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

**LaVon Rutherford, CHP**
NIOSH, Health Science Administrator

**Advisory Board on Radiation and Worker Health**

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# Overview

- Introduction
- NIOSH Responses
  - SC&A Line of Inquiry 1
  - SC&A Line of Inquiry 2
  - SC&A Line of Inquiry 3
- NIOSH Conclusion

# Introduction

# Introduction (1 of 2)

- On August 22, 2022, NIOSH received SC&A's Supplemental Review of M&C Work Group Issues
- NIOSH's response paper was sent to the work group on February 1, 2023
- The response paper addresses comments, observations, and findings from that review

# Introduction (2 of 2)

- SC&A's supplemental review posited three lines of inquiry based on current work group concerns, and NIOSH organized the response paper accordingly
- In each SC&A Line of Inquiry section, NIOSH responds to SC&A findings, observations, and other SC&A comments where clarification is necessary

# NIOSH Response to SC&A Comments, Findings, and Observations – SC&A Line of Inquiry 1

## Conditions and Work Activities Associated with the Metals and Controls Corp. (M&C) Residual Period

# M&C Work Activities – Key Issue

- SC&A indicated the key issue before the Work Group is how M&C compares to other AWE sites in terms of "unusual work activities with high dose potential for which NIOSH was unable to evaluate the source term"

# Intrusive Nature of Maintenance Work (1 of 2)

- SC&A Comment –
  - *The active and intrusive nature of the described maintenance work at M&C during the residual period clearly exceeded the residual period conditions and activities at other AWEs, as described in their corresponding evaluation reports and site profiles, and what would be assumed under OTIB-0070 for application of its resuspension and volumetric soil values.*

# Intrusive Nature of Maintenance Work (2 of 2)

- SC&A Comment –
  - *It falls within the continuum of post-operational intrusive activities ranging from Norton and Vitro (very active, D&D-like activities) to that of Linde (renovation activities), with M&C being closer to the latter, but without the radiological protection controls, protective equipment, and personnel monitoring that were typical of formal D&D programs.*

# NIOSH Response (1 of 3)

- Work intrusiveness is primarily addressed by applying standard industrial hygiene or nuclear industry resuspension factors to a source term
- Norton Co. and Vitro Manufacturing were not added to the Special Exposure Cohort (SEC) because of the intrusiveness of their activities
- They were added because the lack of useful source-term information prevented NIOSH from calculating a plausible dose estimate

# NIOSH Response (2 of 3)

- This is NOT the case at M&C because NIOSH does have relevant source-term information for M&C
- NIOSH suggests SC&A's Table 1 of their supplemental report should be evaluated further
- NIOSH will develop a table that lists the known activities that occurred during the residual period at the AWE sites
- NIOSH previously stated that residual-period tasks at other sites also included contaminated soil excavation, welding, and torch-cutting in contaminated areas.

# NIOSH Response (3 of 3)

- NIOSH Response cont.
  - For example, in NIOSH's brief review of activities associated with Bliss and Laughlin, NIOSH identified
    - The trench was cleaned, scabbled, jack-hammered, and sand-blasted
    - Ceiling trusses and perpendicular members were decontaminated
    - The concrete pad over trenches and pits removed and trench remediated (max 1420 pCi/g)

# SC&A comment – Blocked Drains (1 of 3)

- SC&A provided a statement they obtained from an interview of a former M&C maintenance worker “who spoke of cleaning out blocked drain lines from Building 10 on a regular basis”

# SC&A Comment – Blocked Drains (2 of 3)

- SC&A also pointed to the interview of a Health Physicist who worked during the D&D period indicating the difference between D&D work and maintenance work
  - Remediation workers are not handling the material in the pipe (sealed entity)
  - Maintenance job is to clean the pipe out

# SC&A Comment – Blocked Drains (3 of 3)

- SC&A Comment Cleaning out Blocked Drains (cont.)
  - "D&D is a controlled environment where the workers were very aware of what [they] were doing," whereas the latter was "uncontrolled, unconfined, aggressive as hell, using mechanical processes that cause aggravation and clouds of dust"
  - Moreover, maintenance worker "environments were rarely cleaned because they are not part of the normal process areas"

# NIOSH Response – Blocked Drains (1 of 2)

- The worker indicated they “cut the line with a snap cutter, replace the line,” that is not the same as “cleaning out blocked drain lines,”
- In fact, it resembles the decontamination and decommissioning (D&D) work the health physicist describes (i.e., removal as “a sealed entity”).
- Additionally, M&C placed cones around work areas
- An outside contractor was primarily used to saw-cut the concrete floor

