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Advisory Board on Radiation and Worker Health  
National Institute for Occupational Safety and Health

**SC&A’s Review of the White Paper,  
“NIOSH Resolution of W. R. Grace Site Profile Finding 1”**

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*SC&A, Inc. Technical Support for the Advisory Board on Radiation and Worker Health's Review of NIOSH Dose Reconstruction Program*

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## Abbreviations and Acronyms

ABRWH, Board	Advisory Board on Radiation and Worker Health
AWE	Atomic Weapons Employer
NIOSH	National Institute for Occupational Safety and Health
NOCTS	NIOSH Division of Compensation Analysis and Support Claims Tracking System
ORAUT	Oak Ridge Associated Universities Team
WRG	W. R. Grace Company

## 1 Introduction and Background

W. R. Grace Company (WRG) was an Atomic Weapons Employer (AWE) facility from 1958 through 1970, with an AWE residual contamination period from 1971 through March 1, 2011. The National Institute for Occupational Safety and Health (NIOSH) issued on August 28, 2019, the white paper “NIOSH Resolution of W. R. Grace Site Profile Finding 1” for WRG, Erwin, Tennessee (NIOSH, 2019a; hereafter referred to as the “white paper”). The purpose of the white paper was to address finding 1 of SC&A’s SCA-TR-SP2013-0041, revision 0, “Review of the NIOSH Site Profile for the W. R. Grace and Company in Erwin, Tennessee” (SC&A, 2013). Finding 1 was concerned with verification and validation of the accuracy and completeness of the recorded bioassay data used in processing claims for WRG workers.

During the meeting on August 3, 2015, the Advisory Board on Radiation and Worker Health (ABRWH) Work Group on Uranium Refining Atomic Weapons Employers (AWE Work Group, 2015) discussed this finding. NIOSH indicated that, while the site profile provides uranium intakes for unmonitored workers during the operational period of 1958–1970 and intakes from residual uranium contamination starting in 1971, a review was needed to determine (1) whether or not the available uranium bioassay data are sufficient to assess intakes for the period of Burial Grounds remediation starting in 1991, and (2) whether or not the available plutonium bioassay is sufficient to reconstruct intakes of plutonium.

## 2 Outline of White Paper

This section outlines NIOSH’s response to SC&A’s finding 1, which was concerned with the need for the verification and validation of the accuracy and completeness of the recorded bioassay data.

### 2.1 Bioassay program (white paper pages 2–5)

NIOSH reviewed the monitoring records of all WRG claims in the NIOSH Division of Compensation Analysis and Support Claims Tracking System (NOCTS). The following is a summary of their results.

- Two hundred seventy claims were found in NOCTS as of May 3, 2019 (page 2).
- There was a comprehensive uranium urinalysis program for 1964–1993. Most workers with potential exposure were bioassayed. Coworker intakes are provided for those workers who should have been monitored but were not (page 2).
- One hundred fifty-one claims were for employment post 1990. One hundred nineteen claims were for pre-1991 employment (page 2).
- Of the 151 claims with post-1990 employment, 136 claimants worked on site during the period 1991–1993. Of these 136 workers, 110 had routine uranium urinalysis and 26 workers had no, or only occasional, uranium urinalysis (page 3).
- There were no routine uranium urinalysis records for the period 1994–1996. Routine uranium urinalysis began again in 1997 (page 3).

- Of the 151 claims with uranium urinalysis after 1990, 97 had uranium urinalysis post 1996. Of the 97 workers, 42 had routine uranium urinalysis and 55 workers did not have routine uranium urinalysis post 1997 (page 3).
- Chest counts performed by an outside contractor began in 1970 and continued until an onsite in vivo counting system became operational in 1987. However, the results recorded by the outside contractor appeared to underestimate the amount of uranium-235 in the lung (pages 3 and 4).
- After the onsite in vivo counting system became operational in 1987, most workers listed in NOCTS had annual chest counts recorded (page 4).
- One hundred forty-one of the 151 post-1990 claimants have chest count results available in NOCTS. One hundred twenty-one were routinely monitored, and 20 were occasionally monitored (page 4).
- Starting in 1994, Nuclear Fuel Services supplied the U.S. Nuclear Regulatory Commission with individual workers' annual intakes on Form 5. These intakes were derived from air concentration monitoring, and NIOSH assumed they included individual bioassay results (page 4).

## 2.2 Adequacy of uranium data (white paper pages 5–6)

NIOSH assessed all 151 post-1990 employment claims for uranium bioassay data because of the Burial Grounds remediation work, without regard to the worker's work location. The following is a summary of their results.

