



Memorandum

To: Advisory Board Work Group on Grand Junction Facilities

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Subject: Grand Junction Monitoring Program in 1991

Date: July 27, 2017

In May 2016 Sanford Cohen & Associates (SC&A) issued *A Focused Review of the NIOSH SEC Evaluation Report for Grand Junction Operations Office, Addendum to Petition SEC-00175*. The report contained one Finding.

Finding 1: Workplace air monitoring data do not support the assumption that unmonitored radiation workers would not have exceeded 200 DAC-hours or that non-radiation workers would not have exceeded 40 DAC-hours in a given year.

This finding concerns whether or not the Grand Junction site implemented a workplace monitoring and worker bioassay program in 1991 that could be used to provide an upper bound intake for radiation and non-radiation workers. The 200 DAC-hour per year exposure, which NIOSH proposed as an upper bound, is the equivalent of 2,000 hours per year exposure to an air concentration of 10% of the DAC (derived air concentration), which at that time was provided in DOE Order 5480.11.

On July 20, 2016, NIOSH provided an initial response (NIOSH, 2016) to the Advisory Board Work Group on Grand Junction Facilities (Work Group), to which SC&A provided a further response on September 27, 2017 (SC&A, 2016). On October 5, 2016, the Work Group met to discuss the issue.

SC&A's issue with the NIOSH assumption that 200 DAC-hours provides a bounding intake for unmonitored workers concerns verification of the implementation of the air monitoring and bioassay program as described below in the SC&A memorandum of September 27, 2016.

*Although the technical basis document for bioassay programs (Geotech 1990) describes how the program **should** operate to detect intakes resulting in a dose of 100 mrem, no document or database was presented containing air monitoring results, sample locations, workers present, etc. to demonstrate that the workplace controls described in the technical basis document had actually been implemented. SC&A does not believe NIOSH has shown sufficient workplace air monitoring data to support its assertion that unmonitored radiation workers would not have*

exceeded 200 DAC-hours or that non-radiation workers would not have exceeded 40 DAC-hours in a given year.

Discussions during the Work Group meeting failed to resolve the issue. It was suggested that NIOSH determine activities in the 1991 era that may have the potential for generating a significant air concentration. It was also suggested that NIOSH interview the site [redacted] at the time for information about the air sampling and the bioassay program. In response to this suggestion, NIOSH performed additional review of activities in the 1991 era, focusing on 1991 through 1993, a period in which there is little available air monitoring data. NIOSH also interviewed a Grand Junction site [redacted] who had direct knowledge of the work activities and monitoring programs that were conducted during this time period (ORAUT, 2017).

Information from Site [redacted]

On March 16, 2017, the [redacted] interview was conducted. The [redacted] was employed at the Grand Junction site from [redacted] through [redacted]. On March 29, 2017, a follow-up interview was conducted to allow the interviewee an additional opportunity to respond (ORAUT 2017). The interviewee confirmed the implementation of a bioassay program based on 10% DAC, although the [redacted] provided details that indicate some changes to how the program was implemented from that described in the 1990 Geotech technical basis for bioassay sampling document (Geotech, 1990). Details from that interview are provided below, along with some additional details from supporting references.

The [redacted] indicated that upon their hiring in [redacted], a monitoring program to implement the requirements of DOE Order 5480.11 had already been implemented. The [redacted] indicated that the internal dosimetry program was implemented through ES&H Procedure 3.8 (SRDB 90529). That reference is an October 1990 draft copy of a revision to the monitoring program. The revision was issued May 15, 1991 (Ref ID 98111, pp. 26-33). The information indicates that the site transitioned from the interim bioassay program described in the 1990 document, which relied on frequent rotating bioassay samples, to a program based on entries into Airborne Radioactivity Areas (ARAs).

Under the requirements of the 1990 document, the site was collecting routine bioassay samples every 6 days, rotating through workers, so that every worker was sampled approximately every 26 days (SRDB 100231, pg. 3). This resulted in a nine month backlog of un-analyzed samples (~500) in 1991 at the bioassay lab (SRDB 97784, pg. 14). The procurement for lab services in [redacted] was one of the [redacted] main duties to address when they were first hired. The site's original (interim) program for implementation of DOE Order 5480.11 was to collect routine bioassay samples for people on the job. They soon realized that this resulted in an oversampling of the workforce. Coupled with an issue of increased turnaround time with the bioassay analysis lab, TMA Norcal, the site decided that a trigger-based program was more appropriate. The [redacted] indicated that the high number of bioassay samples during the 1989-1991 timeframe was not an indication of the degree of exposure to airborne radioactivity. Rather, it was an example of the impact of an overaggressive sampling program. As they looked at the actual air monitoring data, the site realized that it was unnecessary to collect so many bioassay samples, given they did not have the airborne conditions to trigger such

monitoring. Therefore, a change was made from the hundreds of individuals that were routinely sampled under the interim program prior to 1991.

