Evaluation of Monitoring of Subcontractor Construction Trades Workers (CTWs) at the Savannah River Site (ORAUT-RPRT-0083)

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Advisory Board on Radiation and Worker Health 118th meeting

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Background

• **Goal:** Determine whether subcontractor Construction Trades Workers (CTWs) were sufficiently monitored for internal exposure to support co-worker model development.

• June 2016 - NIOSH located and captured a fairly large set of job plans for the 773A building over an extended time period (1981-1986)

• Job plans covered all off-normal work in the area including operations work, DuPont construction work (maintenance), and subcontractor construction work.
### Example Job Plans

#### Date: 8.21.82

**Operation**

Describe operation, safety precautions, and radiation and contamination control precautions.

**Title of Job:**

Steps to be taken during each exposure.

**PROTECTIVE CLOTHING**

- **Number of:** 1
- **Done by:**
- **Req’d:**

**Job Evaluation Box 8**

**Estimated Exposure**

- **Name:**
- **Body Pencil Exposure:**
- **Left Hand Exposure:**
- **Right Hand Exposure:**

**Job Evaluation**

- **1. Does job alter ventilation patterns?**
- **2. Is rigging approved?**
- **3. Building Services?**
- **4. Will operation effect other jobs and/or personnel?**
- **5. Does job require a special procedure?**
- **6. Has area been properly cleared for job?**
- **7. Procedure review for HLC personnel?**
- **8. Procedure review with Craftsmen (Maint., EAI, TAT)?**
- **9. Fire Hazard?**
- **10. Lockout required?**
- **11. Does job equipment meet safety standards?**
Internal Monitoring of CTWs

• DuPont CTWs (Maintenance)
  • Predominately routine monitoring (DPSOL 193-302), but also have incident based data, and some job specific data

• Subcontractor CTWs
  • Nearly equal routine monitoring vs. incident-based monitoring or job specific monitoring
Subcontractor evaluation

- Evaluated 550 subcontractor CTW-job pairings (255 unique subcontractor workers)
- Randomly selected 110 subcontractors (133 subcontractor CTW-job pairings)
- Reasonable distribution of crafts from random sample
Data Collection and Evaluation

• Nov 2016 conducted data capture at SRS to obtain bioassay

• Bioassay data found for 105 of the 110 subcontractor Construction Trades Workers (CTWs)

• Of the 133 subcontractor CTW-job pairings, 88 individual subcontractor CTWs required respirator use
  • Some bioassay results found for the 105 workers were for Job Plans that did not required use respiratory protection and were not considered (i.e. only considered respiratory job plan work).
  • Some bioassay results preceded the date of the job plan and were not considered (i.e. only considered post job plan bioassay).
## Workers with Internal Monitoring Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Subcontractor CTW-Job Pairings</th>
<th>Subcontractor CTWs w/respirator use</th>
<th>Subcontractor CTW w/Bioassay</th>
<th>Percent monitored (%)</th>
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<tbody>
<tr>
<td>1980-1981</td>
<td>19</td>
<td>18</td>
<td>11</td>
<td>61.1</td>
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<tr>
<td>1982-1983</td>
<td>26</td>
<td>20</td>
<td>12</td>
<td>60.0</td>
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<td>1984</td>
<td>29</td>
<td>11</td>
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<tr>
<td>1986</td>
<td>16</td>
<td>16</td>
<td>12</td>
<td>75.0</td>
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<tr>
<td>Total</td>
<td>133</td>
<td>88</td>
<td>59</td>
<td>67.0</td>
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</table>
Why is this reasonable for a Co-worker Model?

1) We use a distribution of bioassay data to develop the co-worker model, typically assign $95^{th}$% to the unmonitored worker.

- 67% of the total data is sufficient as long as there isn’t a bias in the data.
  - Since we are using the $95^{th}$%, were high exposures or incident data present in the random sample? - Yes
- NIOSH did not find any evidence of a bias.
Example of incident bioassay data

• Some of these bioassay data are positive.
• Some were incidents and subsequent follow-up bioassay were negative or below detection limits.

