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# Jessop Steel Company

## BL.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.

## BL.2 Site Description

In the early and mid 1950s, the Jessop Steel Company was under contract to the AEC for metal fabrication with some work through DuPont. In the early 1950s, records indicate that uranium metal in nickel scrap was sent to Jessop to make stainless steel piping for Fernald. In 1954, tentative plans were made for Jessop to roll uranium for Fernald billet production.[1]

### BL.2.1 Site Activities

Jessop Steel was involved in the processing of nickel scrap that was contaminated with uranium, for the purpose of making piping for the Fernald facility. Although there was minimal information in the file, it appears that Jessop processed between 2 and 3 tons of uranium-contaminated nickel scrap during the month of December 1952. This is documented in two memoranda found in the database. A memo from December 1952 indicates that 2 tons of scrap would be sent, while a report by the AEC summarizing activities for the month indicated 3 tons of scrap were processed by Jessop.[2] In addition, Jessop Steel sheared an unknown number of uranium plates for DuPont on March 2, 1954.[3] Finally, the database contains a memorandum indicating that Jessop was interested in rolling uranium metal for Fernald, but this memo ended with the statement that the rolling would be suspended and would proceed instead at the Fernald facility.[4] There is no indication of any additional work at this facility.

### BL.2.2 Job Categories

Table BL.1 assigns Jessop Steel Company claimants' job titles as of the effective date of this appendix to the Job Category listed in **Bold Text** below. One claimant was a ladle crane operator and the other a laborer and craneman. As such, both would likely have been in the processing area operating cranes above the furnaces in which the nickel was melted. Overhead crane operators would be expected to have among the highest exposures (at least as high as furnace operators or employees involved in handling the molten metal) given their work locations above heated operations.

| | |
|---|---|
| **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.

## BL.3 Occupational Medical Dose

No information regarding occupational medical dose specific to Jessop Steel Company was found. One of the CATI interview summaries indicated "don't know" when asked about medical X-rays, and the other indicated "no" when asked the question. 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.

## BL.4 Occupational Internal Dose

There were no data found in the site research database regarding air dust levels associated with the work at Jessop Steel Company. However, similar work was performed at Huntington Pilot Plant for which ORAU has produced a Technical Basis Document. Exposure levels were calculated using Table 4 from this document.[5] Exposure data, in terms of mg Ni/$m^3$, are presented for all departments in the Huntington Pilot plant. Using the GM and GSD for these data, the 90th percentile value was calculated and this value was considered the mean for "Plant floor high." Assuming that exposures for this job category were lognormally distributed with the same GSD as overall plant data, we were able to calculate the distribution for plant floor high exposures. Similar lognormal distributions were calculated for plant floor low (mean = 50% of plant floor high), supervisor (mean = 25% plant floor high) and clerical (mean =2.5% plant floor high). Since the exposure data from the Huntington Pilot Plant were presented in terms of mg Ni/$m^3$, we then converted the exposures to pCi/$m^3$ by multiplying the values by a factor of 11.43, which is the sum of the ratios of uranium isotopes to nickel in the starting material as shown on Table 3 in the Huntington TBD.[6]

As stated previously, it appears, based upon information in the site research database, that between 2 and 3 tons of nickel scrap was processed in December 1952 and that uranium plates were sheared on March 12, 1954 and that this was the extent of the AWE work at Jessop Steel. Since we have based exposure levels on data taken from the Huntington Pilot Plant which processed over 2 million pounds annually (or nearly 85 tons/month), the assigned exposure levels are favorable to the claimant. Given the amount of material processed by the two facilities, it is likely that Jessop Steel could have processed the 2-3 tons of scrap in one day. A favorable assumption is that the processing took place every day during the month of December 1952. Similarly, it was indicated that plate shearing occurred on one day (March 12, 1954). We assume 10 hours of exposure in 1954 for this activity. Table 7.5 of the uranium metalworking TBD was used to find the air concentration for this process. There were no data corresponding to shearing, but a value of 45 dpm/$m^3$ was given for cutoff, milling, or slotting. All of these processes can be expected to generate much more dust than shearing; this assumption is also favorable to the claimant.

Tables BL.2 and BL.3 contain inhalation and ingestion intakes in terms for pCi per day for each job category and each year.

## BL.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 from exposure to contaminated air or contaminated floor must be 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. External doses are also taken from the Huntington Pilot Plant TBD, Tables 7, 8 and 9.[7]

Handling the uranium-contaminated nickel would produce external exposures. This exposure estimate is based on photon and beta dose rates for uranium metal. However, the uranium in this case is lightly dispersed in the Ni metal, which provides shielding. The effectiveness of this diluted condition of the uranium in producing a dose rate can be estimated using the specific activities of pure U metal (684 pCi/mg) and the contaminated nickel (11.4 pCi/mg), and by comparing the atomic numbers of Ni and U, to make a rough estimate of the shielding effectiveness of the Ni. Thus a ratio of 0.0549 was developed to apply to the external dose rates from natural uranium metal to obtain an estimate of the dose rates from the U dispersed in nickel.

