



# SC&A's Review of Observation 3, Potential Radon Calibration Chamber Exposure at the Grand Junction Facility

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# History of Grand Junction Facility TBD that resulted in observation 3

- ◆ May 18, 2018 – NIOSH issued ORAUT-TKBS-0060 (TBD), revision 00 (NIOSH, 2018) for the Grand Junction Facility (GJF) in Grand Junction, CO
- ◆ August 17, 2021 – SC&A issued its review of the GJF TBD (SC&A, 2021)
  - SC&A's review identified 5 observations
  - Observation 3, lack of consideration for potential exposure from the radon calibration chamber (RCC), still outstanding

# Addressing observation 3

- ◆ February 15, 2022 – the Subcommittee for Procedure Reviews (SPR) discussed observation 3 at its meeting

Action item:

- NIOSH would provide relevant documents for SC&A to review
- ◆ May 2022 – SC&A reviewed five GJF RCC documents provided by NIOSH
  - Documents give several snapshots in time of personnel monitoring and resulting intakes and doses

# Site Research Database (SRDB) 160585

- ◆ SRDB 160585 (Geotech, 1991a) – addresses radon dose for 2 years, during which Geotech personnel operated the RCC
- ◆ Used the log entries of stay time and chamber radon concentration measurements to determine intakes and resulting doses, assuming:
  - 50% equilibrium
  - 1 rem per working level month (WLM)
  - any individual event dose <1 mrem was entered as zero
  - any total dose <10 mrem was entered as zero
- ◆ All resulting doses for the 2-year period for all workers were entered as zeros

# SRDB 100192

- ◆ SRDB 100192 (Geotech, 1991b) – summarizes SRDB 160585 for 1990 for reporting purposes
- ◆ Document contains no new information

# SRDB 166851

- ◆ SRDB 166851 (NIOSH, 2017) – NIOSH interview with a senior health physicist in March 2017 about health physics monitoring in general
- ◆ EE worked at GJF during the period the RCC was operational
- ◆ Summary of relevant information about the RCC from the interview:
  - RCC is mentioned as an airborne radioactivity area
  - One door would be locked at  $>30$  pCi/l, and both doors would be locked at  $>100$  pCi/l
  - Radon concentration value multiplied by stay time was used to derive intakes and resulting doses, as detailed in Geotech (1995), PDF p. 9
  - Several RCC workers made routine entries during a year and were monitored per logbook entries (Geotech, 1995)

# SRDB 093732

- ◆ SRDB 093732 (DOE, 1985) – RCC operating manual issued January 1985
- ◆ A few highlights of the manual:
  - Exposure chamber was a steel cylinder 11 feet in diameter by 9 feet in height
  - Radon generator contained 5 millicuries of radium-226
  - Five live-time radon detectors and four live-time radon decay product detectors with the results recorded on computer
  - No entry into the chamber was allowed at radon concentrations >100 pCi/l
  - External exposure rate <1.1 mR/h outside the RCC

# SRDB 098093

- ◆ SRDB 098093 (Geotech, 1995) – Internal memorandum summarizing individual doses and WLM values for EEs who entered the RCC periodically during one year of operation
  - Appendix A provides the internal dose assessment calculations
  - Attachments A.1 through A.6 provide:
    - detailed list of the calculated intakes in WLM
    - committed effective dose equivalent
    - lung dose for the year for each of the EEs
  - Attachment A.7 contains radon chamber entry log sheets for the year

# SC&A analysis of SRDB 098093

- ◆ SC&A analyzed:
  - internal dose assessment methodology
  - equations used in the calculations
  - calculated intakes in WLM, committed effective dose equivalent, and lung dose in attachments A.1 through A.6 for a year of RCC operation
- ◆ SC&A found methods and calculations to be correct and applicable

# Results of SC&A's analysis of SRDB 098093

## ◆ SC&A found:

- The largest recorded acute equilibrium-equivalent radon concentration for the one operational year was 22 pCi/l with a stay time of 4 minutes
- The largest dose for the year for any EE who entered the RCC was 3 mrem
- The largest derived WLM from the log entry information for that year for any EE was 0.0022 WLM
- The maximum recorded number of RCC entries made by an individual during the one-year period was recorded in the document

