

# **NIOSH Response to SC&A Review of Savannah River Site Plutonium Construction Trade Worker Stratification Refinement White Paper**

**Response Paper**

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**National Institute for Occupational  
Safety and Health**

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## **INTRODUCTION**

This paper provides responses from the National Institute for Occupational Safety and Health (NIOSH) to the findings and observations in the memorandum from SC&A, Inc. (SC&A) to the Savannah River Site Work Group and SEC Issues Work Group with the subject *Review of NIOSH's Refined Construction Trade Worker Stratification Comparisons for Plutonium*. [ORAUT 2019c].

Issue-specific responses are provided in detail under each Finding/Observation. There is a common theme among the responses related to the original scope of the exercise. The intent of this exercise was to perform a limited comparison of bioassay data between prime (DuPont) and subcontractor Construction Trades Workers (CTW) to determine if there might be a substantial difference in these results. Timeliness was a factor in the design and execution of the exercise; therefore, the analysis was truncated to 5 non-contiguous years covering the mid-1970s through the mid-1980s. NIOSH does have access to additional logbooks through the 1980s; however, the coding and analysis of the entire volume of data would be a time-consuming process. While this extra coding would provide a more consistent analysis of the two strata, NIOSH believes the results of the current analysis adequately demonstrate prime and subcontractor CTW bioassay data are similar. This exercise was not designed to be a comprehensive application of the original study; more specifically, a formal set of quality assurance (QA) testing measures were not applied to the datasets compiled for this analysis. The original NIOSH-Division of Compensation Analysis and Support Claims Tracking System (NOCTS)-sourced data used in this exercise were a subset of datasets used in OTIB-0081 Rev. 04 [ORAUT 2019a] and therefore had some level of QA review. The data transcribed from the laboratory logbooks did receive a limited review for both accurate transcription and reasonableness of the reported result.

## **FINDING 1**

*In SC&A's opinion, the conclusion that subcontractor construction trade workers had higher excretion rates and derived intakes at the 95th percentile is significant from the standpoint of stratification because the 95th percentile is what is proposed for assignment to unmonitored subcontract construction workers.*

## **NIOSH Response**

The data provided below show no significant difference between subcontractor CTWs and prime CTWs and that sub-stratification is not necessary. Further, the 95th percentile is not necessarily assigned to all unmonitored subcontractor CTWs. This is a decision made during the dose reconstruction process. Some subcontractor CTWs worked on new construction and may be assigned environmental dose. Others may be determined to have an exposure potential that does not merit assigning the 95<sup>th</sup> percentile and the geometric mean (GM) is assigned instead.

The prime CTWs have a greater geometric mean excretion rate in 4 of the 5 years evaluated and a greater 95th percentile excretion rate in 3 of the 5 years. For the calculated intake rates, the

prime CTWs have a greater geometric mean intake rate for both intake periods. In only one of the two intake periods was the subcontractor 95th percentile intake rate greater than that for prime CTWs. A summary of the statistics for prime and subcontractor CTWs is noted in Table 1. These data do not support a significant difference from the standpoint of stratification.

**Table 1. Prime and subcontractor CTW Plutonium excretion rates.<sup>a</sup>**

Year	Prime CTW GM (dpm/1.5L)	Prime CTW GSD	Prime CTW 95th(dpm/1.5L)	Sub CTW GM (dpm/1.5L)	Sub CTW GSD	Sub CTW 95th(dpm/1.5L)
1974	0.004689	7.26	0.12227	0.001439	7.45	0.039152
1977	0.003447	4.866	0.046541	0.001745	6.838	0.041234
1980	0.005597	6.129	0.110462	0.009319	5.736	0.164923
1983	0.007492	5.341	0.117906	0.005914	5.364	0.093733
1986	0.01141	3.522	0.090522	0.00917	4.79	0.120648

a. GSD = geometric standard deviation; Sub = subcontractor.

In addition, this is only a sampling of all the years for which data are available. The purpose of this effort was to provide insight to determine whether additional sub-stratification of CTWs was warranted. The conclusion of this white paper is that such sub-stratification is not needed.

