

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

**Timothy D. Taulbee, PhD, CHP**

Research Health Scientist

Division of Compensation Analysis and Support

**Advisory Board on Radiation and Worker Health 118<sup>th</sup> meeting**

Santa Fe, New Mexico

August 24, 2017

# 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

**Done By** [ ] **Operation**

Date: 4-13-84  
 Time of Operation: 9 AM  
 Contact: \_\_\_\_\_  
 Done by: Const  
 Phone: 3035

Describe operation, safety precautions, and radiation and contamination control precautions.  
(CPF - Repair cell 1+2)

Title of Job: \_\_\_\_\_

PROTECTIVE CLOTHING		Item 1	Item 2	Rq'd
1. Coveralls	One (Two)	(Two)		✓
2. Respirator				✓
3. Breathing Air				
4. Cap	(Hood)			✓
5. Shoe Covers		(X)		✓
6. Gloves		Y		✓
7. TLD Badge (By)		✓		X
8. Self-reading Dosimeter		Y		X
9. Safety Belt				
10. Rubber Boots				
11. Lab Coat				

(1) Remove and repipe the cell inflatable seal line.

(2) Remove the 2 cell vac lines.  
 Between glovebox 1+2  
 (a) as each pipe is unscrewed place top over its opening

**-JOB PLAN** **Done By** [ ] **Operation**

Date: 8-21-82  
 Time of Operation: \_\_\_\_\_  
 Contact: \_\_\_\_\_  
 Done by: MAINT  
 Phone: 3615

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

Title of Job: \_\_\_\_\_  
Repipe 125" air pressure base face of cell 11 wall  
Install consoles on cells 10, 11, 12, top mounting holes to be drilled in wall. Wall under paint possibly contaminated  
 \* Respiratory equipment to be worn when drilling wall

PROTECTIVE CLOTHING		Rq'd
1. Coveralls	One (Two)	✓
2. Respirator		* ✓
3. Breathing Air		
4. Cap	(Hood)	✓
5. Shoe Covers		✓
6. Gloves		✓
7. TLD Badge (By)		
8. Self-reading Dosimeter		✓
9. Safety Belt		
10. Rubber Boots		
11. Lab Coat		
12. RT-1 Pers. Rad. Monitor		
13. Neutron Badge		

JOB EVALUATION		Rq'd
1. Does job alter ventilation patterns?		NO
2. Rigging approved?		NA
3. Building Services?		NA
4. Will operation effect other jobs and/or personnel?		NO
5. Does job require a special procedure?		Yes
6. Has area been properly cleared for job?		Yes
7. Procedure review for HLC personnel?		NA
8. Procedure review with Crafts (Maint., E&I, T&T)?		Yes
9. Fire Hazard?		NO
10. Lockout required?		NO
11. Does job equipment meet safety		

**Job Evaluation Box 8**

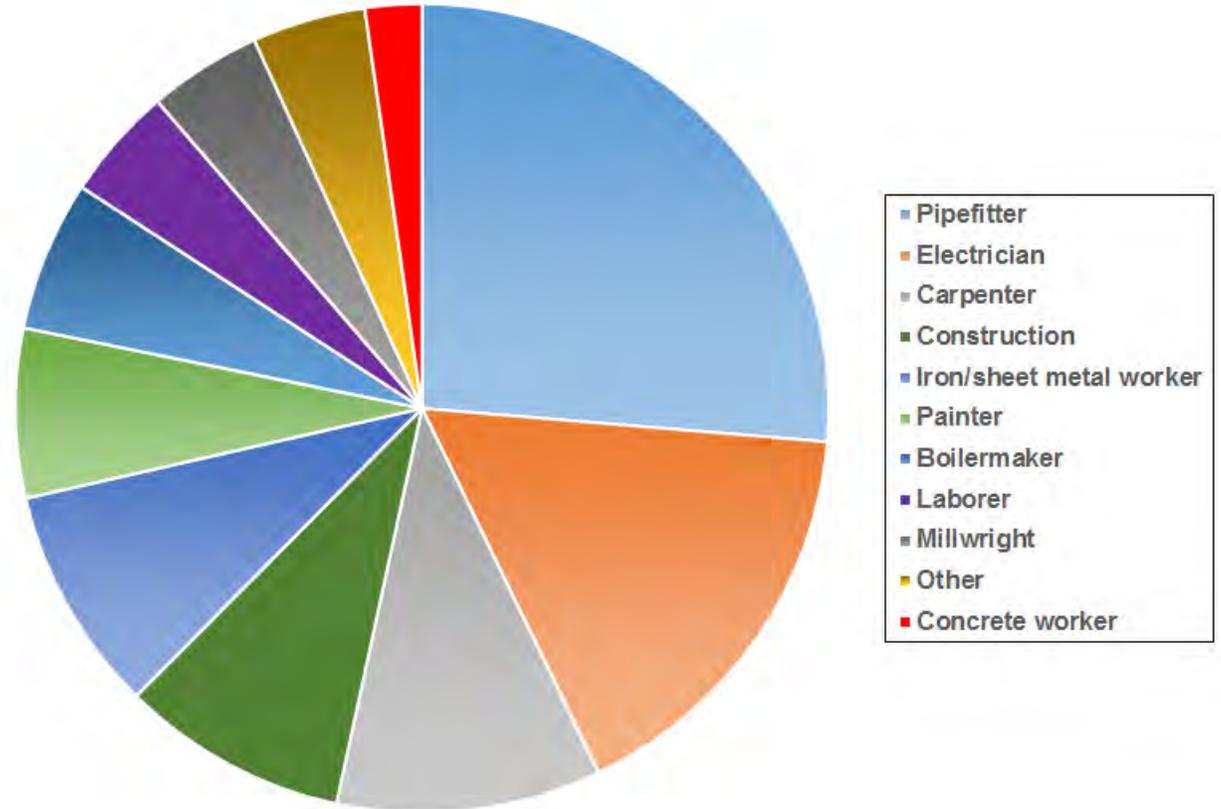
ESTIMATED EXPOSURE			
Name	Body Pencil mR	Left Hand mrem	Right Hand mrem
	5		
	5		
	5		

