

Review of the Use of Surrogate Data for Estimating Intakes of Uranium at General Steel Industries

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FIVE BOARD CRITERIA REGARDING THE USE OF SURROGATE DATA

Summary of Findings

- **Criterion 1. Hierarchy of Data**
 - Data from 1993 FUSRAP survey on contamination of floor of Old Betatron Building not utilized
 - Adjustments to reported measurement not appropriate to uranium handling scenario at GSI
- **Criterion 2. Exclusivity Constraints:** Use of surrogate data not stringently justified
- **Criterion 3. Site or Process Similarities:**
 - Forms of uranium metal: slugs produced by powder metallurgy vs. recast ingots or direct reduced dingots
 - Processes: stamping numbers on slugs vs. transporting and positioning uranium objects
 - NIOSH recently reviewed data from four additional sites¹—these data not subjects of present review
 - Insufficient data regarding characteristics of surrogate site
- **Criterion 4. Temporal Considerations:** Justified by NIOSH¹
- **Criterion 5. Plausibility**
 - Calculation of surface contamination from uranium aerosol concentration not scientifically plausible
 - Surface contamination resulting only from deposition of aerosols lacks workplace plausibility

¹ Allen, D. 2012. "Use of Surrogate Data at GSI: Response to SC&A Review Dated July 16, 2012."

Detailed Evaluation

- **Criterion 1: Hierarchy of Data:**

- *Surrogate data should only be used to replace data if the surrogate data have some distinct advantages over the available data and then **only after the appropriate adjustments have been made to reflect the uncertainty inherent in this substitution** [emphasis added]*
- Available Data
 - No monitoring data on U intakes at GSI
 - Duration of U handling operations based on MCW purchase orders
 - Uranium handling operations based on recollections of former workers
- NIOSH did not utilize available surface contamination measurements in Old Betatron Building—the only site-specific data on uranium contamination at GSI—made at end of residual period

- Inappropriate adjustments to surrogate data

- Value of U concentration for slug stamping scenario used to calculate geometric mean (μ_g)

- * Use of μ_g inappropriate, calculation based on assumed value of geometric standard deviation

- * Errors in calculating μ_g in TBD-6000, correct method (note correction to equation in SC&A report):

$$\mu_g = \mu e^{-\frac{(\ln \sigma_g)^2}{2}}$$

μ_g = geometric mean
= 162 dpm/m³ (vs. 264 dpm/m³ cited in TBD-6000)

μ = arithmetic mean
= 590 dpm/m³

σ_g = geometric standard deviation
= 5 (TBD-6000)

“The use of the geometric mean is an attempt to prevent the value from being unrealistically high.”¹
Lowering the value in this manner does not constitute an appropriate adjustment.

- Assumption that operator exposed only 75% of time: inconsistent with 30-min duration of handling operations

- * Corrected value: $162 \times 0.75 = 121$ dpm/m³ (vs. 198 dpm/m³ cited in Appendix BB)

- Conclusion: Criterion 1 not fully satisfied

¹ Allen, D. 2012. “Use of Surrogate Data at GSI: Response to SC&A Review Dated July 16, 2012.”

- **Criterion 2: Exclusivity Constraints**

- *Surrogate data as the basis for individual dose reconstruction needs to be stringently justified*
- NIOSH selected TBD-6000 scenario that produced lowest aerosol concentrations
- NIOSH agrees that the current use of surrogate data not stringently justified
- Conclusion: Criterion 2 not fully satisfied

- **Criterion 3: Site or Process Similarities**

- *Factors . . . include . . . similarity of production processes*
 - SC&A: Uranium slugs produced by powder metallurgy dissimilar to recast uranium ingots or “dingots” (ingots produced by direct reduction of UF_4) at GSI
- *Are there other sources of surrogate data that were not used?*
 - NIOSH reviewed data from four additional sites¹—these data not subjects of present review
- *Adequate data characterizing the site . . . that . . . support its application to other sites?*
 - SC&A: Work site cited in TBD-6000 not identified, sparse descriptions of facilities
- *Do the surrogate data reflect the type of operations and work practices in use at the facilities in question?*
 - SC&A: Slug stamping does not reflect the type of operations and work practices used at GSI
- Conclusion: Criterion 3 is not satisfied

¹ Allen, D. 2012. “Use of Surrogate Data at GSI: Response to SC&A Review Dated July 16, 2012.”

- **Criterion 4: Temporal Considerations**

- *Surrogate data should belong in the same general period as the period for which doses are sought to be reconstructed unless it can be demonstrated that the working conditions [and] procedures . . . were comparable to the period in question*
- SC&A: Harris and Kingsley data collected before 1957, perhaps as early as the late 1940s; 10–20 years prior to the end of AEC operations at GSI (mid-1966)
- NIOSH argued that processes at GSI did not change over time¹
- Conclusion: Criterion 4 does not preclude use of Harris and Kingsley data

¹ Allen, D. 2012. “Use of Surrogate Data at GSI: Response to SC&A Review Dated July 16, 2012.”

- **Criterion 5: Plausibility**

- *The manner in which the surrogate data are to be used must be "plausible" with regard to the reasonableness of the assumptions made. The plausibility determination should address issues of:*
 - *Scientific plausibility. Are the assumed models . . . scientifically appropriate? Have the models been validated (where feasible) using actual monitoring data collected in a similar situation?*
 - * NIOSH assumed uranium concentration achieved immediately and disappeared immediately
 - * SC&A:
 - Dust generated during handling, settles to floor until airborne concentration depleted
 - If dust extends to the roof (35 ft = 10.7 m), takes ~4 h to settle
 - Simonds Saw data indicate very slow decline after operations—order of days
 - * Assumption of instant cessation of settling not scientifically plausible nor claimant favorable
 - * NIOSH:
 - Surficial contamination based on deposition during one year—no buildup from year to year
 - Maximum July 1, 1961–June 30, 1962
 - Constant after June 30, 1962—no additional buildup
 - * NIOSH needs to demonstrate that 1-year period of accumulation scientifically plausible

- *Workplace plausibility. Are the assumed processes and procedures . . . plausible for the facility in question? Have all of the factors that could significantly impact exposure been taken into account? Is adequate information available about the facility in order to be able to make a fair assessment?*

- * SC&A:
 - Aerosol levels from handling uranium ingots at GSI not comparable to uranium slug stamping
 - Surficial contamination levels cannot be calculated from the airborne concentrations: Uranium oxide could have been removed from surfaces of ingots or dingots by abrasion during transport and positioning
 - Particle size: from aerosol to ¼-inch

- * NIOSH
 - “Large flakes of uranium that are produced would fairly quickly be ground into dust under foot and forklift traffic typical of operating area. They would then be available for resuspension and contribute to the air concentrations.” (Response to SC&A finding on TBD-6000)
 - TBD-6000: 30 days required for equilibrium between surface layer and aerosol

- * SC&A:
 - Uranium handling ~30 min
 - Equilibrium not achieved

- * Conclusion: Workplace plausibility criterion not satisfied

ALTERNATE SCENARIOS

- TBD-6000: Other five scenarios not applicable to GSI
- Handling of uranium rods at melt plant building at Hanford: more similar to GSI uranium handling

| Operation | U concentration dpm/m ³ |
|--|---------------------------------------|
| Unloading rods from truck with fork lift | 3,926 |
| Receiving rods: unloading truck and stacking rods | 517 |
| Loading straightened rods directly from table onto truck | 88 |

- Max scenario: 3,926 dpm/m³ vs. 198 dpm/m³ in TBD-6000
- Ignored by NIOSH
- Remaining concerns over plausibility of NIOSH model