# Review of NIOSH Response to SC&A's Supplemental Review of M&C

Joe Fitzgerald, MS, MPH

Bob Barton, CHP

Advisory Board on Radiation and Worker Health, M&C Work Group

July 13, 2023

# Chronology

- M&C Work Group tasked SC&A to focus on any remaining lines of inquiry or outstanding issues relevant to work group's review of SEC-00236 evaluation report.
- SC&A issued supplemental review on August 22, 2002, based on:
  - Record of work group discussions
  - Former worker input
  - Supporting NIOSH and SC&A reports, responses, white papers, and presentations
- NIOSH issued response paper to SC&A's supplemental review on January 13, 2023.
- SC&A issued review of NIOSH response on April 25, 2023.
- M&C Work Group meeting held May 12, 2023.

# Findings and observations

- **Finding 1:** The back application of a high 1995 sediment survey result to bound inside subsurface activities is not adequately supported by information for M&C worker activities from the earlier residual period.
- **Finding 2:** The application of surrogate data from the Mound project to provide a dust-loading factor for M&C activities does not satisfy the Board's surrogate data policy.
- **Observation1:** The use of blended D&D characterization survey data from 1984 and 1992 to support a bounding dose for outside subsurface activities may not be necessarily bounding for work in nonuniform soil contamination, given the presence of hot spots that existed during the residual period at M&C.
- **Observation 2:** References to the M&C safety and health manual, NRC inspection results, operator training, and other programmatic considerations do not necessarily substantiate the conservatism of the 95th percentile soil contamination value being applied.

# Intrusive nature of M&C maintenance work

- SC&A considers M&C maintenance activities unique in terms of their level of intrusiveness (excavations, pipe cleaning, pipe cutting), work environments (confined spaces), and uncertain or unknown source terms (contaminated pipe sediments and scale, presence of coagulants, repurposed equipment).
- Like Linde Ceramics, M&C better fits “building renovation” scenario under NUREG/CR-5512 (NRC, 1992) than it does “building occupancy” scenario that typifies OTIB-0070 resuspension assumptions for other AWEs.
- NIOSH responds that “intrusiveness” should be judged “applying standard industrial hygiene or nuclear industry resuspension factors to a source term” (NIOSH, 2023a, p. 8), and that the “source term at the Linde Ceramics Plant was considerably larger than M&C’s” (NIOSH, 2023a, p. 10).
- SC&A agrees M&C dose levels are relatively low compared with some SEC sites but are comparable to others (e.g., Pantex, Blockson, Sandia).

# Subsurface inside: Pipe replacement vs. cleaning out

- NIOSH disagrees with SC&A's interpretation that M&C maintenance workers were "cleaning out blocked drain lines" and that it "resembles the [D&D] work the health physicist describes" in the following interview (NIOSH, 2023a, p. 2):

  > *I think that one of the differences that I would suggest is that these remediation workers are not handling the material inside the piping because usually it is dealt with in some way that it is a sealed entity. In many cases when there was piping or ductwork, the idea was not to take material out of it and clean it. The idea was to get rid of it.* ***On the other hand, the maintenance worker's job is to clean the pipe. So, I think the difference is the proximity to the source term, the handling of the source term, and their physical presence near the source term was probably a little different.*** [NIOSH, 2017a, p. 6, emphasis added]

- SC&A agrees with the cited interviewee, as amplified by the Petitioner (2023), who emphasizes the contrast between the controlled manner in which D&D workers performed such work compared with the more intrusive activities of M&C maintenance workers.
- For D&D workers, a comprehensive radiation safety program was in place, whereas for M&C maintenance activities, workers were unaware of radiological contamination, with no radiological controls, no health physicist, and no rad control oversight.

# Concern with subsurface inside bounding concentration: Presence of coagulants

- A vegetable-based mineral oil that was used in Building 10 for drawing wire had the properties of a coagulant. Upon discharge to the drainage system, M&C workers found it would frequently "plug up the drains" (NIOSH, 2017b).
- The discharged oil may have consolidated and concentrated drain pipe sediments, including existing AWE uranium and thorium.
- **Question:** During active Building 10 operations (through 1981), would regular releases of coagulants have led to more frequent and substantial blockages, involving elevated uranium and thorium as a function of binding properties of the coagulant oil?