The 1991 change reduced the number of bioassay samples collected by implementing a site trigger for bioassay based on entry into an ARA, which was defined as an area with an air concentration of 10% of DAC or greater (SRDB 90529). If an individual did not enter an ARA, the site assumed there was no potential to meet the criteria for bioassay monitoring. The [redacted] indicated the site had a very robust air sampling program that included the use of area and personal air samplers.

The [redacted] indicated that there was only a minimal number of ARAs at the Grand Junction site during the early 1990s. The only routine ARA on site would have been the radon calibration chamber. The chamber was posted as ARA “when in use.” However, the [redacted] indicated that “when in use,” there would not be anyone in the chamber itself, and the access was controlled.

There were also intermittent ARAs established for decontamination and demolition (D&D) activities. However, the [redacted] indicated that there was not a lot of D&D operations in the early 1990s. They indicated that the bigger onsite D&D projects were in the mid and late 1990s. In the early 1990s, the site focused more on the vicinity properties.

NIOSH has also reviewed claim data and various documents in the NIOSH site research database that confirm a bioassay monitoring program based on entries into an Airborne Radioactivity Area (ARA) was in place. Procedure 3.8 (Ref ID 98111) required sign in sheets to be completed for all entries in an ARA. The sheets were submitted to the Radiological and Environmental (R&ES) Safety Dosimetry office, who was responsible for tracking bioassay and requesting samples. R&ES was also to be notified when a worker no longer was making ARA entries to be taken off the bioassay program, in which case a termination sample was required. NIOSH has found examples from 1991 and later to verify this program was implemented. Claims [redacted] have records of tracking ARA entries and bioassay sampling. Ref IDs 100183, 100185, 100188 have various records showing tracking compliance with bioassay requirements in 1992. Examples of 1991 bioassay data results can be found in Ref IDs 97890, 97891, and 97894.

NIOSH concludes the site implemented a program of baseline, routine, and termination bioassay samples for workers who entered an ARA and had a system to track compliance.

Evaluation of Sources of Airborne Radioactivity

The discussion above indicates an interim bioassay program was in place prior to 1991, and a bioassay program based on entry into an ARA was introduced in 1991. NIOSH has reviewed site information to determine potential sources of airborne radioactivity for the 1991 through 1993 period. The period after 1993 is not discussed in detail in this memorandum because there are numerous air monitoring data available for the site remediation activities in 1994 through 2001. The site also implemented 10 CFR 835 during that period (Ref ID 98093, p. 4).

Principle on-site sources of airborne radioactivity were identified in the NIOSH ER Addendum, section 7.2.1.3: particulates from the Sample Prep Lab and on-site remediation work, and radon

exposures. There are also many records of monitoring workers for off-site remediation of vicinity properties who were covered under the same internal dose program.

The Grand Junction laboratory work included grinding and crushing of samples in the Sample Prep Laboratory in Building 7A, which was equipped with a baghouse for collection of dust. The operation and use of the associated baghouse was described in a report from an environmental audit conducted in May and June 1991 (Ref ID 129462, p. 50). Sample prep activities continued in Building 7A until early 2001, at which time the operation was transferred to Building 46 (Ref ID 129381, p. 27; Ref ID 89880, p. 14).

In the 1980s the Sample Prep Lab was utilized to prepare (crush) relatively large quantities of ores and tailings for use in calibration pads and reference materials. However, those activities ended before 1991. The site [redacted], who started working in [redacted], who was interviewed by NIOSH did not recall there being any ARAs associated with the sample preparation work. Available references indicate small quantities of samples in the sample prep laboratory (Ref ID 165319; Ref ID 165320). NIOSH has not identified any significant source of material being processed in the 1990s. The ER Addendum discusses 1986 bioassay and air sampling data for workers in the sample prep lab. Bioassay data was found in 1990 for those workers (Ref ID 98098, pp. 217-230), when the interim bioassay program was in effect. The available information indicates the Sample Prep Lab did not exceed 10% DAC after 1990.

NIOSH reviewed the potential for airborne radioactivity from on-site remediation work in 1991 through 1993. Per the ER (NIOSH 2011), the Grand Junction Project Office Remedial Action Project (GJPORAP) occurred from the mid-1980s to about 2000. However, the early years were investigations. The Record of Decision (ROD) was issued in April 1990. The initial ROD specified remediation of exterior spaces by removal of tailings and contaminated soils and demolition of four buildings: 6, 31, 37, and 38 (Ref ID 76720; Ref ID 88610). Some exterior remediation occurred in the late 1980s prior to the ROD, and the excavated media stockpiled pending final disposition. In addition to the exterior excavations and four buildings identified in the 1990 ROD, D&D activities occurred in the mid to late 1990s after additional buildings were added to the remediation project.

