Review of Simonds Saw and Steel Plant
Residual Internal Dose

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SC&A Finding 7

> *Appropriateness of Chosen Internal Methodology During Residual Period and Consistency with OTIB-0070*

SC&A's Finding 7 and discussion on the residual period internal doses in Section 4.7 of the Site Profile Review (Barton 2012) consist of the following three issues.

Issue 1:
The appropriate air sample value to use at the start of the residual period and the number of work hours presumed for the residual period.

Issue 2:
A discussion is needed on how the Exposure Point Concentration (EPC) values for 2007 were determined and the parameters used in developing the values.

Issue 3:
Justification is needed for presuming depletion ended in 1982 and presuming the 2007 contamination levels were the same as in 1982.

Background Information on Simonds Residual Contamination

The residual contamination at the former Simonds Saw & Steel site is primarily in the "excised area", a nine acre isolated area that includes Buildings 1, 2, 3, 4/9, 5, 6, 8, and 35, as shown in Figure 1 below. The rolling mills and forge shop that were used for AEC work are located in the circled area that includes Buildings 6 and 8 and part of Building 3 (Vitkus 2000).

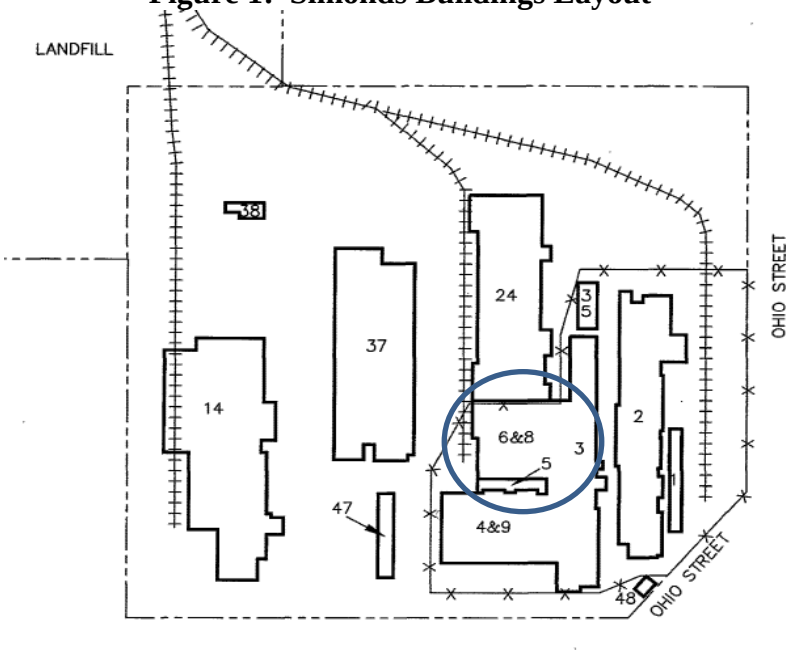
Buildings 6 and 8 are not physically separated, and contain the 10" and 16" rolling mills, respectively. The Forge Shop used during the AWE operational period was located in Building 3, which is open to Buildings 6 and 8 (as well as Building 4&9).

Building 24 is not part of the excised area; however, the southern end of Building 24 is contaminated and is adjacent to Building 8. Building 24 was constructed in parts over a period of time. The southwestern portion is the original structure dating to 1941 and was once the loading dock of Building 8 and used for uranium packaging and weighing. Construction of the southeast portion of Building 24 was completed in 1959. The three sections can be seen in Figure 2 below. At least some of the southeast section, including overhead beams existed during the AEC contract period (which ended in 1957). Both of the southern portions of Building 24 have contaminated surfaces. Construction of the northern portion of Building 24 was completed in 1966 and it is essentially free of contamination (ORNL 1979; Earth Tech 2010).

When the Simonds property was split in 1984, Building 24 was included in the sale of the 52-acre parcel to Allegheny Ludlum; it was an active warehouse during the 2007 surveys (Earth Tech 2010). More details of the operating history during the residual period were provided in the September 30, 2013, DCAS white paper on residual external dose (Tomes 2013).

The buildings of interest in this evaluation are Buildings 3, 6, 8, and the southwest and southeast portions of Building 24, which comprises the entire south end of the building. The AEC operations occurred in all or parts of these four buildings. Although some contamination has been identified in other buildings, such as Building 4&9 and Building 2, it is not as significant.

Figure 1: Simonds Buildings Layout



From Vitkus 2000, Figure 2

Figure 2: Building 24 Overhead Photograph

Building 24 with roof showing the southeast and southwest sections, and the newer, northern section. Building 8 is it at the south end.

Image from Earth Tech (2010).