# Presence of coagulants: NIOSH response

- NIOSH finds that “premise in the SC&A review is inaccurate” in that release of coagulant oil during the residual period (by HFIR operations) did not introduce higher concentrations of “*covered* uranium and thorium from AWE operations (1952–1967) to the subsurface” (NIOSH, 2023a, p. 12).
- NIOSH notes that “wire operations during the residual period did not process radioactive materials; therefore, most material rinsed into the drains was non-radioactive except for residual contamination that remained in cracks and crevices” (NIOSH, 2023a, p. 12).
- SC&A: Releases of *nonradioactive* coagulant oil to drain lines was done separately from any HFIR operational radioactive releases and may have had a potentially significant, but collateral, influence on how AWE-related uranium and thorium *already* in “cracks and crevices” of drain pipes would have been consolidated and concentrated over time (SC&A, 2023, pp. 6–7).
- **Potentially elevated source term related to the effects of regular coagulant releases at M&C during the residual period remains uncertain and unresolved.**

# Concern with aerosolization of contaminated scale

- Accumulation of contaminated scale on inside of piping confirmed, with one survey exceeding 1,000,000 dpm/100 $cm^2$ for a 4-inch mainline drain being cut and removed.
- During M&C residual period, drain pipes were frequently cut, repaired, replaced, and cleaned out, using power tools such as saws, drills, grinders, and powered snakes, as well as cutting torches.
- As noted by DOE in its hazard assessment of Bridgeport Brass AWE, "the residual uranium could eventually be released . . . through intrusive work activities such as pipe cutting and removal," and that "it is possible that under certain conditions (such as cutting through a steel pipe with a cutting torch) surface activity attached to the steel could be released with the steel particles" (DOE, 1996, PDF p. 11).
- Such pipe cutting may have released fine aerosols that would have been concentrated by the confined space (trenches, pits) atmospheres where such work was performed.

# Aerosolization of contaminated scale: NIOSH response

- NIOSH finds that contaminated scale constituted “isolated hot spots,” not a systemic condition, and that, in any case, NIOSH does not believe there is any evidence that even higher activity levels might have existed (NIOSH, 2023a, p. 16)
- SC&A finds that NIOSH has not provided any evidence that:
  - contaminated scale would not have been present elsewhere in the piping system
  - contaminated scale could have involved both metal and clay pipes
  - higher activity levels were not present during the M&C residual period
- **SC&A: Potentially elevated source term and exposure potential related to the aerosolization of contaminated scale during pipe cutting remain uncertain and unresolved**

# Concern with subsurface inside bounding concentrations: Confined space effects

- Presence and effect of extensive confined space work at M&C not reflected in exposure modeling. Leads to increased resuspension of contaminant particulates and concentration of aerosols.
- Prevalence of confined space work at M&C differentiates it from other AWEs.
- Mound project data used for M&C dust loading factor do not account for confined space effects and is not an acceptable surrogate.

# Confined space effects: NIOSH response

- NIOSH acknowledges that “potential particulate enhancement in confined space[s]” represents new information and “agrees that addressing the potential change in resuspension in a confined space needs to be addressed” (NIOSH, 2023b).
- Configuration of M&C confined spaces, time frames, work activities, and contaminant release modes (resuspension vs. fume generation) remain uncertain.
- **Potentially elevated exposure potential related to subsurface activities by M&C maintenance workers in confined spaces remains uncertain and unresolved.**

# Finding 1: "Inside subsurface" summary conclusion

- Available information is questionable and may be insufficient to account for the exposure contribution to M&C maintenance workers during the residual period from confined spaces, contaminated scale releases, and the effects of coagulants.
- M&C maintenance activities during the residual period were not controlled for radiation exposure as were later D&D-related activities from which "bounding" samples were taken. The maintenance pipe cleanout was not similar to the D&D pipe removal in terms of proximity, intrusiveness, and potential exposure.
- References to the M&C safety and health manual, NRC inspection results, operator training, and other programs for Building 10 radiological controls do not necessarily substantiate the conservatism of the 95th percentile soil contamination value being applied.
- Use of "extreme conservatism" in formulating proposed upper bound concentration to account for "intrusive activities, high exposure conditions, uncertain facility activities, or unknown contamination sources" is not a plausible approach to compensate for inadequate or insufficient information about M&C workers during the residual period.
- Therefore: **The back application of a high 1995 sediment survey result to bound inside subsurface activities is not adequately supported by information for M&C worker activities from the earlier residual period.**

# Finding 2: Surrogate data (Mound Plant dust loading)

- NIOSH acknowledges default dust loading value of 100 ug/$m^3$ from ORAUT-OTIB-0070 and NUREG/CR-5512 not appropriate for intrusive M&C work.
- Dust-loading factor derived from 294 hi-volume air samples taken at backhoe excavation activities at Mound in 1997 was used to corroborate increase in modeled M&C resuspension factor (NIOSH, 2018, p. 8).
- SC&A finds that Mound surrogate data do not satisfy Board's surrogate data policy for site and process similarities; not apparent how Mound project addressed considerations related to particulate resuspension in a confined space (e.g., trenches, pits, and vault spaces at M&C).
- Prevalence of confined spaces in M&C maintenance activities differentiates it from other AWEs.
- Therefore: **The application of surrogate data from the Mound project to provide a dust-loading factor for M&C subsurface activities does not satisfy the Board's surrogate data policy.**

# References (1 of 2)


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