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Site Profiles for Atomic Weapons Employers that Worked Uranium Metals

Appendix G – Anaconda

Document Owner: David Allen

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J.W. Neton, Associate Director for Science Revision 0

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4/30/2007	4/30/2007	0	Appendix to Battelle-TBD-6000 describing the use of the TBD for claims at Anaconda
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G.1 Introduction

This document serves as an appendix to Battelle-TBD-6000, *Site Profiles for Atomic Weapons Employers that Worked Uranium 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.

G.2 Site Description

The Atomic Weapons Employer Anaconda Company was located in Waterbury Connecticut. During the time of the AEC work, the facility was known as American Brass Company. It is listed as an Atomic Weapons Employer in 1942 and 1956 through 1959. In 1942, the American Brass Company produced the barriers used in the gaseous diffusion process. In the late 1950s, under contract to Nuclear Metals Inc., the company extruded copper-clad uranium billets into tubes at least two separate times for the Savannah River Site. While the original plans called for work on 500 billets, only around 50 were actually processed. The operations involved plating, heating, extruding, sawing, drilling, deburring, cleaning, testing, crating, and shipping. Work was conducted at the West Tube Mill. AEC Health and Safety Laboratory personnel visited the site in 1956 and 1959, and obtained air quality and surface radiation measurements during the later visit (DOE web site).

G.2.1 Site Activities

In 1956, two projects were planned. The first was a pilot project involving the extrusion of 4 uranium billets that had been clad with copper at another facility (Harris 1956). The second would involve extruding about 500 billets and was expected to take three 16 to 24 hour shifts to accomplish the work (Harris 1956). The pilot operation with 4 billets was planned for September 29, 1956 (Harris 1956). Other documentation indicates American Brass performed 10 extrusions in March of 1957 (Thornton 1977b) while others indicate American Brass extruded about 50 billets (Thornton 1977a, Thornton 1977b). This appears to be the second extrusion project that was originally intended to be 500 billets.

An additional project to extrude uranium billets occurred on October 19th, 20th and 21st of 1959 (Herde 1959). The rate of extrusion reported during this project was approximately 4 billets per hour.

The original plan was to extrude 500 uranium billets in 48 to 72 hours (three 16 to 24 hour shifts). That represents a rate of at least 7 billets per hour. If only 50 billets were extruded and the actual rate was 4 billets per hour (as reported in 1959), the amount of time necessary for the project would have been 12.5 hours. The pilot project (4 billets) would have taken about 1 hour.

This estimate will assume the pilot project took one full 8 hour shift on September 29th, 1956. The 50 billets are assumed to take two full 8 hour shifts in March of 1957 and the work in 1959 is assumed to take three full 8 hour shifts each day between October 19th and October 21th of 1959. Individual operators are assumed to be present for the full shift in 1956 and both shifts in 1957. However, in 1959 operators are assumed to work

one 8 hour shift on each of the three days. That is, they are not assumed to be present at work for 72 consecutive hours.

No additional information was found on what work was being done in 1942. Production of barriers used in the gaseous diffusion process would not involve radioactive material and so no radiation dose to Anaconda employees would result. Therefore, medical x-rays will be the only dose estimated for 1942 at this site.

G.3 Occupational Medical Dose

No detailed information regarding occupational medical dose was found in any of the site research or telephone interviews. Information to be used in dose reconstructions, for which no specific information is available, is provided in ORAUT-OTIB-0006, the technical information bulletin covering diagnostic x-ray procedures. This estimate will assume each employee received one AP chest x-ray each year of the covered period which includes 1942 as well as 1956 through 1959.

G.4 Occupational Internal Dose

Monitoring was performed in the work areas in 1956 and 1959 by the Health and Safety Laboratory (HASL). HASL reported the highest air concentration was 39 dpm/m^3 while approximately one third of the samples had no alpha activity detected. HASL also reported breathing zone samples at the sawing operation were below detection and the average breathing zone concentration at the drilling and debarring operation was 5 dpm/m^3. Lastly, they reported the average general area samples were 3.3 dpm/m^3 at the press and adjacent areas and 0.3 dpm/m^3 in the saw, drill and testing areas (Glauberman 1959).

This estimate will use 39 dpm/m^3 as the airborne value during extrusion operations. For the time periods between operations, operators will be assumed to be exposed to residual contamination. This is estimated by first estimating the general surface contamination levels. That is done by assuming the 39 dpm/m^3 settled at a rate of 0.00075 m/s during the entire 96 hours (section G.2.1) of operations without any cleanup or removal by any means. Even though these operations were spread over a four year period, this estimate will assume the resulting contamination level was present during the entire period of 1956 through 1959. This results in a contamination level of 10,109 dpm/m^2.