# NIOSH Response – Blocked Drains (2 of 2)

- Water was applied during cutting as a dust suppressant
- After the concrete was broken, two or three M&C workers would use shovels to access the clogged pipe and remove it.
- As noted by SC&A in their 2022 paper where they quoted a M&C maintenance worker, “it was incumbent on us to clean up after we finished the job”

# NIOSH Response – D&D vs. Maintenance

As noted earlier SC&A quoted a health physicist who worked during the D&D that the maintenance activities were significantly different from a control perspective than D&D

However, in our response paper we provide quotes and portions from ***maintenance workers interviews who worked during the period in question*** that would lead to a different conclusion

# Quotes from worker interview (1 of 3)

- Concerning Texas Instruments (TI) Safety
  - *"As far as I'm concerned, they (TI) were top-notch in their security and all of that kind of stuff. They really cared about their people."*
  - *"I was lucky to be there. I loved the job. They were so safety conscious. If they said something was safe, I believed them."*
  - *"Texas Instruments had a great safety program. If you did not follow the safety procedures, you would be terminated quickly."*

# Quotes from worker interview (2 of 3)

- Concerning Surveying prior to equipment removal
  - *"I know that was done when there were some major mills that went into Building 10. Because of the foundations that were associated with the mills, they had to saw-cut the concrete floor to get into the soils below. They did some readings then to see if there was still any residual contamination."*

# Quotes from worker interview (3 of 3)

- Concerning Surveying prior to equipment removal
  - *“So, what they wanted to make sure of was that there wasn’t anything residual at the floor line before they started to cut the floor.”*

# Conclusion – SC&A Line of Inquiry 1 (1 of 2)

- NIOSH concludes the conditions and work activities associated with the M&C residual period are not unusual
- Still, all sites have differences, so NIOSH starts with approved standard modeling procedures and applies scientifically sound and conservative modifications (e.g., $10^{-3}$ resuspension) to tailor these procedures to each site

# Conclusion – SC&A Line of Inquiry 1 (2 of 2)

- Furthermore, NIOSH has demonstrated that M&C exposure potentials are not higher than those addressed by ORAUT-OTIB-0070 and ORAUT-TBD-6000.

# NIOSH Response to SC&A Comments, Findings, and Observations – SC&A Line of Inquiry 2

## Exposure Pathway Bounding Methods for M&C Compared to Other AWE Sites

# M&C Dose Reconstruction Methods Compared to other AWE Residual Periods

- SC&A stated that the threshold questions are whether the bounding approach for nonroutine exposure pathways applied to M&C are consistent with past practice and precedent for AWE residual periods, and whether dose reconstruction methods prescribed for these pathways can be considered plausible and sufficiently accurate.

# SC&A Comment – Materials Released in Drains (1 of 2)

- SC&A Supplemental Review asks
  - *Would it not be as likely that the regular release of a coagulant to the drain line system during active Building 10 operations (through 1981) would have led to more frequent and substantial blockages, perhaps involving higher concentrations of uranium and thorium as a function of the binding properties of the coagulant oil and other residues?*

# SC&A Comment – Materials Released in Drains (2 of 2)

- Additionally SC&A Supplemental Review states
  - *The accumulation of various artifacts in the M&C drain lines can be attributed to missing grates on the drains, which allowed production residues and items to go down them, contributing to blockages that were apparently aggravated by the presence of vegetable-based oils used in production that coagulated in the drain line*

# NIOSH Response – Materials Released in Drains (1 of 12)

- NIOSH questions the premise to the SC&A review
  - TI reported to the NRC that the AWE operations (Buildings 3, 4, and 10) were decontaminated and decommissioned and that all radioactive materials were removed during the period from 1955 to 1968
  - The largest Building 10 cleanup effort occurred at the end of 1958

# NIOSH Response – Materials Released in Drains (2 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - Contaminated noncombustible scrap material and machinery were collected in 55-gallon steel drums and disposed of through authorized agencies or buried on-site in compliance with 10CFR20.304

# NIOSH Response – Materials Released in Drains (3 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - TI also reported that all three areas were surveyed after each area's respective D&D efforts
  - TI could not locate the survey documentation from 1968 for Buildings 3, 4, and 10, so in 1982, TI resurveyed the areas used for AWE operations and documented that the three areas had remained decontaminated since the end of AWE Facility operations.

