3.0	Measured air samples
Plant Floor Low	1956	Residual	1000	Th	5.34E-05	3.0	Based on calculated deposition & resuspension of 1956 operation
Plant Floor Low	1957-60	Residual	2000	Th	1.07E-04	3.0	Based on calculated deposition & resuspension of 1956 operation
Supervisor	1956	Operations	10	Th	4.94E-03	3.0	Measured air samples
Supervisor	1956	Residual	1000	Th	5.34E-05	3.0	Based on calculated deposition & resuspension of 1956 operation
Supervisor	1957-60	Residual	2000	Th	1.07E-04	3.0	Based on calculated deposition & resuspension of 1956 operation
Clerical	1956	Operations	10	Th	4.94E-04	3.0	Measured air samples
Clerical	1956	Residual	1000	Th	5.34E-05	3.0	Based on calculated deposition & resuspension of 1956 operation
Clerical	1957-60	Residual	2000	Th	1.07E-04	3.0	Based on calculated deposition & resuspension of 1956 operation

Table CU.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 Thorium slugs

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

All doses during the operational period are in total mR for the operating period. For residual periods, it is mR/d averaged over a calendar year.

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	External Whole Body (mR/d*)	GSD	TBD Reference or Research Justification
Plant Floor High	1956	Operations	10	Th	1.40E+01	3.0	Generic Metal TBD, Section 6.3
Plant Floor High	1956	Residual	1000	Th	2.37E-07	3.0	Generic Metal TBD, Section 6.3
Plant Floor High	1957-60	Residual	2000	Th	9.49E-07	3.0	Generic Metal TBD, Section 6.3
Plant Floor Low	1956	Operations	10	Th	7.00E+00	3.0	Generic Metal TBD, Section 6.3
Plant Floor Low	1956	Residual	1000	Th	2.37E-07	3.0	Generic Metal TBD, Section 6.3
Plant Floor Low	1957-60	Residual	2000	Th	9.49E-07	3.0	Generic Metal TBD, Section 6.3
Supervisor	1956	Operations	10	Th	7.00E-01	3.0	Generic Metal TBD, Section 6.3
Supervisor	1956	Residual	1000	Th	2.37E-07	3.0	Generic Metal TBD, Section 6.3
Supervisor	1957-60	Residual	2000	Th	9.49E-07	3.0	Generic Metal TBD, Section 6.3
Clerical	1956	Operations	10	Th	3.60E-05	3.0	Generic Metal TBD, Section 6.3
Clerical	1956	Residual	1000	Th	2.37E-07	3.0	Generic Metal TBD, Section 6.3
Clerical	1957-60	Residual	2000	Th	9.49E-07	3.0	Generic Metal TBD, Section 6.3

Table CU.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 Th metal.

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

Assume no handling of Th metal.

Assume 10x the photon whole body dose rate

All doses during the operational period are in total mR for the operating period. For residual periods, it is mR/d averaged over a calendar year.

Job Category	Year	Operation Phase	Hr/Yr	Relevant Nuclide	Hands & Forearms (mR/d*)	Other Skin (mR/d*)	GSD	TBD Reference or Research Justification
Plant Floor High	1956	Operations	10	Th	1.41E+02	7.00E+01	5	Generic Metal TBD, Section 6.3
Plant Floor High	1956	Residual	1000	Th	2.37E-06	2.37E-06	5	Generic Metal TBD, Section 6.3
Plant Floor High	1957-60	Residual	2000	Th	9.49E-06	9.49E-06	5	Generic Metal TBD, Section 6.3
Plant Floor Low	1956	Operations	10	Th	7.03E+01	3.50E+01	5	Generic Metal TBD, Section 6.3
Plant Floor Low	1956	Residual	1000	Th	2.37E-06	2.37E-06	5	Generic Metal TBD, Section 6.3
Plant Floor Low	1957-60	Residual	2000	Th	9.49E-06	9.49E-06	5	Generic Metal TBD, Section 6.3
Supervisor	1956	Operations	10	Th	7.03E+00	3.50E+00	5	Generic Metal TBD, Section 6.3
Supervisor	1956	Residual	1000	Th	2.37E-06	2.37E-06	5	Generic Metal TBD, Section 6.3
Supervisor	1957-60	Residual	2000	Th	9.49E-06	9.49E-06	5	Generic Metal TBD, Section 6.3
Clerical	1956	Operations	10	Th	0.00E+00	0.00E+00	5	Generic Metal TBD, Section 6.3
Clerical	1956	Residual	1000	Th	2.37E-06	2.37E-06	5	Generic Metal TBD, Section 6.3
Clerical	1957-60	Residual	2000	Th	9.49E-06	9.49E-06	5	Generic Metal TBD, Section 6.3