The estimated contamination level was then resuspended with a resuspension factor of 1E-5 m^{-1} to arrive at an airborne concentration of 0.1 dpm/m^3 during the periods between uranium operations. This airborne concentration is assumed to be present at all times and is added to the operational airborne concentration during periods of operation. The total inhalation intake for each year is calculated based on these concentrations and the operational times discussed in section G.2.1. The total inhalation intake was then divided by 365 calendar days per year to find an average airborne concentration a worker would have been exposed to throughout the year. The estimate will vary by year due to the different durations of operation. Values are included in Table G.1. Since the maximum airborne concentration is used for this estimate, doses derived from this intake will be assumed to be a maximum and no uncertainty is assigned.

Potential ingestion intakes are also assigned based on OCAS-TIB-009 (OCAS 2004). This TIB estimates ingestion intakes assuming contamination levels have reached a maximum level during continuous operations. Therefore using this method at Anaconda will result in ingestion intakes higher than likely occurred and is considered a bounding estimate. The ingestion intakes derived from OCAS-TIB-009 were assigned every work day of the year since the earlier assumptions are that the contamination was present at that level from the start and not removed by any mechanism. This intake was then adjusted to a calendar day basis and included in Table G.1.

G.5 Occupational External Dose

The HASL survey performed in 1959 included a radiation survey for beta radiation. The levels reported for the billet storage area were 19 mrep/hr one foot from the billets and 6 mrep/hr three feet from the billets (Glauberman 1959). There was no other reported radiation levels found for the Anaconda plant. A mrep is an outdated unit approximately equal to a mrem of beta radiation (NBS 1952, pg 4). TBD-6000 uses a default beta dose rate value of 20.8 mrem/hr at one foot from uranium. This is in reasonable agreement with the measured 19 mrep/hr. Therefore, the TBD-6000 default dose rates and assumptions will be used to estimate the dose here.

The TBD-6000 default assumptions for operators are 2.08 mrem/hr photon at one foot, 20.8 mrem/hr beta at 1 foot and 230 mrem/hr beta on contact. Also, operators are assumed to be exposed at 1 foot from the metal for 50% of the work day. The operators' hands are assumed to be in contact with the metal for that same time frame.

In addition to the metal dose, operators are assumed to be exposed to uranium contamination. The contamination levels were estimated in section G.4 and conversion factors from Table 3.10 of TBD-6000 were applied to estimate the photon and beta dose rates from contamination. These dose rates are assumed to be present every work day from 1956 through 1959. The total dose each year from both sources of external exposure are added and presented in Table G.2.

G.6 Residual Contamination

Residual contamination potentially existed between operations with uranium at Anaconda. However, surveys showed the potential was low and so no residual contamination period was designated after 1959. The periods between operations is accounted for in a favorable manner in sections G.4 and G.5. Also, since there was no radioactive material associated with the operations described for 1942, no residual contamination is assumed prior to 1956.

G.7 References

DOE website, DOE Office of Environment, Health, Safety and Security, EEOICPA web site. https://hsspublic.energy.gov/search/facility/findfacility.aspx

Glauberman 1959, Memo from Harold Glauberman to A. J. Breslin, *Survey at American Brass Company, Waterbury, Connecticut*, December 2, 1959, SRDB 9363 pp. 7 & 8.

Harris 1956, Memo from W. B. Harris New York Operations Office to G. H. Giboney Savanah River Operations Office, *Visit to American Brass*, September 20, 1956, SRDB 9363 pp. 5 & 6.

Herde 1959, Memo from Karl E. Herde to A. J. Breslin, *Request for Survey at American Brass Company, Waterbury, Connecticut*, October 9, 1959, SRDB 9363 pg. 4.

NBS 1952, National Bureau of Standards Handbook 51, Radiological Monitoring Methods and Instruments, April 7, 1952.

OCAS 2004, Office of Compensation Analysis and Support, *Estimation of Ingestion Intakes*, OCAS-TIB-009, April 13, 2004.

Thornton 1977a, Memo from William T. Thornton to R. Kennedy, *ERDA Resurvey Program – American Brass, Waterbury, Connecticut*, March 7, 1977, SRDB 16439.

Thornton 1977b, Notes from telephone conversations, SRDB 14811 pp. 6-8.

Table G.1 – Intakes

a – Shifts of exposure represent the number of 8 hour shifts an individual is assumed to be exposed to uranium operations.

Year	Shifts of Uranium Operations	Shifts of Exposure [a]	Inhalation (dpm/day)	Ingestion (dpm/day)
1956	1	1	1.69	5.34
1957	2	2	2.72	5.34
1958	0	0	0.66	5.34
1959	9	3	3.74	5.34

Table G.2 – External Dose

Year	Photon (mR/year)	Beta - whole body (mrem/year)	Beta - hands and forearms (mrem/year)
1956	8.3	84	921
1957	16.6	167	1841
1958	0.008	0.77	0.77
1959	25.0	250	2761