# What this information indicates

- ◆ RCC likely operated during the period 1985–1994 but could have been operated during other years
- ◆ RCC was an established facility with control of who could be present and who could operate it
- ◆ Operating and entry information were recorded in logs
- ◆ Exposure was controlled and personnel limited
- ◆ There were real-time radon monitors with results recorded on a computer
- ◆ Internal radon doses for the 2-year period addressed in SRDB 160585 were all <10 mrem total for each of the RCC workers
- ◆ The largest radon dose in SRDB 098093 for any EE who entered the RCC was 3 mrem, and the largest derived WLM from the log entry information was 0.0022 WLM

# What is still uncertain

- ◆ The following information was not provided in the five documents reviewed:
  - exact years the RCC was operational (the RCC manual was dated 1985, and Building 32 was remediated in 1999–2000)
  - intakes and doses during operational years other than 1989, 1990, and 1994
  - number of chamber entries that one individual could make per year

## Summary: Use of 5.7 pCi/l intake

- ◆ The question raised by observation 3 was: Does the 5.7 pCi/l used from Building 30 bound the radon exposure at the RCC?
- ◆ According to table 5-7 in ORAUT-TKBS-0060 for 1975–1998, 5.7 pCi/l radon at 50 percent equilibrium equals:
  - 2.85E-2 working levels
  - which equals 0.340 WLM/year
  - at 1 rem per WLM (Geotech, 1991a, pdf p. 3), this would result in a dose of 340 mrem/year
- ◆ Additionally, thoron dose is assigned per table 5-7 of ORAUT-TKBS-0060 at an intake level of 5.7 pCi/l

# Summary: Assigning 0.340 WLM/year

- ◆ The assignment of 0.340 WLM/year radon intake (which would result in a dose of 340 mrem/year) to all employees during the years 1975–1998 would bound:
  - individual events of <1 mrem
  - a maximum annual total <10 mrem
  - a maximum of 3 mrem recorded for one year of operation addressed in SRDB 098093
  - an intake of 0.0022 WLM for one year of operation addressed in SRDB 098093

# Status

- ◆ Currently, radon dose information for the period outside the 3 years of monitoring has not been made available
- ◆ Indications are:
  - The RCC was a controlled facility with monitoring in place
  - 5.7 pCi/l would bound exposures, but those conclusions are somewhat subjective outside of the 3 years of monitoring data currently available
  - Exceeding 0.340 WLM/year would require substantial deviation from standard operations
- ◆ Observation 3 remains open until resolved to the satisfaction of the SPR



# Questions?

# References

Geotech, Inc. (1991a). *Assessment of internal dose for Geotech workers occupationally exposed due to radon chamber entries during 1990*. SRDB Ref. ID 160585

Geotech, Inc. (1991b, February 20). *Internal dose assessment due to radon chamber entries during 1990* [Internal memorandum]. SRDB Ref. ID 100192

Geotech, Inc. (1995, February 28). *Internal radiation doses* [Internal memorandum]. SRDB Ref. ID 098093

National Institute for Occupational Safety and Health. (2017). Documented communication with [redacted], March 16 & 29, 2017. SRDB Ref. ID 166851

National Institute for Occupational Safety and Health. (2018). *Site profile for Grand Junction Facilities* (ORAUT-TKBS-0060, rev. 00). <https://www.cdc.gov/niosh/ocas/pdfs/tbd/gjf-r0-508.pdf>

SC&A, Inc. (2021). *SC&A's review of ORAUT-TKBS-0060, revision 00, "Site profile for Grand Junction Facilities"* (SCA-TR-2021-PR001, rev. 0). <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-gjfsp-r0-508.pdf>

U.S. Department of Energy, Technical Measurements Center. (1985). *Operating manual for the radon-daughter chamber* (GJ/TMC-18, UC-70A). SRDB Ref. ID 093732