Tables BL.4 and BL.5 contain external doses associated with the work at this facility.

## BL.6 Residual Contamination

A report from 1991 found in the Site Research database (Ref 11035, pp. 14-19) discusses radiological surveys completed at the Jessop Steel site as well as at a residence in which some salvaged building materials from the site were used to construct a deck. No levels above background were found. In addition, the NIOSH "Report on Residual Radioactive and Beryllium Contamination at Atomic Weapons Employer Facilities and Beryllium Vender Facilities" indicates "there is little potential for significant residual contamination outside of the period in which weapons-related production occurred."[8] Thus no residual period was needed for dose assessment after 1954.

Residual contamination is used for estimating doses in 1953 and the first two months of 1954, between the contaminated nickel operation and the uranium shearing operation. This assessment assumes that no cleanup occurred after the contaminated nickel operation, even though cleanup may have occurred.

## BL.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. Reference ID 11035, site research database, pp. 29 & 34.

3. Reference ID 11035, site research database, p. 27.

4. Reference ID 11035, site research database, p. 30.

5. Technical Basis Document: Basis for Development of an Exposure Matrix for Huntington Pilot Plant. Document No. ORAU-TKBS-0004, p. 7

6. Ibid. p. 7.

7. Ibid. pp. 11-13.

8. 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 BL.1 Job Categories for all current claimants who worked at Tocco Induction Heating Division**

| Job Title | Exposure Category |
|---|---|
| Ladle Crane Operator | 1 |
| Laborer/Craneman | 2 |

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**Table BL.2 INTERNAL DOSE PATHWAYS - Inhalation of Airborne Radionuclides**

**Assumptions:**
Operational Period Daily Weighted Average Air Concentration, Plant Floor High: 2.7 (1952) & 45 ('54) dpm/$m^3$
Residual Period Daily Weighted Average Air Concentration: 0.0013 dpm/$m^3$
TBD GSD Default is 5
Conversion Factor : 2.22 dpm/pCi
Breathing Rate: 1.2 m^3/hour
All intakes and doses assume full-time employment for the given year.

| Job Category | Year | Operation Phase | Hr/Yr | Relevant Nuclide | Intake (pCi/d) | GSD | TBD Reference or Research Justification |
|---|---|---|---|---|---|---|---|
| Plant Floor High | 1952 | Operations | 183 | U234 | 7.24E-01 | 4.3 | Measured Air Concentrations |
| Plant Floor High | 1953 | Residual | 2200 | U234 | 5.02E-03 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Plant Floor High | 1954 | Operations | 44 | U234 | 6.66E-01 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Plant Floor Low | 1952 | Operations | 183 | U234 | 3.62E-01 | 4.3 | Measured Air Concentrations |
| Plant Floor Low | 1953 | Residual | 2200 | U234 | 5.02E-03 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Plant Floor Low | 1954 | Operations | 44 | U234 | 6.66E-01 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Supervisor | 1952 | Operations | 183 | U234 | 1.81E-01 | 4.3 | Measured Air Concentrations |
| Supervisor | 1953 | Residual | 2200 | U234 | 5.02E-03 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Supervisor | 1954 | Operations | 44 | U234 | 6.66E-01 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Clerical | 1952 | Operations | 183 | U234 | 1.93E-02 | 4.3 | Measured Air Concentrations |
| Clerical | 1953 | Residual | 2200 | U234 | 5.02E-03 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Clerical | 1954 | Operations | 44 | U234 | 6.66E-01 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |

