Review of Simonds Saw and Steel Plant
Residual External Dose

Prepared by Thomas Tomes, DCAS

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SC& A Finding 6

More Quantitative and Substantive Discussion of Available External Monitoring during Residual Period

NIOSH Response

SC&A's Finding 6 and discussion on the residual period external doses in Section 4.6 of the Site Profile Review (Barton 2012) consist of the following issues, listed as TBD issues 1 through 5 for discussion purposes:

1. The value used as the 95th percentile gamma dose rate during the residual period.
2. Suggestion that a geometric standard deviation of 5 be considered in the absence of other information.
3. The TBD did not consider non-penetrating dose from the 10" Bar Mill Bed.
4. The assumption of an 8-hour workday (2000 hours per year) during the residual period, although a 10-hour workday is presumed for the AWE operational period.
5. A more thorough analysis and discussion of the residual period radiation surveys is needed.

Current TBD External Doses During the Residual Period

The TBD lists the external dose during the residual period in Table 23, as summarized in the two paragraphs below.

Penetrating dose from 1958 to the present is 0.160 R per year, applied as the geometric mean (GM) of a lognormal distribution having a geometric standard deviation (GSD) of 3.5.

The non-penetrating dose from 1958 to the present is 0.400 rem per year, applied as the GM of a lognormal distribution having a GSD of 2.6.

Background Information on the Residual Period

Simonds Saw & Steel did uranium and thorium work for the AEC from 1948 to 1957. The plants and equipment used for the AEC work continued to be used in a commercial capacity until 1983. The facility was operated by Simonds until 1966, by Wallace-Murray Corporation from 1966 to 1978, then by Guterl Specialty Steel Corporation. Guterl filed for Chapter 11 bankruptcy in 1982; the plant closed May 1, 1983. The bankruptcy was changed to a chapter 7 bankruptcy (USACE 2010a, p. 4; ORNL 1984, p. 3); however, some of the assets and part of the property were sold to Allegheny Ludlum Corporation in 1984.

For the sale to Allegheny Ludlum Corporation in 1984, the court divided the 70-acre property into a 9-acre "excised area," a 9-acre landfill area, and a 52-acre parcel that comprised the remainder of the property. The excised area included the buildings and grounds and equipment that were used for the uranium and thorium work. Allegheny purchased the 52-acre portion of the property, i.e., all of the property except the landfill and excised area. However, one of the buildings included in the Allegheny Ludlum purchase, Building 24, has some uranium contamination. Although most of Building 24 was built after the end of AEC work, the southwestern part of the building was built in 1941, connects to Building 8 and was used during AEC work (USACE 2010).

The excised area of the site remains abandoned and has been characterized for the Army Corps of Engineers for remediation. The equipment used for AEC work is essentially in place the same as it was during the AEC work. Commercial business continues on the property purchased by Allegheny Ludlum under the name of Allvac (USACE 2010), and it is currently identified as ATI Allvac on the internet (http://www.atimetals.com/businesses/locations/Pages/North-America.aspx, accessed 9/11/2013).

There were numerous dose rates measurements and characterization data from the residual period. Radiation measurements are available from surveys taken in 1957 (after AEC operations), 1976, 1980, 1984, 1999, and 2007 (Heatherton 1957; ORNL 1979; FBDU 1981; ORNL 1984; Vitkus 2000; Earth Tech 2010).

Surveys:

1957: Survey by NLO after clean up and prior to contract termination. This survey included the areas were uranium was processed and stored but did not list specific number of measurements nor specify the completeness the scans. Only selected spots that had the highest results were listed in the report. Highest 3 foot gamma dose rate was 0.080 mR/hr.

1976: Extensive characterization survey by ORNL using grids and full scan of surfaces in contaminated areas. Highest one meter gamma dose rate recorded was 0.048 mR/hr (ORNL 1979).