NIOSH Response to SC&A Comments

Issue 1:
The issue of the air concentration at the start of the residual period was discussed during a TBD-6000 Work Group meeting. Based on the discussion to use 1954 air sampling data instead of averaging earlier data, DCAS is proposing to change the value in the TBD for the air concentration at the beginning of the residual period. Since the general area air during uranium operations would be influenced both by residual contamination previously deposited on surfaces and from uranium processing operations, the general area air concentration should provide a bounding estimate for the alpha airborne radioactivity from residual contamination alone. The *1954 Air Sample Results* are presented in Attachment A. The geometric mean alpha air concentration for 1954 was 122 dpm/m^3. As with proposed changes in the residual external dose, it is now recommended that a 2,500 hour work-year be presumed. At a 1.2 m^3/hr inhalation rate, 122 dpm/m^3 results in an annual intake of 3.66 x 10^5 dpm (1.65 x 10^5 pCi), or a calendar day intake rate of 1003 dpm/d (452 pCi/d). Ninety nine percent of the activity is presumed to be from uranium, resulting in a uranium alpha intake rate of 448 pCi/d. The TBD currently uses 420 pCi/d. Intake ratios of other radionuclides will be apportioned similar to the current version of the TBD.

Issue 2:
The Exposure Point Concentration (EPC) values used in the TBD for contamination levels in 2007 were taken from Table 6-3 of the Army Corps of Engineer Remedial Investigation (RI) Report (Earth Tech 2010). The EPC represented the 95% upper confidence limit (UCL) of results from the 2007 beta surface contamination surveys. Table 6-3 of the RI report listed the beta contamination in the buildings in units of pCi/g, and footnotes to the table enabled back-calculation to determine the corresponding beta contamination levels that are shown in Table 22 of the current TBD. Upon review of this issue DCAS requested and received from the Army Corps of Engineers copies of the Remedial Investigation Report Appendices (A through W), which contain the 2007 survey reports, maps, and various other supporting data and information. Disks were also provided that had the spreadsheets of data used in the calculations for Table 6-3 of the RI report. This level of detail was not previously available.

The RI used all the 2007 beta contamination data for each of the buildings listed in Table 22 of the TBD and entered each set of building data it into a computer program to determine the 95% UCL. The EPC value for Building 24 data was the highest of all the buildings; the value for that building was a nonparametric result based on the 97.5% Chebyshev UCL.

The survey reports and maps were provided in Appendix T of the RI (Earth Tech 2010T). The various survey reports of the buildings were generally written based on surface or area of building being surveyed. The Building 24 data consisted of surveys of contaminated areas and areas of the building that are not contaminated, the north portion, which agrees with the history and layout of the building.

DCAS compiled all the Building 24 RI data (541 measurements), ranked, transformed, and fit the data to a lognormal distribution. The fit of the line suggested the data could be comprised of multiple distributions (the RI concluded the 541 results did not fit a particular distribution). DCAS also looked closely at the surveys for the other buildings, in particular Buildings 6 and 8 (used for AEC work) and Building 3 (part of which was used for AEC work) and how the RI EPC results compared with the distribution of results from the detailed contamination surveys in 1999. It was concluded that the 2007 data should be reevaluated.

Most of the 2007 building surveys were very comprehensive, including extensive surveys in rooms and areas that had little or no contamination. Combining all the data for a building as one distribution, particularly for Buildings 3 and 24 was questionable because there were hundreds of measurements of areas and surfaces of the building that were relatively free of contamination, while other areas and surfaces of the building were contaminated. Of the 1,540 measurements for Building 3, hundreds of them were of clean walls, doors, and remote areas of that large building that were not significantly contaminated.

For the above reasons, DCAS evaluated the 2007 results by selecting areas and surfaces that would provide a more appropriate and claimant-favorable distribution of contaminated surfaces in the mostly highly contaminated areas, while omitting certain measurements, e.g., walls, and areas of the buildings not used for AEC work.

An evaluation of the 2007 contamination data and data from a characterization in 1999 is provided in Attachment B. Attachment B also has more information on surveys performed and the removable contamination (alpha and beta) results from the 1999 and 2007 surveys.

Table 1 of Attachment B has statistics on the contamination levels in Buildings 3, 8, and 24. The upper 95th percentile value of the total beta contamination is estimated to be 67,000 dpm/100 cm^2, based on the values for the south end of Building 24 in 2007. The highest 95th percentile value from the 1999 surveys was slightly lower.

To determine intakes for 2007, the beta surface contamination results are presumed to be equal to the uranium alpha values based on equilibrium of U-238, Th-234, Pa-234m, and U-234 in normal uranium. A resuspension factor of 1 x 10^{-6}/m is used to estimate airborne radioactivity from the 67,000 dpm/100 cm^2, resulting in a concentration of 6.7 dpm/m^3 (3.0 x 10^{-12} µCi/ml). This is about an order of magnitude higher than the maximum air concentration observed during the 2007 surveys (see Attachment A).