**Table BL.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

| Job Category | Year | Operation Phase | Hr/Yr | Relevant Nuclide | Intake (pCi/d) | GSD | TBD Reference or Research Justification |
|---|---|---|---|---|---|---|---|
| Plant Floor High | 1952 | Operations | 183 | U234 | 6.75E-03 | 4.3 | Measured Air Concentrations |
| Plant Floor High | 1953 | Residual | 2200 | U234 | 4.68E-05 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Plant Floor High | 1954 | Operations | 44 | U234 | 6.21E-03 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Plant Floor Low | 1952 | Operations | 183 | U234 | 3.37E-03 | 4.3 | Measured Air Concentrations |
| Plant Floor Low | 1953 | Residual | 2200 | U234 | 4.68E-05 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Plant Floor Low | 1954 | Operations | 44 | U234 | 6.21E-03 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Supervisor | 1952 | Operations | 183 | U234 | 1.69E-03 | 4.3 | Measured Air Concentrations |
| Supervisor | 1953 | Residual | 2200 | U234 | 4.68E-05 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Supervisor | 1954 | Operations | 44 | U234 | 6.21E-03 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |
| Clerical | 1952 | Operations | 183 | U234 | 1.80E-04 | 4.3 | Measured Air Concentrations |
| Clerical | 1953 | Residual | 2200 | U234 | 4.68E-05 | 4.3 | Residual from '52 operations: assume deposition & resuspension |
| Clerical | 1954 | Operations | 44 | U234 | 6.21E-03 | 5.0 | TBD-6000 Table 7.5 for cutoff, milling or slotting |

**Table BL.4 EXTERNAL DOSE PATHWAYS - Whole Body**

**Asumptions:**
Submersion Dose Conversion Factor: 2.462E-09 mrem/h/dpm/m^3
Deposition velocity: 0.0008
Contaminated Surface Dose Conversion Factor: 5.615E-10 mrem/h/dpm/m^2
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 (mR/d) | GSD | TBD Reference or Research Justification |
|---|---|---|---|---|---|---|---|
| Plant Floor High | 1952 | Operations | 183 | U234 | 7.85E-03 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Plant Floor High | 1953 | Residual | 2200 | U234 | 5.21E-06 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Plant Floor High | 1954 | Operations | 44 | U234 | 7.81E-03 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Plant Floor Low | 1952 | Operations | 183 | U234 | 3.92E-03 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Plant Floor Low | 1953 | Residual | 2200 | U234 | 5.21E-06 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Plant Floor Low | 1954 | Operations | 44 | U234 | 3.90E-03 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Supervisor | 1952 | Operations | 183 | U234 | 3.93E-04 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Supervisor | 1953 | Residual | 2200 | U234 | 5.21E-06 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Supervisor | 1954 | Operations | 44 | U234 | 3.90E-04 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Clerical | 1952 | Operations | 183 | U234 | 3.72E-07 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Clerical | 1953 | Residual | 2200 | U234 | 5.21E-06 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |
| Clerical | 1954 | Operations | 44 | U234 | 2.33E-08 | 5 | Generic Metal TBD, Section 6.3 & assumed air concentrations |

**Table BL.5 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) for pure U metal; adjusted by a factor of 0.0549 for U-contaminated nickel

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 7.41E-6 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 | Hands & Forearms (mR/d) | Other Skin (mR/d) | GSD | TBD Reference or Research Justification |
|---|---|---|---|---|---|---|---|---|
| Plant Floor High | 1952 | Operations | 183 | U234 | 3.17E+00 | 2.86E-01 | 5 | Generic Metal TBD, Section 6.3 |
| Plant Floor High | 1953 | Residual | 2200 | U234 | 5.21E-05 | 5.21E-05 | 5 | Generic Metal TBD, Section 6.3 |
| Plant Floor High | 1954 | Operations | 44 | U234 | 3.15E+00 | 2.85E-01 | 5 | Generic Metal TBD, Section 6.3 |
| Plant Floor Low | 1952 | Operations | 183 | U234 | 1.58E+00 | 1.43E-01 | 5 | Generic Metal TBD, Section 6.3 |
| Plant Floor Low | 1953 | Residual | 2200 | U234 | 5.21E-05 | 5.21E-05 | 5 | Generic Metal TBD, Section 6.3 |
| Plant Floor Low | 1954 | Operations | 44 | U234 | 1.58E+00 | 1.42E-01 | 5 | Generic Metal TBD, Section 6.3 |
| Supervisor | 1952 | Operations | 183 | U234 | 1.58E-01 | 1.43E-02 | 5 | Generic Metal TBD, Section 6.3 |
| Supervisor | 1953 | Residual | 2200 | U234 | 5.21E-05 | 5.21E-05 | 5 | Generic Metal TBD, Section 6.3 |
| Supervisor | 1954 | Operations | 44 | U234 | 1.58E-01 | 1.42E-02 | 5 | Generic Metal TBD, Section 6.3 |
| Clerical | 1952 | Operations | 183 | U234 | 0.00E+00 | 0.00E+00 | 5 | Generic Metal TBD, Section 6.3 |
| Clerical | 1953 | Residual | 2200 | U234 | 5.21E-05 | 5.21E-05 | 5 | Generic Metal TBD, Section 6.3 |
| Clerical | 1954 | Operations | 44 | U234 | 0.00E+00 | 0.00E+00 | 5 | Generic Metal TBD, Section 6.3 |