# 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

Year	Subcontractor CTW-Job Pairings	Subcontractor CTWs w/respirator use	Subcontractor CTW w/Bioassay	Percent monitored (%)
1980-1981	19	18	11	61.1
1982-1983	26	20	12	60.0
1984	29	11	6	54.5
1985	43	23	18	78.3
1986	16	16	12	75.0
Total	133	88	59	67.0

# 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<sup>th</sup>% 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<sup>th</sup>%, 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.

OSR 4-24 (Rev 2-78)

## SPECIAL BIOASSAY REQUEST

URINE    FECES    BLOOD    OTHER

DISTRIBUTION		White & Blue - Dosimetry, 735-A	
		Blue - Return to Originator	
		Yellow - Retained by Originator	

LAST NAME	INITIALS	PAYROLL NO.	DEPT	DATE AND TIME OF EXPOSURE
			Const	7/13/83 9 <sup>30</sup> AM
LENGTH OF EXP	SWP OR DPSOL NO.	EXPOSURE LOCATION (BLDG & ROOM NO.)	DATE SAMPLE STARTED	
~ 3 hrs		773 A, C-005		
ANALYSIS REQUESTED		REQUESTED BY	DATE	
FP	Pu X U	Am Cm	7/13/83	
REASON FOR REQUEST				
Painting in C-005				
RESULTS				DATE RECEIVED
Pu - LOI Am 0.5				7-22-83
			ANALYZED BY	DATE ANALYZED
				8/18

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<sup>(1,2)</sup> of the 29 unmonitored subcontractor CTWs, we found 23 of the 29 co-workers were monitored.

*(1) Co-worker listed on the same job plan as the unmonitored worker*

*(2) Co-worker could be DuPont Operations, DuPont CTW, or Subcontractor CTW*

- 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  $0.2 \times 10^{-12}$  uCi/cc
- < 10% of Derived Air Concentration – DAC

OSR 4-17 (Rev 4-72) SRDB# 116776 p. 20

**RADIATION SURVEY LOGSHEET - GENERAL**

SURVEY OFFICE E-037		DATE OF SURVEY 1/16/86	
JOB LOCATION High Bay Area behind TFF	BLDG NO. 773-A	LEVEL Basement	DEPARTMENT Const.
INSTRUMENT USED <input checked="" type="checkbox"/> JUNO <input type="checkbox"/> THYAC <input type="checkbox"/> CUTIE PIE		AIR SAMPLED <input type="checkbox"/> STAPLEX <input type="checkbox"/> DUCT <input type="checkbox"/> IMPACTOR <input type="checkbox"/> KANNE	
EXPOSURE RATE ESTABLISHED A 111 mrad/mR/hr # general area B C $\times 10^{-8}$ $\mu$ Cl $^3$ H/cc # D $\times 10^{-8}$ $\mu$ Cl $^3$ H/cc #		TIME SPENT ON JOB 30 min. TIME SURVEYED 9:30-10:00 AM	
TRANSFERABLE CONTAMINATION DETECTED AVERAGE MAXIMUM			
DESCRIPTION OF SURVEY SEE SKETCH <input type="checkbox"/> REVERSE SIDE <input type="checkbox"/> ATTACHED			
Surveyed for construction pipelitters to complete job started yesterday. DGE line was bagged up and cut into 2 sections. No problems were encountered during job.			
Construction and DHP wore 2 pr. white coveralls, cloth and plastic shoe covers, cloth hood, rubber gloves and full face respirator for job.			
No transferable contamination was detected during job. Impactor air sample taken during job calculated to $< 2 \times 10^{-12}$ uCi/cc			
Job was completed at this stage.			

# 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 95<sup>th</sup>% of the co-worker distribution developed from the monitored Construction Trades Workers.

# Status of Issues

#	Issue Topic	Deliverable	Delivered	SC&A Comments	NIOSH Response
1	Co-worker Models	Initial or interim ORAUT-OTIB-0081 (Rev 3)	Nov. 2016	Mar. 2017	Aug. 2017
		Full ORAUT-OTIB-0081 (Rev 4)	Nov. 2017		
2	Neptunium	ORAUT-RPRT-0065 – Np Operations	Sep. 2016	Mar. 2017	Jul. 2017
		ORAUT-RPRT-0077 - Identification	Nov. 2016	Apr. 2017	
		ORAUT-RPRT-0080: <i>PuFF Construction</i>	Feb. 2017	Aug. 2017	
3	Thorium	ORAUT-RPRT-0070: Thorium Exposures - 1972	Jun. 2017		
		ORAUT-RPRT-0081: Thoron Exposures	Apr. 2017		
4	Metal Hydrides	ORAUT-RPRT-0072: Metal Hydride exposures	Jan. 2017		
5	Subcontractor Follow-up	ORAUT-RPRT-0083: Job Plan Evaluation of Construction work	Jun. 2017		

# Co-worker models

- Revision 4 of ORAUT-OTIB-0081 to contain all remaining radionuclides of interest<sup>3</sup>
- Data completeness and QA verification completed.

**Final Modeling is progressing**

**Scheduled completion November 2017**

<sup>3</sup>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. 95<sup>th</sup>%) 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)