1980: Engineering evaluation that cited ORNL survey data with a few additional measurements in the rolling mill area (FBDU 1981).
1984: Survey to verify conditions of plant after closure. One spot in the open area in the vicinity of the 10" mill furnace at had a one meter dose rate of 0.120 mR/hr. Additionally, a dose rate of 0.100 mR/hr was found in one location when the steel floor plates were removed (ORNL 1984).
1999: Seventy two gamma measurements taken in excised area buildings. Highest dose rate at one meter was 0.050 mR/hr in Building 8. Two hundred sixty measurements taken in the exterior areas, both in and out of the excised area (Vitkus 2000).
2007: Gamma dose rate surveys were performed for the Remedial Investigation Report. The highest result found in 2007 was 63 µR/hr in Building 2, which was the highest reading from a well characterized hot spot; the second highest of the 428 measurements in Building 2 was 13 µR/hr). Building 2 was not one of the areas were AEC work occurred, although it was in use at the time and some contamination was found. The highest result in Building 3 was 21µR/hr, the highest for Building 24 was 12 µR/hr, while the highest dose rate measured in the Building 6/8 rolling mill areas was 45 µR/hr. There were 29 measurements taken in Building 6/8.

Proposed TBD External Doses During the Residual Period

Upon review of the comments from SC&A and review of available data, changes to the TBD are being recommended to both the penetrating dose and the non-penetrating dose as specified below.

Penetrating dose

Available whole body gamma dose rates from surveys from 1957 to present were compiled. The dose rate measurements from outside the excised area were lower than the dose rates considered in this evaluation so the numerous survey data from those areas were not considered applicable to bounding dose from a maximally exposed mill worker. The areas considered for the purpose of bounding dose to the maximally exposed worker was the dose rates in Buildings 3, 6, and 8, which were the locations of the rolling mills and forge shop.

The surveys from 1957 to 1999 are in general agreement and there is no indication of any significant change in dose rates from 1957 to present, although the maximum one meter gamma dose rate on the various surveys varied from 48 µR/hr to 120 µR/hr. The TBD currently uses the 80 µR/hr maximum observed whole body (measurement at 3 feet) gamma result from the 1957 survey as the median dose rate. Subsequent to the 1957 survey, characterization surveys were done and documented on both a set grid basis and on a selective basis from surfaces scans that identified hot spots. Of the many measurements taken, only two results exceeded 80 µR/hr, which were results reported in the 1984 survey: 120 µR/hr and 100 µR/hr measurements taken in an open area near the 10" furnace and an area next to the 16" rolling mill, respectively.

Results indicate that these higher dose rates are spots from localized contamination in the dirt floor and not representative of dose rates for an area. The surveys performed both in 1979 and 1984 included characterization of hot spots in the floor.

For this evaluation, the various survey results from the rolling mill and forge area were compiled and analyzed. To determine a distribution of dose rates likely to have been encountered in the work area, 37 results, taken either at one meter or three feet, were used from the various surveys. The dose rate data from 2007 from Buildings 6 and 8 was similar to the earlier data in the same areas, but not as detailed and were not included in the distribution. The range of results in Building 6/8 was 3 – 48 μR/hr and would be within the ranges of the measurements evaluated.

For evaluation purposes, the number of measurements was reduced to 37 for the following reasons: Some building/area survey results from the 1976 and 1999 surveys listed the number of measurements taken but provided only the average and maximum result recorded; for that situation the maximum dose rate was considered as a single measurement. Some of the survey reports (that were done to supplement earlier surveys) included previous survey results and new survey results; duplicate results were omitted. Measurements taken outside of uranium process areas were not used (this eliminated many of the lower results). The 37 measurements consisted of: 3 results documented from the 1957 survey, which were the areas with the highest gamma exposure; 23 measurements from a grid in the rolling mill area from the 1979 survey; 8 results from the 1984 survey, which were taken to supplement the 1979 measurements in the contaminated area; and 3 maximum building dose rates results from the 1999 survey (one each from Buildings 3, 6, and 8). Some of the measurements from were taken both with the steel floor plates in place and with them removed to characterize dose rates from the contaminated dirt floor.