## **FINDING 2**

*A review of 35 randomly selected subcontractor claimants used in the NIOSH analysis indicated that 13 of 35 (~37 percent) may have been incorrectly categorized as subcontractors using the PRID number as the sole indicator.*

## **NIOSH Response**

All 35 of these workers are considered subcontractors for this effort. The workers in question were assigned a five digit payroll identification number, which is associated with the way subcontractors have been identified at the site. For example, DuPont operated two divisions at SRS: Savannah River Operations and Savannah River Construction, aka DuPont Construction. Subcontractors were typically hired by Miller-Dunn, B. F. Shaw, North Brothers, Diversco, MK-Ferguson, but a few other designated subcontracting companies were hired from local union halls by DuPont Construction. DuPont Construction also oversaw the operations of the subcontracting companies. Workers directly hired by DuPont Construction were assigned to projects through Central Shops and worked alongside other craft workers hired through one of the designated subcontracting companies. Some workers were hired both by DuPont Construction and by subcontracting companies depending on the job, such as energy employees D and H. All construction workers, those directly hired and those working for subcontracted companies, worked under management of DuPont Construction through 1989 and Bechtel after 1989. All workers hired under DuPont Construction, whether directly or through subcontracting companies, were treated similarly in terms of job assignments and bioassay monitoring (see DuPont [1993, p. 279], as an example). In both instances, these workers were assigned the five-

digit payroll identification (PRID) numbers and craft codes that were used to identify them as subcontractor CTWs rather than the four-digit PRID numbers used by Savannah River Operations.

### **FINDING 3**

*NIOSH (2019b) does not provide a discussion of or evidence that a quality assurance evaluation of the transcribed plutonium logbook data was performed to assure that derived excretion rates are sufficiently accurate for an effective comparison of the two strata of interest (subcontractors and prime contractors).*

### **NIOSH Response**

NIOSH believes that the derived excretion rates are sufficiently accurate for an effective comparison of the two strata of interest. The original NOCTS-based claim data selected for this analysis were included in the quality assurance tests as part of OTIB-0081 Rev. 04 [ORAUT 2019a]. A full quality assurance evaluation was not performed for the data coded from the logbooks because this effort was not intended to be a formal co-exposure model. It was an accelerated exercise performed in a limited timeframe. Instead, a spot check of the additional logbook data entry was performed by health physics (HP) staff with a focus on high results and unusual censoring levels. Any suspect results identified were corrected before the analysis. As a note, SC&A identified only three errors; the remaining five are indicated as “likely” or “potential” errors due to interpretation issues.

