SC&A Findings on ORAUT-RPRT-0092: Bioassay Data for Subcontracted Construction Trade Workers at SRS

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To the Advisory Board on Radiation and Worker Health

December 9, 2020

Introduction

- ORAUT-RPRT-0092, rev. 00 – NIOSH issued on June 14, 2019. SRS WG tasked SC&A to review.
  - Provides results of NIOSH's sampling analysis of subCTW permit-indicated, job-specific bioassay data completeness at SRS for 1972–1998.
  - Responds to 2017 SC&A review that raised questions of data completeness in light of job-specific bioassay gaps identified by WSRC in 1997 that were subject of DOE enforcement action in 1998.
  - SC&A 2017 review performed in parallel with NIOSH review of Bldg 773-A for 1981–1986. Board concerned about limited scope of NIOSH's timeframe and SRS facilities, and requested expanded scope.
- SC&A review – issued Nov. 12, 2019. Addressed three aspects of NIOSH review: sampling premise, sampling execution, and co-exposure datasets.
  - NIOSH responded to SC&A's review in August 2020; SC&A replied in November 2020.

Background: Job-specific bioassays

- Job-specific bioassays are performed for workers, when warranted by job internal exposure potential, who are not on routine bioassays, or whose routine bioassay program does not include some or all of the radionuclides present for a specific job or location.
- DuPont implemented job plans (with limited SWPs), which relied on procedure-based bioassay type and frequency tables. After 1989, WSRC implemented RWPs, which required job-specific bioassays by 1991, and job-specific bioassays for respirator use by 1992.
- While DuPont routine bioassay monitoring at SRS was based on work location (with established radionuclide type and frequency), some subCTWs intermittently present in controlled areas were bioassayed based only on job plans. (ORAUT-RPRT-0083)
- WSRC self-assessment in 1997 found only 21% of workers on job-specific bioassays submitted bioassays, leading to DOE enforcement action and contributing to DOE-wide moratorium in 1998 to allow sites to make corrective actions for what was considered widespread bioassay program deficiencies.

Question: How complete are job-specific bioassays for preceding years (pre-1997) at SRS, and can those potentially exposed workers be adequately represented in a co-exposure model?

Background: Subcontractors (subCTWs)

- Many subCTWs were temporary, intermittent, and short-term workers, but some had extended onsite work periods.
- DuPont had inhouse construction and hired CTWs directly from union halls, but also hired subCTWs such as pipefitters, electricians, and painters. WSRC used a construction contractor, Bechtel, which hired subCTWs.
- "For externally monitored [subCTWs], a requirement prior to entry in radiologically controlled areas, the annual fractions of those with internal monitoring records ranged between 28% and 98% [based on NOCTS claimant data]. The lowest fractions were in the latter 1970's and generally increased over time. Between 1972 and 1979 the average of the fractions is 51%, for the 1980s it is 72%, and for 1990 through 1997 it is 92%." (ORAUT-RPRT-0094)
- NIOSH: "for most years there is little difference in the 95 percentile urinary excretion between DuPont CTWs and Subcontractor CTWs. The exception appears to be in the later 1970s and 1980s. This observation is somewhat supported by contemporary interviews with subcontractor CTWs…[who] were called in for more contaminated work to save the exposure of onsite CTWs." (Tim Taulbee, email to SRS/SEC Work Groups, 9/29/2017)
- SC&A: Given the completeness issues identified for job-specific bioassay monitoring, a meaningful comparison between job-specific and routine monitoring of subCTWs may not be possible (notwithstanding NIOSH's refined stratification analysis).

NIOSH ORAUT-RPRT-0092

“The chief conclusion of this report is that a large percentage of subCTWs were monitored for potential intakes while working under a Job Plan, SWP or RWP.”

However:

- Large percentage (89%) encompasses all subCTW bioassays over entire 1972–1998 period, without ascertaining to what extent permit-indicated job-specific bioassays actually were performed (Board’s original “completeness” and “representativeness” issue)
- Scope of SRS sitewide survey for 1972–1990 remains only one facility (773-A) for incomplete years (1975–1979 missing)
- Not feasible to identify radionuclide-specific exposure potentials prior to working RWP program in 1990s:
  - Job plans rarely specified radionuclides
  - Workers did not sign in and out of SRS areas (except 773-A) (SRDB 170182)
  - Facility radiological characterization deemed inadequate
  - SubCTWs were often transient and short term and moved around onsite.