Positive Bioassay result from incident involving 13 subcontractor CTWs
Why is this reasonable for a Co-worker Model? cont.

2) When we looked at co-workers\(^{(1,2)}\) of the 29 unmonitored subcontractor CTWs, we found 23 of the 29 co-workers were monitored.

\(\begin{align*}
(1) \text{Co-worker listed on the same job plan as the unmonitored worker} \\
(2) \text{Co-worker could be DuPont Operations, DuPont CTW, or Subcontractor CTW}
\end{align*}\)

• If this is considered the total increases to 82 of the 88 subcontractors (93%) were either directly monitored or a co-worker on the same job was monitored.
Why is this reasonable for a Co-worker Model? cont.

3) Respirator use is a reasonable surrogate for the need of internal monitoring, but not all respirator use requires bioassay.

• Some use of respiratory protection is precautionary. (i.e. in case something happens or if contamination is unexpectedly encountered)

• If there is no contamination then there is no potential for an intake and bioassay is not necessary.
So was wearing a respirator really necessary?

• Yes and No!

• Health Physicist are generally conservative in an effort to prevent intakes of radioactive material.

• Radiological safety culture would rather have a worker in a respirator and not need it, than a worker need a respirator and not have it.
Example of respirator use where bioassay was not needed

• No transferable contamination
• Air concentration less than 0.2x10^{-12} uCi/cc
• < 10% of Derived Air Concentration – DAC
Why is this reasonable for a Co-worker Model? cont.

4) There will **NOT** be 100% compliance with bioassay monitoring of subcontractor employees
   • Limited ability to enforce bioassay compliance (work restriction)
   • Some workers refuse to leave bioassay
   • Subcontractor move onto another job not to return

Question before the ABRWH is:

*How much data is sufficient to support the development and use of a co-worker model for dose reconstruction?*
Summary

• 97% of the subcontractors CTWs monitored for external dose
• 67% of the subcontractor CTWs were monitored by bioassay
  • 34% routine monitoring
  • 33% were incident based on job specific based
• Additional 79% of remaining unmonitored subcontractors workers had a co-worker on the job plan with bioassay
  • 82 of 88 subcontractor CTWs had either personal monitoring or a monitored co-worker (93%)
Conclusions

• Radiation dose to subcontractor Construction Trades Workers (CTWs) may be reconstructed with sufficient accuracy using routine, incident based, and/or job specific bioassay monitoring data available for the individual worker, using coworker data, or using a combination of the two.

• Radiation dose to the unmonitored subcontractor Construction Trades workers (CTWs) can be bounded using the 95th% of the co-worker distribution developed from the monitored Construction Trades Workers.
# Status of Issues

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<th>#</th>
<th>Issue Topic</th>
<th>Deliverable</th>
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<th>SC&amp;A Comments</th>
<th>NIOSH Response</th>
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<td>Nov. 2017</td>
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<td>ORAUT-RPRT-0083: Job Plan Evaluation of Construction work</td>
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Co-worker models

- Revision 4 of ORAUT-OTIB-0081 to contain all remaining radionuclides of interest\(^3\)
- Data completeness and QA verification completed.

**Final Modeling is progressing**

**Scheduled completion November 2017**

\(^3\)Plutonium, uranium, neptunium, mixed fission products, strontium, cesium, and cobalt
Current Work following last week’s Workgroup Meeting

- Respond to Findings in SC&A reviews of documents submitted to the Workgroup
- Develop Response to SC&A report on Subcontractor Monitoring
- Assess distributions (i.e. 95th%) of DuPont CTWs vs Subcontractor CTWs
- Follow-up with site regarding 1995-1997 assessments on Internal bioassay monitoring that lead to a Notice of Violation (NOV) of 10CFR830 (Nuclear Safety Management)