# NIOSH Response – Materials Released in Drains (4 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - In 1983, the NRC was satisfied that the interiors of Buildings 3, 4, and 10 were sufficiently decontaminated and they released Buildings 3, 4, and 10 for unrestricted use
  - The NRC withheld license termination pending further investigations into the former radioactive waste burial site

# NIOSH Response – Materials Released in Drains (5 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - After hearing reports from M&C workers of additional areas of concern, the NRC hired a contractor to investigate
  - After identifying contamination in outside areas, the NRC directed another review of the Building 10 interior using revised release criteria and methods that are more comprehensive

# NIOSH Response – Materials Released in Drains (6 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - The additional contamination identified using updated methods included sections of the concrete floor and subsurface previously inaccessible to outdated survey techniques, and it did not present a significant exposure hazard

# NIOSH Response – Materials Released in Drains (7 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - Contributions to drain lines from production work specifying the use of radioactive materials during the residual period (i.e., HFIR) cannot be considered in determining EEOICPA covered exposures
  - NIOSH modeled the drain sediments as a dusty, dry material in the air for claimant favorability

# NIOSH Response – Materials Released in Drains (8 of 12)

- NIOSH questions the premise to the SC&A review (cont.)
  - Any wet or oily material would trap potential contaminants, reducing or preventing resuspension of the contaminant and limiting the potential for inhalation.

# NIOSH Response – Materials Released in Drains (9 of 12)

- Additional information to support the use of the 1996 data
  - The sampling plan was developed specifically to identify hot spots for upcoming D&D and Maintenance activities
  - The survey found a portion of a uranium rod 5 inches long and 2 inches in diameter in one pipeline
  - Sludge in pipeline as high as 53,000 pCi/g which is 10% of the specific activity of pure natural uranium

# NIOSH Response – Materials Released in Drains (10 of 12)

- Additional information to support the use of the 1996 data (cont.)
  - As NIOSH identified in a previous paper (July 2020) the sediment data was consistent with other AWE data
    - Hot Spots with majority of data orders of magnitude lower
  - NIOSH assumes all of the sediment was produced from AWE operations
    - Naval Reactors (80% of the radiological work)
    - HFIR

# NIOSH Response – Materials Released in Drains (11 of 12)

- Additional information to support the use of the 1996 data (cont.)
  - The 95$^{th}$ percentile sediment concentration 6887 pCi/g is approximately 1% of the specific activity pure natural uranium
    - Of the samples taken 16 of the 20 were an order of magnitude below this
  - NIOSH assumes all of the subsurface soil and piping are at this level

# NIOSH Response – Materials Released in Drains (12 of 12)

- Additional information to support the use of the 1996 data (cont.)
  - NIOSH assumes all workers are occupationally exposed or in close contact with the 95$^{th}$ percentile concentration for two months per year

# NIOSH – Conclusion Subsurface Inside (1 of 3)

- NIOSH finds the use of the 95$^{th}$ percentile concentration is a bounding dose reconstruction approach
- SC&A did not provide any new technical information or technical justifications to indicate why they do not consider the source term developed by NIOSH to be bounding

# NIOSH – Conclusion Subsurface Inside (2 of 3)

- NIOSH and SC&A have done extensive work on the subsurface model and have previously agreed, as shown in the following SC&A 2021 paper:
  - *SC&A believes the impacts of the conservativeness of the assumptions applied to the model are greater than the impacts of the uncertainties associated with material dilution and extraction.*

# NIOSH- Conclusion Subsurface Inside (3 of 3 )

- NIOSH and SC&A have done extensive work on the subsurface model and have previously agreed, as shown in the following SC&A 2021 paper:
  - *(cont.)Taken in combination, SC&A believes that the methods and assumptions used by NIOSH to reconstruct internal doses to M&C workers involved in subsurface maintenance and repurposing activity in Building 10 during the residual period are scientifically sound and claimant favorable*

# M&C Dose Reconstruction Methods Compared to other AWE Residual Periods – Subsurface Outside

- SC&A states in the supplemental review that the appropriateness of the bounding assumption for the data used for the subsurface model are dependent on
  - How much excavations prior to 1984 diluted, spread, and otherwise altered the levels of contamination
  - Whether the bounding levels are sufficiently accurate, sufficiently conservative, and plausible given there is no data prior to 1984