SC&A's review of ORAUT-RPRT-0092

- SC&A reviewed NIOSH's evaluation from three vantage points:
  - **Sampling premise:** Were guiding assumptions upon which evaluation was planned and conducted borne out for time periods in question?
  - **Sampling execution:** Did NIOSH successfully "randomly select radiological workers from the various areas at [SRS], such than an evaluation of monitored and unmonitored workers can be conducted"?
  - **Co-exposure datasets:** Did the evaluation satisfy its stated objective of demonstrating that "monitored [subCTWs] and unmonitored [subCTWs] worked side by side in the same radiological environment at the same time"?
- SC&A focused its review on two distinct SRS operational periods, 1972–1989 under DuPont, and 1990–1998 under WSRC.
- SC&A sought to test central thesis of ORAUT-RPRT-0092: Can bioassays be linked to corresponding work permits so that monitored subCTWs can be compared with unmonitored subCTWs and data completeness established?

Finding 1

No SWPs or job plans sampled by NIOSH for 1972–1990 contain any requirements or indications for job-specific bioassays, despite respiratory protection being required, bringing into question the approach taken to satisfy ORAUT-RPRT-0092's first evaluation objective.

- *For at least 1972–1990, job-specific bioassays cannot be tied to specific work permits or respirator use; completeness must be inferred, associating bioassays by date, and applying later policies for respirator use and facility source terms. NIOSH's proposed use of its "ample" routine, incident, and claimant bioassay data for subCTWs does not address issue of completeness and representativeness called for by OCAS-IG-006 co-exposure guidelines.*

Finding 2

"Radionuclides of interest" assumed for sampled permits in ORAUT-RPRT-0092 are of questionable accuracy given cited lack of adequate radiological source term characterization prior to 1990.

- *In 1990, DOE found such characterization, as a basis for determining bioassay type and frequencies, to be deficient at SRS. Comprehensive analysis-based characterization was not implemented at SRS until 1998.*

Finding 3

The scope of permit sampling for 1972–1990 at SRS is essentially limited to one facility, 773-A, falling short of achieving NIOSH's sampling objective and the representativeness called for in NIOSH's coworker [co-exposure] guidelines.

- *There are many other major radiological facilities at SRS for which subCTW data completeness and representativeness need to be addressed; e.g., F and H Canyons, F and H Tank Farms, Solid Waste Disposal Facility, PuFF and PEF, Uranium Target Fabrication Facility, Fuel Fabrication Facility, Scrap Recovery Facility*

Finding 4

SRS incident-based/special bioassays were provided by workers on a more stringent procedural basis and should not be used to supplement the evaluation of permit-related, job-specific bioassays for 1972–1989 as a measure of historic data completeness.

- *NIOSH and SC&A agree that incident-based data should not be used to complement non-incident/nonspecial bioassay data, e.g., in ORAUT-RPRT-0092 for gauging job-specific bioassay data completeness*

Finding 5

The incompleteness of SRS dose records for 1972–1990 is substantiated by the acknowledged destruction of subcontractor records and firsthand worker accounts, coupled with DOE findings of missing occupational radiation dose data from many SRS personnel files, as well as systemic bioassay delinquencies, and wide gaps in NIOSH's capture of permit documentation.

- *While it is agreed work permits and other records may have been destroyed at the time, SC&A accepts that, to date, no evidence of missing dosimetry records has been found*

Finding 6

For the limited period from 1981–1987, only 20% of the identified subcontractor-job plan combinations identified by NIOSH as requiring americium sampling had internal monitoring performed within an acceptable timeframe (i.e., within 2 years for chest counting).

Finding 7

The total “effectively monitored” population for americium (those monitored directly or have a coworker on the same job plan with a urinalysis result) during the 1980–1989 period is approximately 33%.

Finding 8

Many of the workers (around 70–73%) who should have been monitored for fission products underwent appropriate internal sampling during the two periods evaluated prior to 1990 (1972–1974 and 1980–1989). However, very few of these monitored workers underwent in vivo counting for fission products. Thus, they are not included in the coworker model developed for SRS and are not considered representative of the unmonitored worker.