A 6.7 dpm/m^3 alpha concentration for 2500 work-hours results in an annual intake in 2007 of 20,100 dpm (9,054 pCi), or 55.1 dpm/d (24.8 pCi/d). Ninety nine percent is assumed to be from uranium isotopes, resulting in a calendar day uranium intake rate of 54.5 dpm/d (24.6 pCi/d). The current TBD value is 5.4 pCi/d. Intake ratios of other radionuclides will be apportioned similar to the current version of the TBD.

Issue 3:
The current TBD presumes that the contamination levels remained constant after the plant was permanently closed. However, Building 24 was not part of the excised area and is still an active warehouse. Therefore, it is recommended the TBD be changed to consider depletion of source occurring throughout the residual period.

The depletion rate based on the above recommended alpha intakes:

1958 intake: 452 pCi/d
2007 intake: 24.8 pCi/d
Time span: 50 years

Depletion rate: ln(24.8/452)/50 yr = 0.058/yr; or 0.00016/d

References

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Earth Tech 2010, *Remedial Investigation Report, Former Guterl Specialty Steel Corporation FUSRAP Site, Lockport, New York*, July 2010, Ref ID 89202.

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ORNL 1979, Oak Ridge National Laboratory, *Radiological Survey of the Former Simonds Saw and Steel Co., Lockport, New York*, November 1979, Ref ID 10877.

ORNL 1984, Oak Ridge National Laboratory, *Radiological Survey of the Guterl Steel Facility, Lockport, New York*, July 29, 1984, Ref ID 71882.

Tomes 2013, *Review of Simonds Saw and Steel Plant, Residual External Dose*, DCAS white paper to the TBD-6000 Work Group, September 30, 2013.

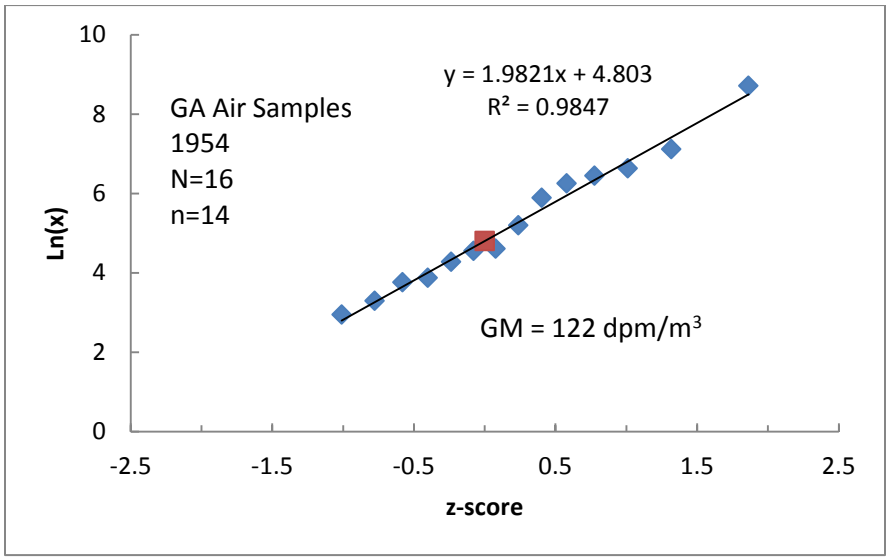
USACE 2010, United States Army Corps of Engineers, *Guterl FUSRAP Timelines*, Ref ID 89201, http://www.lrb.usace.army.mil/Portals/45/docs/FUSRAP/Guterl/guterl-posters-remedinv-2010-10.pdf

Vitkus 2000, Oak Ridge Institute for Science and Education, *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York*, December 1999, Ref ID 10228.

Attachment A: Air Sampling

1954

Twenty one air sample results were available and labeled as general area air samples. The samples were taken during uranium operations in August and October 1954. Ten of the results were from five different locations with samples collected twice during the day; therefore, those were averaged for the air for that location, resulting in 16 results, 14 of which were greater than zero. Samples included some in close proximity to active work. The results are shown in the graph below.



2007

Some air samples were taken during the 2007 surveys. Worker breathing zone samplers (flow rate = 2 liter per minute) were collected during certain characterization activities deemed to have the potential to create airborne radioactivity; these activities includes sample boring activities in Buildings 6 and 8 and work characterizing and sampling of the contaminated roof trusses in the south end of Building 24. Samples were collected and counted on a daily basis. The data was not provided, but the maximum result was reported to be 0.2 DAC-hrs, with most samples below detection limits (Earth Tech 2010, section 3.11).

It is presumed that the Type S uranium DAC was used in the calculations applied to the gross alpha counts; it is the most likely to be present at Simonds and is the most restrictive DAC for uranium at 2×10^{-11} µCi/ml. The 0.2 DAC-hr result equates to a workday intake of 4.8 pCi of Type Y(S) uranium. Presuming it was collected over an eight-hour period, the 0.2 DAC-hr result

equates to a breathing zone air concentration of 5×10^{-13} µCi/ml; the concentration would be marginally higher or lower depending on the number of hours collected during the workday.