# SC&A Comment – Subsurface Outside (1 of 2)

- *NIOSH construes the lack of NRC regulatory direction to signify that the reported "elevated levels" were merely "above background, but less than release criteria (30 pCi/g)," and that "information related to this task supports NIOSH's outside subsurface model, in that the 95th percentile contamination level NIOSH applied (118 pCi/g) is approximately four times higher than the contamination level these workers experienced" (i.e., 30 pCi/g)* (citation omitted),…

# SC&A Comment – Subsurface Outside (2 of 2)

- *…but without giving any apparent substantiation beyond inferring how NRC staff would have perceived the risk and what action they would or would not have taken*

# NIOSH Response – Subsurface Outside (1 of 3)

- NIOSH's statement was explicitly about the airline installation process
- NIOSH concluded the removal of soil and debris for installing the airline was below 30 pci/g based on statements in documents reviewed
- *In early August 1980, Texas Instruments informed Region I that while digging a trench for a pipeline, slightly contaminated material from an old burial ground was dug up.* [NRC 1981–1982, PDF p. 14]

# NIOSH Response – Subsurface Outside (2 of 3)

- *The safety engineer for Texas Instruments, a trained health physicist, surveyed the material, dug up, and placed any contaminated material into 55-gallon drums.* [NRC 1981–1982, PDF p. 14]
- *The licensee revised the drawing for the compressed airline and marked the location where the radioactive low-specific activity waste material dump was excavated* [NRC 1981–1982, PDF p. 14]

# NIOSH Response – Subsurface Outside (3 of 3)

- *The airline debris area was investigated but did not require remediation because the levels of radioactivity detected were below applicable NRC release criteria.* [Texas Instruments 1996c, PDF p. 33]

# SC&A Observation 1 – Subsurface Outside

- 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

# NIOSH Response – Observation 1 (1 of 4)

- By definition, hot spots are limited exposures and not a normally expected condition
  - Hence, NIOSH uses the 95th percentile and not the maximum value
  - NIOSH does not model systemic exposures to hot spots but rather to expected conditions

# NIOSH Response – Observation1 (2 of 4)

- SC&A did not provide any new technical information or technical justifications to indicate why the proposed approach is not considered bounding
- Furthermore, NIOSH and SC&A have done extensive work on this model, and SC&A recommended closing this issue with the following

# NIOSH Response – Observation 1 (3 of 4)

- *In theory, we can assume that a worker might be involved in subsurface work in Building 10, two months per year, and spend ten months per year exposed outdoors to resuspended contaminated* [sediment]*. Given this scenario, the additional dose from this pathway of less than a mrem per year can be ignored.* [SC&A 2020, PDF p. 23]

# NIOSH Response – Observation 1 (4 of 4)

- *Alternatively, we can assign the subsurface internal exposures to uranium in Building 10 to the subsurface exposures to outdoor workers. The data indicate that such an approach would be extremely claimant favorable but would still result in relatively small doses* [SC&A 2020, PDF p. 23]

# NIOSH Response to SC&A Comments, Findings, and Observations – SC&A Line of Inquiry 3

## Source Term, Survey Data, and Other Information Applied by NIOSH

# SC&A Supplemental review – Source Term

- SC&A Supplemental Review states
  - *A guiding principle NIOSH follows for addressing the "uncertainty around the work performed" or the "complete understanding of the work performed (e.g., one person doing all the maintenance work)" is that it is "NOT an issue when the bounding doses are very low, and specifically, during AWE residual periods such as at M&C"*

# SC&A Supplemental review – Site Characterization

- SC&A comments on using Mound data for dust loading
  - *…in terms of specific site characteristics for M&C, it is not apparent how the Mound project addressed considerations related to resuspension or dust loading in a confined space, such as the various manholes, trenches, pits, and vault spaces at M&C in which maintenance workers actively worked*

# NIOSH Response – Confined Space (1 of 2)

- NIOSH agrees that addressing the potential change in resuspension in a confined space needs to be addressed
  - NOTE: This is not a change in source term
- NIOSH concludes this is a global issue that should be addressed in OTIB-0070 along with the enhancement/enrichment factors SC&A previously identified in their 2021 paper