Finding 9

SC&A does not find that the data collected as part of the ORAUT-RPRT-0092 review support the premise that subcontractors on job plans that should have required internal monitoring for americium were either directly monitored (around 20%) or, alternately, appropriately represented in the derived coworker models for SRS (around 13%).

Finding 10

RWP data for 1990 are lacking. Therefore, 1990 should be included with the period of limited data, 1972–1989, and not bundled in with the year 1991.

- *The number of bioassays do not substitute for lack of completed RWPs with job-specific bioassays.*

Finding 11

For both the 1972–1989 and the 1990–1998 periods, when considering all radionuclides requiring internal monitoring per work permit, as opposed to “at least one radionuclide” requiring monitoring, the percentage of monitored workers drops significantly (particularly in the earlier periods). Directly monitored workers ranged from 47–77% (in comparison to 76–96% in ORAUT-RPRT-0092), and effectively monitored workers ranged from 55–89% (in comparison to 85–99% in ORAUT-RPRT-0092).

SC&A comparison of monitoring percentages

SC&A comparison of monitoring percentages involving all radionuclides on work permit

Time period	Directly monitored for all radionuclides associated with work permit	Effectively monitored for all radionuclides associated with work permit
1972–1974	47%	55%
1975–1979	No data	No data
1980–1989	51%	66%
1990–1998	77%	89%

Use of concept of “at least one radionuclide” for work permits in ORAUT-RPRT-0092 does not equate to adequate internal monitoring.

SC&A statements quoted by NIOSH (SRS work group meeting, Nov. 17, 2020)

- "DuPont handled the subs pretty similar to how they handled the in-house workers."
  - **SC&A clarification:** DuPont did manage all workers the same: relied on general DPSOL procedures in absence of RWPs; applied inadequate facility radionuclide characterization; had no means to identify workers entering and leaving operational areas for purposes of monitoring (workers required to sign in and out, beginning 1989 – SRDB 170182); and implemented inadequate termination bioassay program. While "handled pretty similar," the relative impact for subCTWs in terms of dose reconstruction is more problematic than for in-house workers given their often-transient status and mobility on site.
- "The pre-'89 is still relevant but very clearly you're dealing with less subcontractors, fewer subcontractors in a DuPont management system, which is a different system. They held themselves close and the operations were pretty coherent."
  - **SC&A clarification:** While fewer contractors worked under DuPont, the numbers of subCTWs rapidly increased in the 1980s. DuPont's management system, while respected for its emphasis on safety, was insular, considered "expert-based," and relied on facility managers to implement its job plans and require bioassays based on DPSOLs – this system did not adapt to rapidly changing missions in the 1980s–1990s, with an influx of transient subcontractors.

SC&A conclusions: DuPont era, 1972–1990

- NIOSH has been unable to demonstrate the completeness of subCTW job-specific bioassay data and did not accomplish the objectives defined in its sampling plan for the ORAUT-RPRT-0092 analysis.
- Limited analysis of americium by time period (1973, 1981–1987) and location (only 773-A, F-Wing) showed limited associated monitoring to conclude co-exposure models are representative of workers on the job-specific bioassay program. While higher data completeness is ascribed to other radionuclides of concern, e.g., Pu and FP, that analysis relies on job plan/SWP data from one facility, 773-A, that may not be representative of the other 30+ radiological facilities at SRS.
- It remains unknown to what extent past job-specific bioassays are incomplete, but it is known that the gap in 1997 was significant and the weight of evidence provided by SC&A's review invalidates the inclusion of at least pre-1991 subCTW data as sufficiently complete and representative for use in the SRS co-exposure model.

SC&A conclusions: WSRC era, 1991–1998

- SubCTW job-specific bioassay completeness may be established, but with some qualifications that remain to be addressed.
- Most notable is defining when RWPs were sufficiently implemented such that job-specific bioassays can be adequately linked to subCTWs under those permits (e.g., with specific radionuclides and bioassays prescribed) to demonstrate that significant lapses in subCTW job-specific bioassays in 1996–1997 are not apparent in prior years (1991–1995) and would not preclude co-exposure model inclusion.