The characterization group also checked the air concentration under the contaminated roof trusses in Building 24. They found a crusted layer of contamination which sampling indicated contained uranium. Building 24 is an active warehouse, so they pulled an air sample from a fixed head high volume air sampler for 74 hours. The gross alpha activity was reported to be $(1.49 \pm 0.20) \times 10^{-13}$ µCi/ml of air. This concentration is slightly lower than the maximum breathing zone concentration discussed above.

Attachment B: Analysis of Residual Contamination Data

1957 Surveys (Heatherton 1957)
The surveys performed in July 1957 only reported external dose rate results.

1958 Surveys (Glitzer 1958)
A few smear sample results were reported. One result was reported to be 404 dpm alpha, but other results were much lower. The smear results do not indicate significant removable contamination in the areas surveyed but are not useful for fully characterizing contamination.

1976 Surveys (ORNL 1979)
Surveys were performed in October 1976. Some limited direct alpha measurements are available for the floor of Building 8 and of the 16" rolling mill; the highest result was 4,600 dpm/100 cm^2. Surface beta-gamma dose rates were documented, but not contamination levels. Numerous smears were taken on various surfaces throughout the rolling mill and forge shop buildings; all alpha results were less than 15 dpm/100 cm^2, and all beta results were less than 100 dpm/100 cm^2.

The direct (total) surface contamination values from the 1976 survey were limited. Later year surveys were much more extensive and provided higher results; therefore, the 1976 data was not used to estimate residual surface contamination.

1980 Surveys (FBDU 1981)
This was an engineering evaluation report that cited the ORNL survey data with only a few additional contamination measurements in the rolling mill area that were relatively low.

1984 Surveys (ORNL 1984)
This was a survey to verify conditions of plant after closure, mostly of external dose rates. Three alpha contamination results were reported at the location of three samples taken from the dirt floor in Building 8; all three results were relatively low.

1999 Surveys (Vitkus 2000)
This was an extensive characterization of the site. Direct (total) beta surface contamination measurements and removable alpha and beta measurements were made. These surveys were analyzed and are discussed below.

2007 Surveys (Earth Tech 2007)
This was an extensive characterization of the site for the Remedial Investigation (RI) for the Army Corps of Engineers. Direct (total) beta surface contamination measurements and

removable alpha and beta measurements were made. These surveys were analyzed and are discussed below.

Removable contamination:

During the 1999 survey a total of 297 smears were taken in the four buildings of interest: 55 in Building 3, 30 in Building 6, 119 in Building 8, and 93 in the south end of Building 24. The highest alpha result was 185 dpm/100 cm^2 and the highest beta result was 248 dpm/100 cm^2; both of those results were from Building 3. Most smear results were much lower.

During the 2007 surveys a smear sample was taken at the point of every fixed beta contamination measurement; nearly 1000 measurements of total (fixed) contamination are included in the evaluation and graphs of results from applicable areas of Buildings 3, 6, 8, and 24 below. There were also hundreds of other measurement locations. Most smear results were below the MDA (~11 dpm alpha and 15 dpm beta), however some were positive, most from the contaminated ceiling in the southeast section of Building 24 and the ceilings in the area where Buildings 3, 6, and 8 converge. The highest result (alpha: 109 dpm/100 cm^2, beta: 276 dpm/100 cm^2) was from a smear taken on the ceiling near the junction of Buildings 3/6/8.

The data indicates the contamination is predominately fixed with very low levels of removable contamination.

Total (direct measurements) beta contamination

Results of the total beta contamination measurements were analyzed for Buildings 3, 6, 8, and 24 South from the characterization surveys performed in 1999 (Vitkus 2000) and 2007 (Earth Tech 2010).

For the 1999 surveys, the data came from the reference Tables 3, 5, 6, and 8, and Figures 14, 15, 18, 19, 21, 23, and 24, which show locations of measurements. All results were all used; the northern portion of Building 24 was reported separately and not included in the evaluation.

For the 2007 data, the beta contamination values were taken from the survey reports in Attachment T (Earth Tech 2010T). Not all results were used due to the extensive nature of the survey and the large number of measurements in areas that were not significantly contaminated, e.g., there were hundreds of measurements of clean doors in areas of Building 3 that were not directly in the area of AEC work. The rationale and list of data used and omitted is provided in the discussion of each building below.

The analyses presume the data were lognormally distributed. The transformed data provided a good fit to a line after the data were selected based on area/surface being measured. All results

of chosen areas/surfaces, including negative results, were used in the ranking and probability calculations; however, only positive results were used in fitting a line to the data for determination of the lognormal distribution parameters. Some judgment was used when determining positive values. Both references gave ranges of detection limits and background information based on instruments utilized. The data selected for the fit where chosen based on a conservative (low) detection limit range because, in general, including results that may have been marginally below detection limits provided a steeper slope on the fit line and a higher 95th percentile value. In one instance (Building 8 floors in 2007), gross dpm values (uncorrected for background) were generated from provided gross counts based on the provided instrument efficiency because the background used in the survey reports was elevated significantly more than all the other surveys. Use of the gross dpm provided a better fit to the higher values reported (and compared well with the 95th percentile when a typical background was used instead of the elevated background).