The four buildings identified in the initial ROD were demolished in 1992. Of those, Buildings 6 and 31 were the former Small Pilot Plant and Large Pilot Plant that processed uranium ores in the 1950s. Details and pictures are provided in Ref ID 89864. Both were demolished in April 1992. Building 6 was relatively small, as were the two support buildings (37 and 38). Building 31 was a 10,000 ft² building. The debris and materials were hauled off to the Cheney disposal cell (Ref IDs 76615, 76619).

Routine environmental monitoring for airborne radioactive particulate was initiated in December 1985. The 1990 site Environmental Report discusses the monitoring locations (Ref ID 90845, pp. 23-29). Environmental reports for 1990 (Ref ID 90845), 1991 (Ref ID 90853), 1992 (Ref ID 90860), and 1993 (Ref ID 90857) all have airborne radioactivity concentration results of Ra-226, Th-230, and Total U reported, with the overall maximum results of 3×10^{-15} $\mu\text{Ci/ml}$, 7×10^{-15} $\mu\text{Ci/ml}$, and 5×10^{-15} $\mu\text{Ci/ml}$, respectively. The results indicate ambient airborne levels at the site during remediation in

those years were very low. These samplers were in use during the period of exterior excavations and demolition activities.

Grand Junction also characterized airborne alpha radioactivity in the immediate area of tailings excavation. There are 37 air sample results available that were taken during tailings excavations of exterior areas in November and December 1990. The samples were taken from a variety of worker breathing zone and work area samplers. The highest reported alpha air concentration was 9.9% DAC (Ref ID 89909, p. 46).

Buildings 6 and 31 were demolished in April 1992. Although those buildings were used to process uranium in the 1950s, Building 6 had subsequently been used for office space, while Building 31 was used for storage. NIOSH currently has no air sampling data or contamination surveys taken during the demolition work. Radiological monitoring is indicated in the building demolition project close-out reports discussed above (Ref ID 76619, 76615, 88610). NIOSH sent a request to the Grand Junction site inquiring on the availability of air sampling data and contamination surveys from demolition of those buildings. NIOSH recently received a reply to that request.

Grand Junction responded with a lengthy list of available records from the Grand Junction Project Office Remedial Action Project. NIOSH has done a partial review of the list of records as of the issuance of this memorandum. Some records are described as containing radiation work permits (RWPs), contamination surveys and air monitoring data that indicate they are data from demolition of Buildings 6 and 31 in April 1992. The list of records also contain many other records dating back to the late 1980s. The descriptions of those records, which include RWPs, access logs, air monitoring and surveys, verify the Grand Junction site implemented an internal dose assessment program.

Summary of Bounding Exposure

NIOSH considers the information in available references and records sufficient to conclude Grand Junction implemented a monitoring and bioassay program in 1991 sufficient to identify workers who were exposed to the sites 10% DAC trigger level for bioassay.

NIOSH previously analyzed 569 air sample results that are available from remediation activities. NIOSH previously assumed the bounding intake for D&D work was the upper 95th percentile value, or 2.66×10^{-12} $\mu\text{Ci}/\text{ml}$, which corresponds to 38% of the 7×10^{-12} $\mu\text{Ci}/\text{ml}$ DAC being used at the site. Those data were reviewed by SC&A, who concurred the data was sufficient to reconstruct intakes to unmonitored workers during the D&D period (SC&A, 2017). However, as discussed in this memo, exposure to 10% DAC should bound intakes for unmonitored workers in 1991 and later based on the site's bioassay program.

References

DOE, 1988, *Radiation Protection for Occupational Workers*, DOE Order 5480.11, U. S. Department of Energy (DOE), December 21, 1988. Available at www.directives.doe.gov/directives-documents/5400-series/5480.11-BOrder

Geotech, 1990, *Technical Basis for Bioassay Sampling for Sample Preparation Plant and Grand Junction Vicinity Property Workers*, UNC Geotech, March 1990. [SRDB Ref ID 100231]

NIOSH, 2015, *SEC Petition Evaluation Report, Petition SEC-00175, Addendum*, National Institute for Occupational Safety and Health (NIOSH), March 12, 2015.

NIOSH, 2016, *NIOSH Response to SC&A Review of Grand Junction Evaluation Report Addendum*, July 20, 2016. Available at <https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-gjfseceradd.pdf>

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SC&A, 2016, *SC&A Review of NIOSH July 2016 Finding Response*, SC&A, Inc., Vienna, Virginia, September 27, 2016, Available at <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-gjoosec175-092716.pdf>

SC&A, 2017, *Resolution of Finding 3 under SC&A's Review of DCAS-PER-047 (GJOO), Memorandum from Hans Behling to Subcommittee for Procedures; NIOSH; DFP, SC&A, Inc.*, Vienna, Virginia, June 22, 2017.

NIOSH Site Research Database files (Ref IDs) referenced:

76615	98111
76619	100183
76720	100185
88610	100188
89864	100231
89880	129381
89909	129462
90529	165319
90845	165320
90853	
90857	
90860	
97784	
97890	
97891	
97894	
98093	
98098	