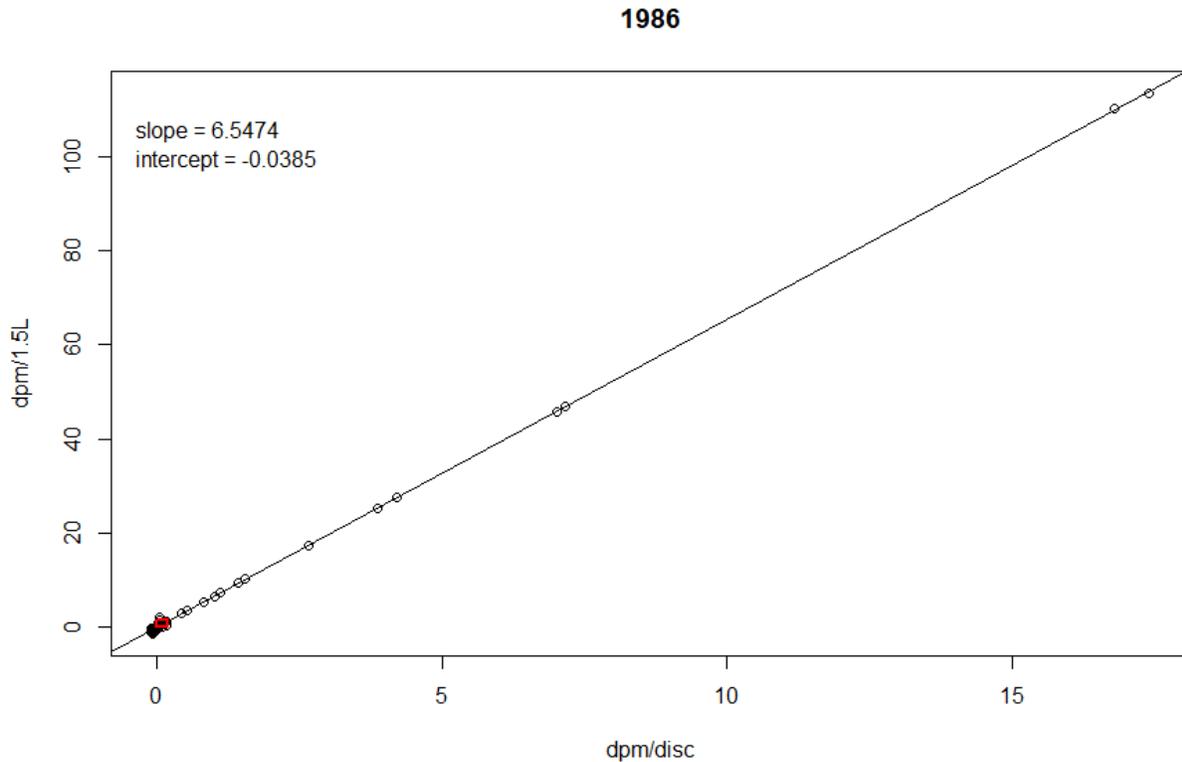
### **FINDING 4**

*The use of a regression analysis to convert raw bioassay results (dpm/disc) to a volumetric result (dpm/1.5 L) has not been technically justified and does not appear scientifically defensible.*

### **NIOSH Response**

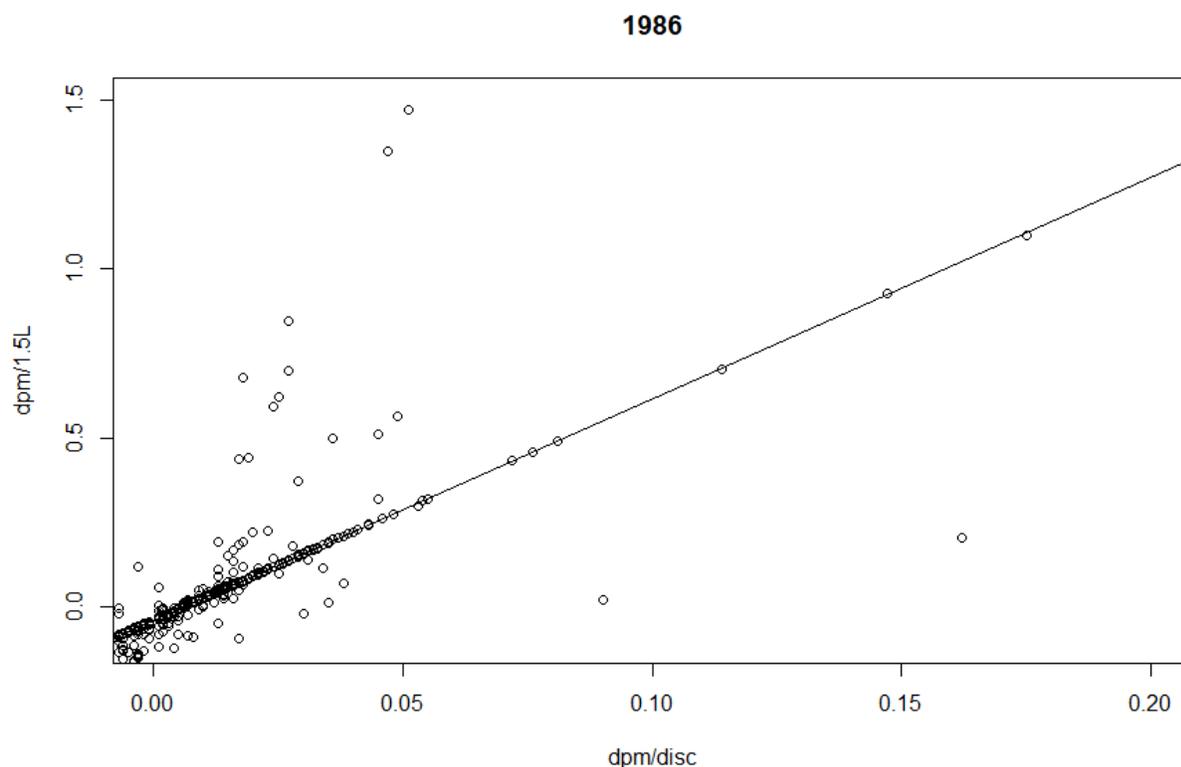
In the absence of a site-supplied formula to convert dpm/disc results to dpm/1.5L, logbook samples with both a dpm/disc and a dpm/1.5L result were plotted using yearly scatterplots. Because of what appear to be fairly strong linear relationships, NIOSH chose to use robust simple linear regressions to describe those yearly relationships. NIOSH acknowledges that the yearly linear relationships are not perfect, because all of the points do not fall exactly on the line. Some data deviate from a linear relationship due to (1) suspected miscalculations from the site, (2) transcription errors, (3) chelation from known intakes, (4) variable recovery factors, and (5) different aliquot sizes. Recognizing that a volume correction may improve these yearly regressions, the use of the robust simple linear regression technique results in the fitted line following the trend of the majority of the data and the volume correction would not have much of an effect. This includes the 1980 plot that SC&A called “a particularly poor fit.”