The tables below provide summary statistics for Buildings 3, 8, and 24 (South). Building 6 was not included in the table because there are very limited data with lower results. The smaller Building 6 is open to Plant 8, which had higher contamination levels. The contamination results were rounded to two significant figures.

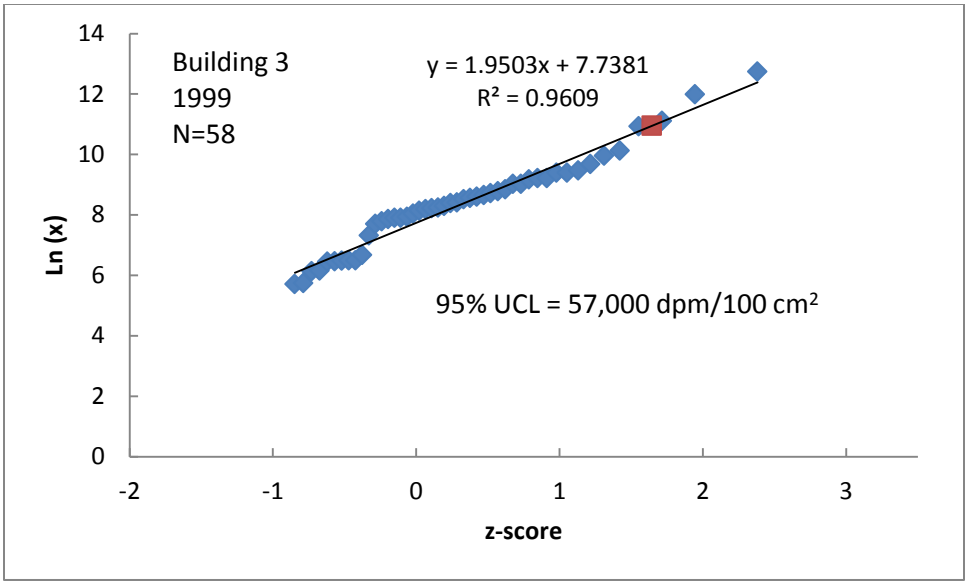
Table 1: Total Beta Contamination Results

Building 3	**1999**	**2007**
Number of measurements	58	756
maximum value	340,000 dpm/100 cm^2*	146,000 dpm/100 cm^2
Geometric mean	2,300 dpm/100 cm^2	2,200 dpm/100 cm^2
Geometric standard deviation	7.03	5.15
95% UCL	57,000 dpm/100 cm^2	32,000 dpm/100 cm^2
Building 8	**1999**	**2007**
Number of measurements	58	38
maximum value	64,000 dpm/100 cm^2	64,000 dpm/100 cm^2
Geometric mean	5,200 dpm/100 cm^2	19,000 dpm/100 cm^2
Geometric standard deviation	3.88	2.02
95% UCL	48,000 dpm/100 cm^2	59,000 dpm/100 cm^2
Building 24 South	**1999**	**2007**
Number of measurements	93	267
maximum value	99,000 dpm/100 cm^2	125,000 dpm/100 cm^2
Geometric mean	3,600 dpm/100 cm^2	2,800 dpm/100 cm^2
Geometric standard deviation	4.82	6.90
95% UCL	48,000 dpm/100 cm^2	67,000 dpm/100 cm^2

*An outlier (a cap on a roller).

Building 3 1999 Data

There were 58 measurements reported for Building 3 in 1999. There were two outliers, one was 340,000 dpm/100 cm^2 measured on a roller cap and the other was 160,000 dpm/100 cm^2 measured on a spot in the trench. The third highest result was 67,000 dpm/100 cm^2.



Building 3 2007 Data

There were 1,540 measurements reported from surveys in Building 3 of floors, walls, ceilings and various equipment. Some of the surveys were not used in analyzing the data because they were not considered applicable to favorably characterize resuspension from contaminated surfaces in the area where AEC work occurred. In total, 784 of the measurements were omitted, which are listed below.

A survey with 80 measurements of the wall on the east side and in rooms on the east side was not used; most values were low or below detection limits. The highest result from survey of those surfaces was 5,714 dpm/100 cm^2.

A survey with 53 measurements of north and east room walls was not included; most were below limit of detection (the highest result from survey of those surfaces 1,815 dpm/100 cm^2).

An exterior survey of the Building 3 (21 measurements) was omitted; results were very low.

Surveys of one north door surfaces and five east door surfaces were omitted. The highest of those 110 measurements was 14,018 dpm/100 cm^2, which was an outlier; the second highest result was 1,265 dpm/100 cm^2.