The results were ranked and a lognormal distribution was fit to the data. The 95th percentile of the distribution is 75 μR/hr. The 80 μR/hr dose rate from the 1957 survey used in the current TBD should provide a bounding dose rate for purposes of estimating annual dose. Although workers could have been exposed to isolated spots with higher dose rates, most of the work areas around the rolling mills and forge area measured less than 50 μR/hr. The penetrating dose during the residual contamination period is calculated by assuming 2,500 hours of exposure per year at 80 μR/hr, resulting in an annual whole body photon dose of 0.200 R/yr. The value is considered bounding and thus will be applied as a constant in IREP.

Non-penetrating dose

The 1957 survey indicated the maximum 3-foot beta dose rate was from the 10 inch bar mill bed, which measured between 1 and 1.7 mrep/hr, with contact beta-gamma being 10-20 mrep/hr.

The 1976 characterization survey recorded contact beta-gamma measurements on a 15 foot grid, but no measurements at 3 feet, nor did subsequent surveys.

Non-penetrating dose from electrons during the residual period will be estimated based on exposure at the 10" bar mill. The midpoint of the 1.0 to 1.7 mrad/hr range of dose rates, 1.35 mrad/hr, is used to estimate dose for exposure for 2,500 hours per year, resulting in an annual beta dose of 3.375 rem. The value is considered bounding and thus will be applied as a constant in IREP.

NIOSH Response to the five TBD issues from the SC&A review.

1. *The value used as the 95th percentile gamma dose rate during the residual period.*

   Table 21 of the TBD has a list of the highest dose rates found during a survey in July 1957 and documented in a Trip Report (Heatherton 1957). The survey was done after Simonds had completed all tasks under the NLO subcontract and was performed in conjunction with a site visit to determine if the subcontract could be closed out. The TBD used the highest gamma dose rate at 3 feet from the surface, 0.08 mR/hr, and assumed it was the median dose rate. However, the TBD used a beta dose rate at three feet, 0.4 mrep/hr, and considered it to be the 95th percentile value. The dose rate distribution in the TBD was determined from those two values, one a gamma rate and one a beta rate.

   The 1957 Trip Report had insufficient detail to determine a true distribution of dose rates because the report simply described the areas surveyed and only listed the representative dose rates, including the highest observed. The 0.4 mrep/hr value used in the TBD is listed as a beta dose rate in the table provided by Heatherton (1957) although the text suggests it is a beta plus gamma (total) dose rate. The value was clearly a reading that included the non-penetrating component, although it is unclear if it was an open window total dose rate (beta plus gamma) or a beta dose rate only (open window minus closed window); regardless, the value should not be used to estimate penetrating dose.

2. *Suggested that a geometric standard deviation of 5 be considered in the absence of other information.*

   The comment on the use of a GSD of 5 is interpreted to be applicable to situations of limited data. However, the recommended doses described above uses the upper end dose rates from many measurements and should provide a bounding annual dose, and thus be applied as a constant.

3. *The TBD did not consider non-penetrating dose from the 10" Bar Mill Bed.*

   The beta dose rates from the 10" Bar Mill Bed is used in the recommended change in bounding non-penetrating dose.

4. *The assumption of an 8-hour workday (2000 hours per year) during the residual period, although a 10-hour workday is presumed for the AWE operational period.*

   A 10-hour workday (2500 hours per year) is now recommended for the residual period calculations.

5. *A more thorough analysis and discussion of the residual period radiation surveys is needed.*

   Additional analysis is provided in this paper. The TBD discussion of dose rates during the residual period (section 5.0) will be edited to summarize the analysis and to be consistent with the proposed changes in the external doses during the residual period.

References

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