For example, Figure 1 represents the 1986 regression line from Figure A5 in the original white paper [NIOSH/ORAUT 2019b].



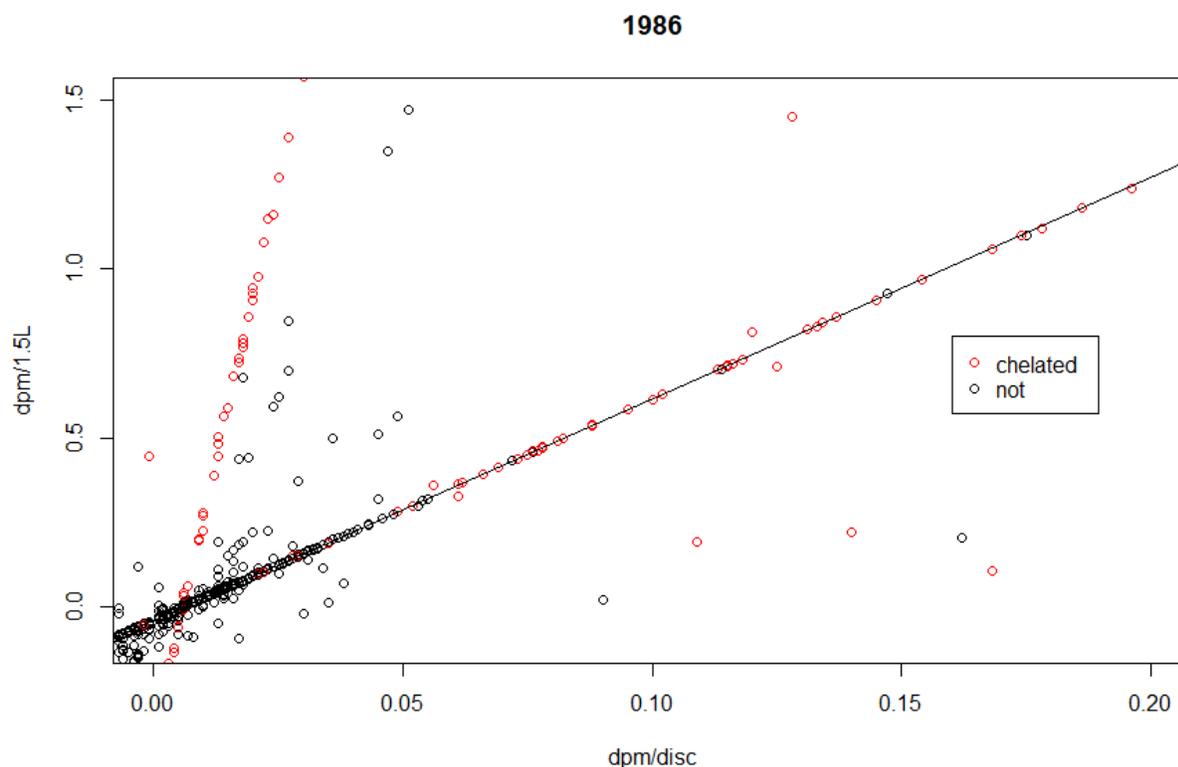
**Figure 1. 1986 Regression coefficient fit plot showing the portion that was expanded by SC&A (see Figure 2).**

SC&A zoomed in on a portion of the x-axis to illustrate the variability associated with the linear fit at these very low concentrations. Figure 2 in this document replicates SC&A's Figure 5.



**Figure 2. Enlargement of 1986 regression coefficient fit plot.**

It is worth noting that the plot above contains negative values whereas SC&A Figure 5 did not include any negative values. There is one other difference between the plot above and SC&A's Figure 5. In the Incident/Exclusions section of the statistical analysis instructions on page 4 of NIOSH/ORAUT [2019b], the final bullet states that a worker was chelated in 1986. All of that worker's results in 1986 were within 100 days of chelation (actually within a month of chelation), so they were not included in any analysis, meaning they were not part of the 1986 regression. These chelated results are in SC&A's Figure 5. For ease of comparison, NIOSH took the plot above and added the chelated points in red. See Figure 3.



**Figure 3. 1986 Regression coefficient fit plot including chelated results.**

Ignoring the chelated results, despite not doing a volume correction, NIOSH believes the relationship between dpm/disc and corresponding dpm/1.5L values is strong enough in 1986 that the robust regression technique is appropriate and scientifically defensible.