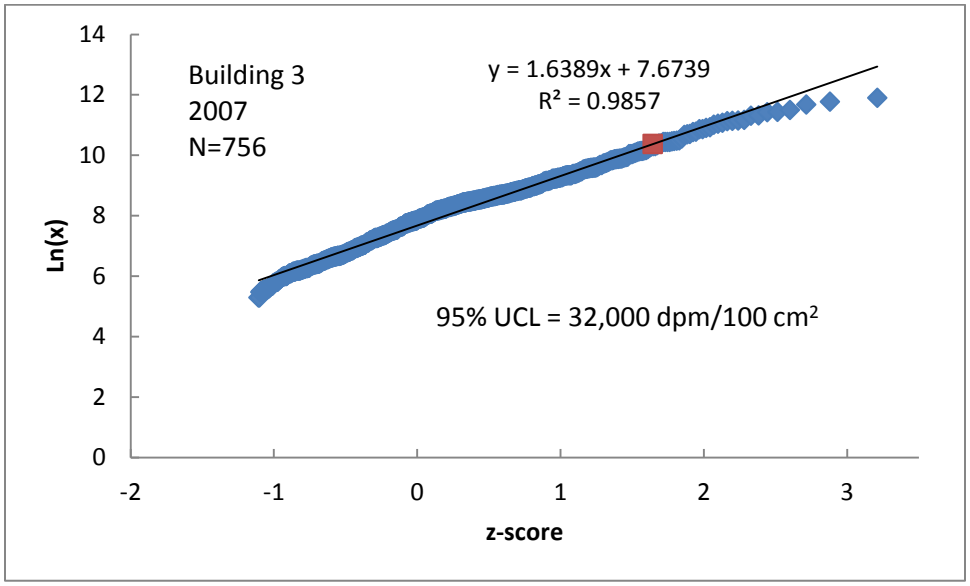
A survey of Class 2 floors and a survey of Class 2 ceilings was omitted (for the RI, Class 2 was those areas not in the footprint of the highest contamination, in this case, not near Buildings 6 and 8). The highest of those 329 results was 9,516 dpm/100 cm^2.

A survey of the trench walls was omitted. The highest of the 20 measurements was 6,254 dpm/100 cm^2.

Surveys of the south furnace stacks, south furnaces, north and south stacks, and north furnaces were omitted. The highest of those 192 measurements was 3,105 dpm/100 cm^2.

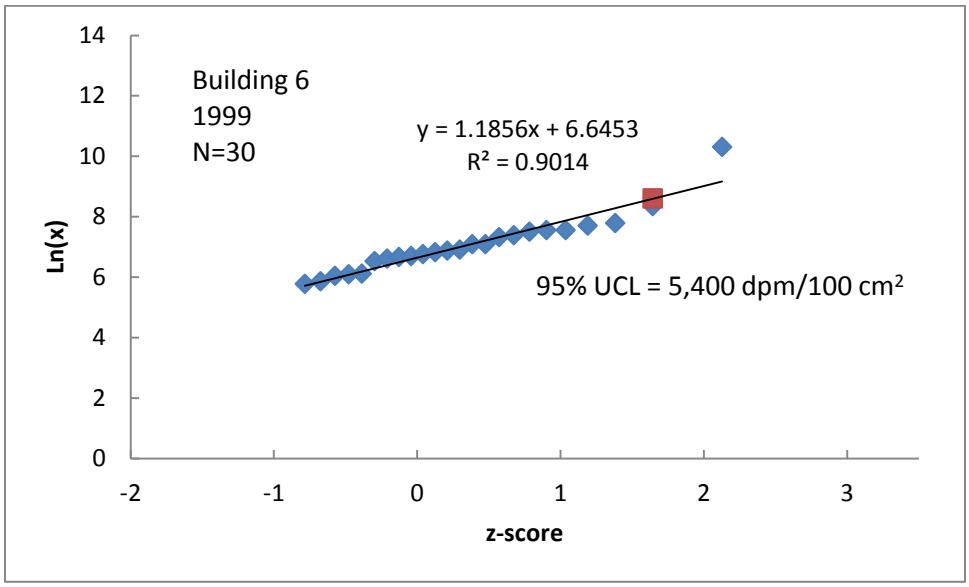
After exclusion of the above 784 measurements, the remaining 756 results were analyzed. Those results included contaminated ceilings and floors were AEC work occurred and miscellaneous surveys of contaminated equipment and surfaces in the area. There were 6 floor hot spots that were surveyed in detail to determine the footprint of the hot spots. The 108 measurements of those floor spots were included in addition to a survey of the floor that contained 246 measurements on a grid.

The highest of the 756 measurements used was 146,000 dpm/100 cm^2 on a floor hot spot. The distribution is shown in the graph below.