# NIOSH Response – Confined Space (2 of 2)

- As for manholes, NIOSH and other SC&A reviewers concluded the manholes would not be a significant source of contamination at M&C
- SC&A quote from 2021 work group meeting
  - *Well, there are certainly materials that accumulated. But since they weren't directly handling radiological materials in the manholes, as far as we know, we wouldn't expect there to be a high contamination level there.*

# SC&A Supplemental review – Finding 2

- SC&A Finding 2 - 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
- Specifically, SC&A's supplemental review indicates the criteria **for site and process similarities**, has not been met

# NIOSH Response – Finding 2 (1 of 6)

- SC&A's 2021 report states
  - *Considering the totality of information compiled in this report, SC&A believes that the use of a dust loading of 212 µg/m$^3$ for subsurface work both indoors and outdoors at M&C is reasonably compatible with data and information summarized in this report, including the data reported from Mound by the interviewed SME.*

# NIOSH Response – Finding 2 (2 of 6)

- *SC&A concludes that NIOSH's adoption of 212 µg/m$^3$ for estimating respirable outdoor dust loading during excavation activities is reasonable but not necessarily bounding*
- *Additionally, SC&A believes that NIOSH should refer to the numerous dust loading studies cited in section 5 as the basis for the dust loading of 212 µg/m$^3$ in addition to the Mound data*

# NIOSH Response - Finding 2 (3 of 6)

- *While SC&A's survey and interpretation of the data indicate that the suggested value of 212 µg/m$^3$ may not necessarily be sufficiently conservative for many excavation scenarios, a number of mitigating factors are also present at M&C that should be considered*
  - Soil likely moist
  - Assumed close contact entire two-month time period

# NIOSH Response – Finding 2 (4 of 6)

- NIOSH Responded to SC&A's 2021 paper
  - *NIOSH intends to review the references provided by SC&A and incorporate them as appropriate. In addition, NIOSH will update our M&C models that utilize dust loads (i.e., Subsurface Inside, Subsurface Outside) to consider the impact of enhancement factors*

# NIOSH Response – Finding 2 (5 of 6)

- SC&A expressed concern in using the dust loading factor generically in OTIB-070
- *However, this cannot be said for the use of the 212 µg/m$^3$ for use as a generic value for outdoor and indoor excavations at some unknown facility or site. Hence, its use as a generic dust loading in OTIB-0070 should be uniquely evaluated at each site of proposed use*

# NIOSH Response – Finding 2 (6 of 6)

- NIOSH responded to this concern
  - *Although NIOSH will use M&C to inform our modeling of similar Energy Employees Occupational Illness Compensation Program Act work, we agree with "one size will not fit all." We will address this further during the next ORAUT-OTIB-0070 revision*

# SC&A Supplemental review – 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

# NIOSH Response – Observation 2 (1 of 2)

- NIOSH was not using the M&C Safety and Health manual, NRC inspection results, operator training, and other programmatic considerations to *justify* using the 95th percentile
- The 95th percentile is consistent with the statistical approach used at every site under the EEOICPA

# NIOSH Response – Observation 2 (2 of 2)

- The M&C Safety and Health manual, NRC inspection results, operator training, and other programmatic considerations provide credence that the site was mindful of the impact associated with the current and historical radiological work.

# NIOSH Conclusions

# NIOSH Conclusions (1 of 4)

- SC&A's conclusion states that "*Precedent suggests that while less precision or technical accuracy can be tolerated if the* ***exposure of a worker cohort is relatively low****… "*
- For comparison purposes
  - Linde dose 5479 mrem/yr (CED)
  - M&C dose 71 mrem/yr (CED)

# NIOSH Conclusions (2 of 4)

- The second part of SC&A's conclusion
  - *…the **use of a high exposure** or concentration values based on these data to bound or represent that of other workers in a facility or on a site for long time periods would not be appropriate if their exposure potential could be higher, conditions were different, or if there is lack of information upon which to make those judgments.*
- This applies at Linde but does not apply at M&C

# NIOSH Conclusions (3 of 4)

- NIOSH has a more complete data set to characterize M&C and a better understanding of M&C maintenance work than we had with Linde
- NIOSH has performed due diligence since 2017 to identify the maintenance tasks with the highest exposure potential and has created models that bound exposures associated with these tasks.

# NIOSH Conclusions (4 of 4)

- With the exception of the potential particulate enhancement in confined space, SC&A did not provide any new technical information or technical justifications to indicate why they do not consider the proposed approach to be bounding
- NIOSH continues searching for and welcomes any new technical information available to improve our bounding models.

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

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