- Of 151 workers, 121 had routine annual bioassays throughout their employment period. Twenty workers had some chest count records available, but not for all years, and 10 had no in vivo chest count records (page 5).
- A review of the 30 workers who had some chest count records available but not for all employment years, or no chest count records available, indicated that 28 had jobs that would not likely result in elevated intakes and would be assigned environmental intakes. Two worker's files appeared incomplete, and NIOSH will conduct followup with the site (page 5).

Based on a review of all 151 claims in NOCTS with post-1991 site work, NIOSH concluded that all the workers have either sufficient data to reconstruct intakes of uranium, or that environmental intakes are appropriate for the workers with unmonitored periods of employment (page 5).

## 2.3 Adequacy of plutonium data (white paper page 6)

The previous discussion concerning the adequacy of uranium in vivo bioassays post 1990 applies to plutonium because the in vivo bioassays detected and recorded plutonium-239 activity and the appropriate detection limits. However, there were 12 claimants that worked during the period 1988–1990 (or part of that time period), which was prior to 1991. These 12 claims may not have been encompassed by the post-1990 analysis. NIOSH reviewed these 12 claims and found the following:

- The files for one claimant appeared incomplete, and NIOSH will follow up with the site.
- The files of another claimant indicated that the work location was known, and it did not involve work at the plutonium facilities. The worker was monitored regularly for uranium.
- Ten workers had routine in vivo monitoring.

Based on the bioassay data available, NIOSH concluded that, with the exception of three workers whose DOE response files are incomplete, the in vivo data are sufficient to estimate or bound intakes of plutonium from 1988 onward.

### 3 SC&A's Evaluation of White Paper

SC&A analyzed the white paper in view of the NOCTS data available for WRG claimants. SC&A did not reevaluate all the claims but reviewed the claimant list and spot checked some of the workers' associated bioassay data to verify NIOSH's methodology and conclusions in general.

#### 3.1 Bioassay program

SC&A reviewed the WRG bioassay program as outlined in the white paper (pages 2–5), which consisted of the following sections:

- “Routine Uranium Urinalysis Program 1964 Through 1993”
- “Routine Uranium Urinalysis Program 1997 to Present”
- “In Vivo Monitoring”
- “Other Internal Dose Monitoring Data”

SC&A analyzed the number of NOCTS claimants stated (270 total, 151 post 1990, etc.) in these sections of the white paper as outlined in section 2.1 of this report. SC&A concurs that the WRG bioassay program provided for reasonable monitoring of uranium and plutonium intakes.

#### 3.2 Adequacy of uranium data

SC&A reviewed the uranium bioassay data as outlined in the white paper and concurs that if 151 claimants with post-1990 employment were routinely monitored for uranium ( $121/151 = 80$  percent), and those that had only partial monitoring ( $28/151 = 19$  percent) had low potential for exposure, then there are adequate uranium data available. NIOSH is to follow up with the site to obtain more information on the remaining two cases.

#### 3.3 Adequacy of plutonium data

SC&A reviewed the plutonium bioassay data as outlined in the white paper and concurs that the post-1990 in vivo bioassay encompasses the monitoring of plutonium. The 12 claims with employment prior to 1991 were addressed, and NIOSH found that 10 had routine in vivo records, one was not in the plutonium facilities, and one requires NIOSH to obtain additional information from the site. SC&A has previously reviewed NIOSH white paper, “Internal Dosimetry

Coworker Intake and Exposure Model for the W. R. Grace Company, Erwin, Tennessee” (NIOSH, 2019b), for plutonium intakes and had no findings (SC&A, 2019).

SC&A evaluated NIOSH’s white paper concerning verification and validation of the accuracy and completeness of the recorded bioassay data. SC&A found that NIOSH’s analysis of all the WRG claimant bioassay data in NOCTS was inclusive and covered the numerous time periods at the various facilities for the uranium and plutonium radionuclides of concern. In general, workers were bioassayed, and for workers that should have been, but were not, monitored, NIOSH provides coworker or environmental intakes for dose reconstruction purposes in their responses to finding 3 (NIOSH 2019b), findings 2 and 7 (NIOSH 2019c), and in the technical basis document, ORAUT-TKBS-0043, revision 02, “An Exposure Matrix for W.R. Grace and Company in Erwin, Tennessee” (NIOSH, 2011).

## 4 Summary and Conclusions

SC&A’s review of the white paper found that NIOSH’s response and recommendations concerning finding 1 (verification and validation of the accuracy and completeness of the recorded bioassay data) were reasonable and verifiable. SC&A had no findings in this review. NIOSH has three claimants for which addition information from the site is required.

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