Building 6 Data

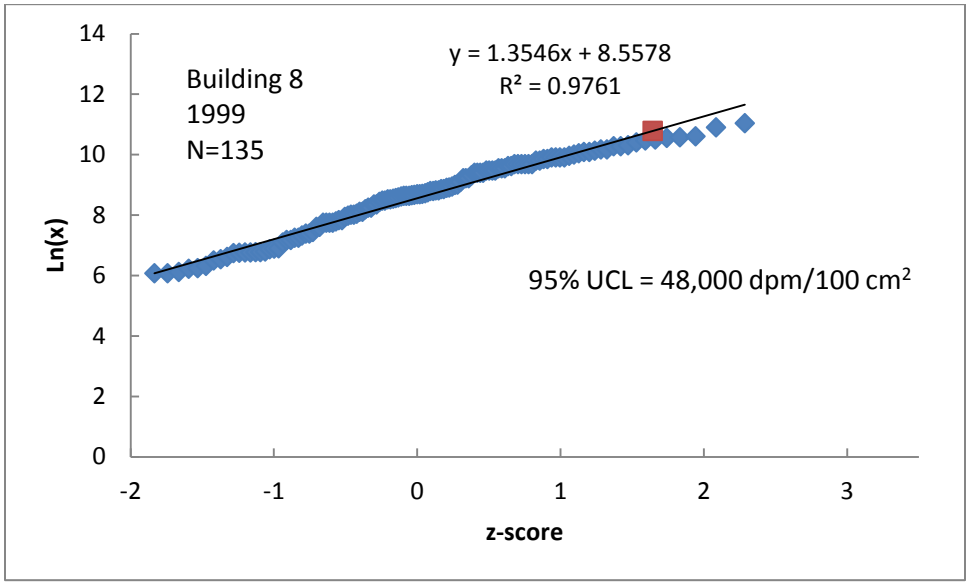
Building 6 is a relatively small building and is adjacent and open to Building 8. There were 30 measurements reported in 1999; the maximum value was 30,000 dpm/100 cm^2. The lognormal distribution of those result is shown below.



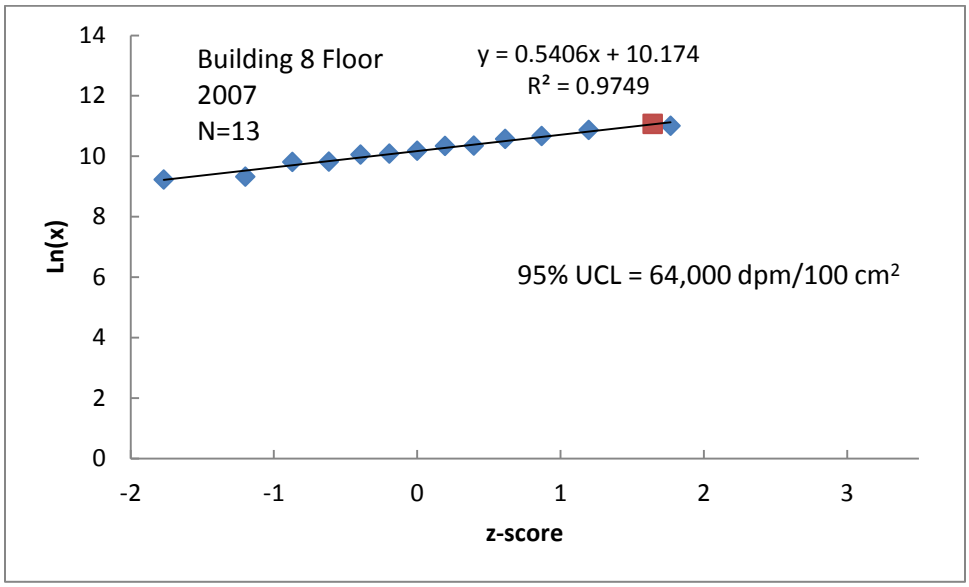
There were no measurements taken inside Building 6 in 2007. Since the smaller Building 6 is open to Building 8 (location of the 16" rolling mill), and much more data is available for Building 8, Building 8 values are presumed for Building 6. Building 6 data were not included in the summary statistics in the table above.