### **OBSERVATION 1**

*The evaluation in NIOSH (2019b) was limited to 5 years during the DuPont Era (1972–1989), and additional data (beyond previously captured NOCTS data) were coded for only subcontractors during 3 of these 5 years. Given that subcontract construction workers showed higher derived intakes at the 95th percentile from 1979 through 1987, a more rigorous analysis during the SEC period may be appropriate to determine the extent to which such differences exist in other years, which may further prompt the need for stratification.*

### **NIOSH Response**

While additional data would provide for a more comprehensive analysis between prime and subcontractor CTWs, the current assessment provides sufficient information to conclude that further stratification is not necessary.

The intent of this exercise was to perform a limited comparison of prime and subcontractor CTW data to see if a substantial difference in bioassay data between the two groups was apparent for the selected years. The original tasking specified analysis of 5 non-contiguous years of data covering the mid-1970s thru the mid-1980s. The selection of this time frame coincided with the transition from DuPont's limited use of subcontractor CTWs (pre-1980) to the period where the subcontractor workforce became the majority of CTWs (1980s). To obtain a sufficient number of uncensored data points (~30 results) to perform a statistical analysis, additional coding of subcontractor data was performed for 4 of the 5 years (only 1980 had an acceptable number of uncensored results based solely on NOCTS data). Finally, it is important to consider the entire set of analysis and results which do not support a significant difference between prime and subcontractor CTWs.

Also see response to Finding 1.

## **OBSERVATION 2**

*The urinary excretion rates for claimant subcontractors at the average and lognormal geometric mean suggest a higher exposure potential than non-claimant subcontractors for the years in which non-claimant data were used to supplement the evaluation (1974, 1983, and 1986). Because non-claimant data dominate the evaluated subcontractor population in these years, this could have a significant effect on the combined subcontractor analysis and subsequent comparison to prime contract workers.*

## **NIOSH Response**

The SC&A analysis compared simple metrics (arithmetic mean, 95<sup>th</sup> percentile rank order, geometric means) without accounting for the associated uncertainties to conclude claimant exposures dominate non-claimant exposures. Additionally, in 1974, 1983, and 1986, there were 5, 3, and 9 uncensored TWOPOS results for claimant subcontractor CTWs, respectively. These are far less than the recommended 30 uncensored results desired to conduct a valid statistical analysis. SC&A conducted a miniature stratification using these limited data which do not adequately represent the whole population of CTWs. As noted in SC&A's memo, ORAUT-OTIB-0075 [ORAUT 2016] provides the justification for why the claimant population represents the same exposure potential as the non-claimant population, which conversely means that the entire population represents the same exposure potential as the claimant population.

## **OBSERVATION 3**

*SC&A identified data pairs in which a zero or negative measurement of the activity on a given aliquot disc (dpm/disc) was reported as a positive volumetric bioassay result (dpm/1.5 L). SC&A believes this calls into question whether a reasonable numerical relationship between the individual aliquot measurements and normalized volumetric bioassay results can be effectively derived.*

## NIOSH Response

SC&A identified 12 instances where a zero or negative dpm/disc result was reported associated with a positive dpm/1.5L result, 8 of which were attributed to transcription/legibility issues. There are over 3,000 data pairs contained in the data sources used for this white paper, only 4 of which were identified that may legitimately be questionable. This is an insignificant fraction of the total, and in most of these instances, the dpm/1.5L result is available and used, in which case the numerical relationship between the aliquot measurement and the normalized volumetric bioassay result is irrelevant. Given the nature of the averaging processes used, these 4 results have an insignificant impact on the overall conclusions.

Also see the response to Finding 4.

## CONCLUSION

NIOSH limited this evaluation to the 5 years to provide reasonable, yet timely, insight into potential differences in bioassay monitoring between prime and subcontractor CTWs. This evaluation required coding of data from logbooks for both NOCTS Claims and non-NOCTS subcontractor CTWs. NIOSH acknowledges that this limited exercise may benefit from additional analysis beyond the 5 years of data evaluated; however, the final conclusion that sub-stratification is not necessary remains unchanged based on this analysis. NIOSH does have access to plutonium logbooks through the 1980s; however, additional coding and analysis would take many months, if not years to complete. While the assumed intake for subcontractor CTWs was higher in one of the modeled periods, the prime CTW intake rates were larger in remaining eras. When the entire spectrum of analysis is taken under consideration, NIOSH maintains the conclusion that sub-stratification is not necessary and that doses can be calculated with sufficient accuracy for compensation purposes.

## **REFERENCES**

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