Building 8 Data

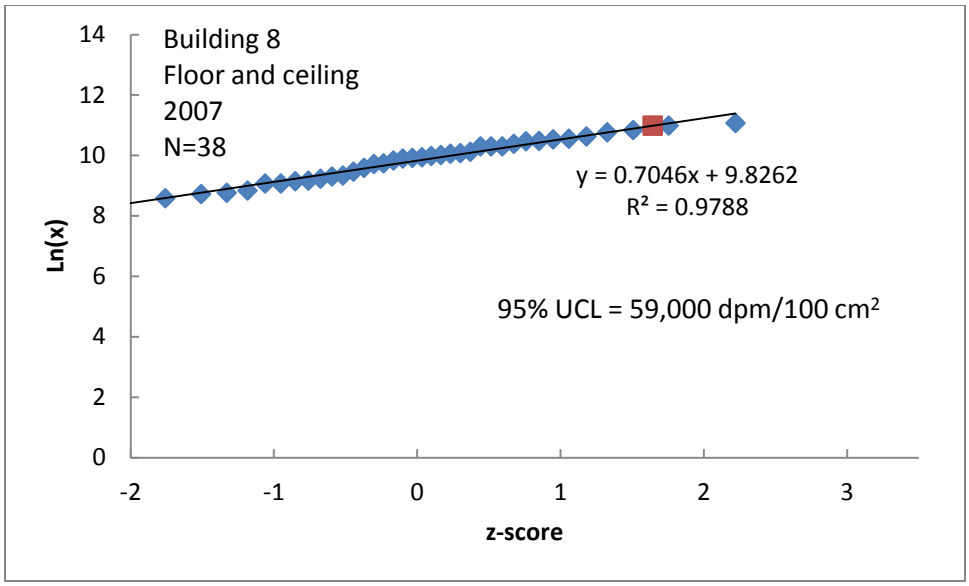
There were 135 measurements reported for Building 8 in 1999. The highest result was 64,000 dpm/100 cm^2.



There were 114 results reported for the interior of Building 8 in 2007. The graph of the results appeared to consist of two distinct distributions. Upon review of the surveys in Appendix T of the RI, there were only 13 measurements reported for inside Building 8 in 2007, all of the floor, which were the highest results. The survey map indicated the other 101 measurements were from the "exterior of 6, 8" (Earth Tech 2010T, pdf p. 628). The 13 measurements of the floor were plotted as a lognormal distribution below. The highest result was 60,000 dpm/100 cm^2.

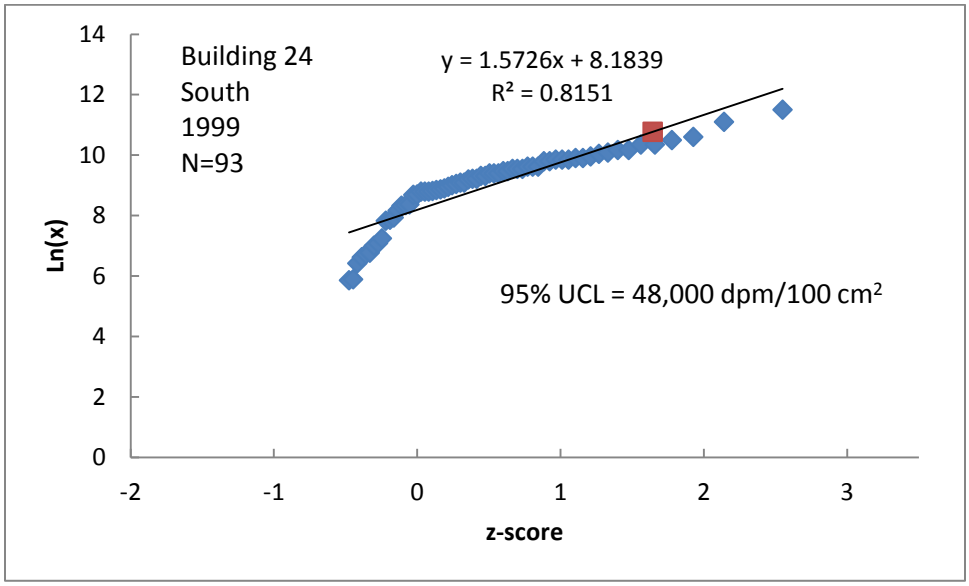


There were also 25 measurements of the ceiling reported with the Building 3 surveys in 2007; those measurements were made in an open area where Buildings 3, 6, and 8 merge (see survey map in Earth Tech 2010, Appendix T, pdf p. 413). The 25 measurements were included with the Building 8 measurements because they are in close proximity to the Building 8 furnaces and work activities. The highest result was 64,000 dpm/100 cm^2. The ceiling measurements were combined with the thirteen Building 8 floor measurements and plotted in the graph below. The ceiling results were also included in the Building 3 evaluation.



Building 24 Data

There were 93 measurements taken in 1999 in the south sections of Building 24. The highest measurement was 99,000 dpm/100 cm^2. The distribution is shown below.



There were 300 measurements reported for the south sections (southeast and southwest) of Building 24 in 2007. The north section surveys were omitted because that newer section is not contaminated. There were also 33 measurements of the walls in the south section that were omitted; the highest of those was 1,076 dpm/100 cm^2. Of the remaining 267 measurements the highest result was 124,000 dpm/100 cm^2 from the southeast ceiling. The ceiling of this section (not measured in previous surveys) was reported to have significant contamination; the 22 highest results were from the ceiling, while the floor in the southeast section had relatively low levels of contamination. Building 24 South showed more variability than some of the other contaminated buildings, presumably because it was built in sections over a period of time, including before, during, and after the AEC contract period.

The distribution of the 267 results is shown below.