



Response to SC&A Comments on ORAUT-RPRT-0092

John Cardarelli, PhD, CHP, CIH, PE

Research Health Physicist

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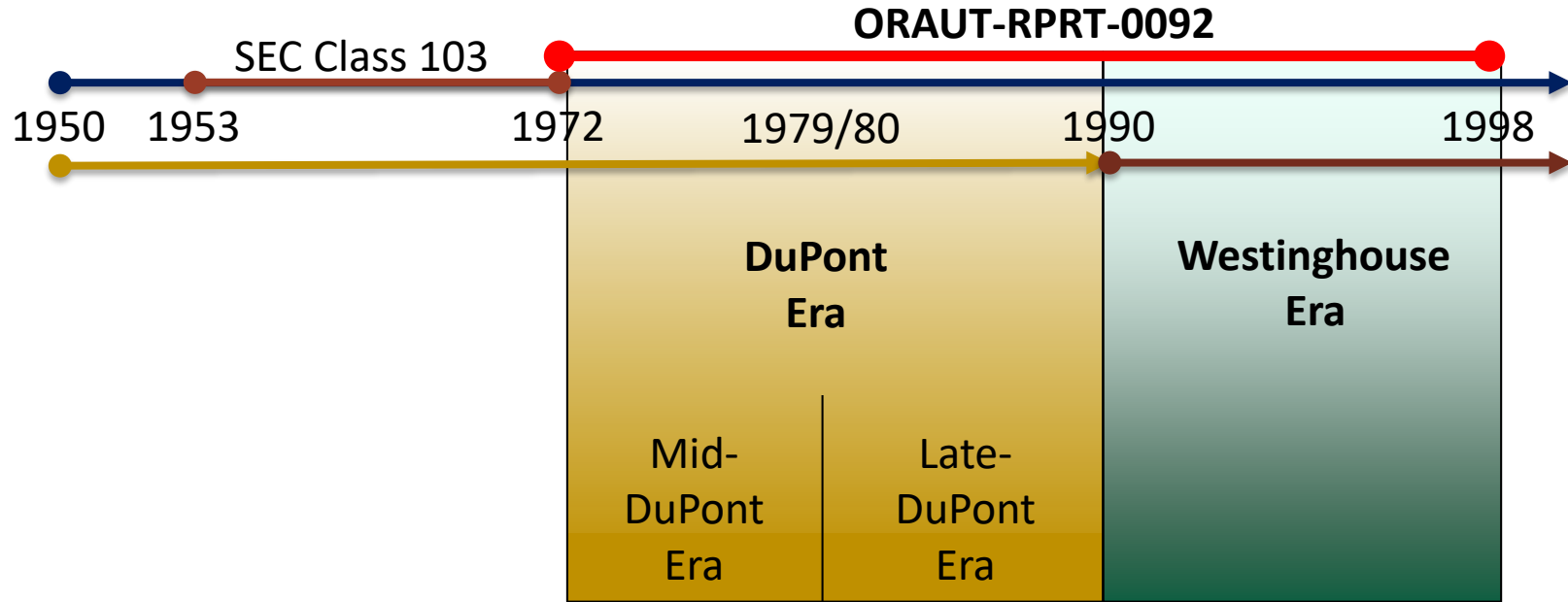
Acknowledgements

- ORAUT SRS-SEC Team members
 - Mike Mahathy, HP Lead Savannah River Site
 - Roger Halsey, CHP

Background

- Key question: **Did unmonitored workers work in the same environments as monitored workers?** The workgroup (WG) asked NIOSH to obtain more information from Special Work Permits (SWPs), Radiation Work Permits (RWPs), and Job Plans to answer this question.
 - DuPont Era (1972 – 1990) vs. Westinghouse Era (post-1990)
 - If yes, then the use of coexposure models is applicable for dose reconstructions
 - If no, then a different approach may be needed.
- NIOSH preference is not to stratify subCTWs from the CTW population.

ORAUT-RPRT-0092 Timeline (not to scale)



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 RPRT-0092's first evaluation objective which was to determine the fraction of subCTWs identified on RWPs of interest who were monitored for internal intakes.

This finding questioned the completeness of the dataset for subCTWs during the DuPont era (1972-1990).

SC&A Finding 1

NIOSH Response to SC&A Finding 1

- NIOSH contends that even though the bioassay choice may neither have been checked nor entered on the standard work permits and job plans between 1972 and 1989, there was an ample number of bioassays taken after respirator work was conducted to verify workplace controls.
- RPRT-0092 used the era-specific criteria to determine if bioassays should have been taken for the 1972–1989 time period.
- Bioassays were obtained based on the operational philosophy, management approach and procedures at the time.

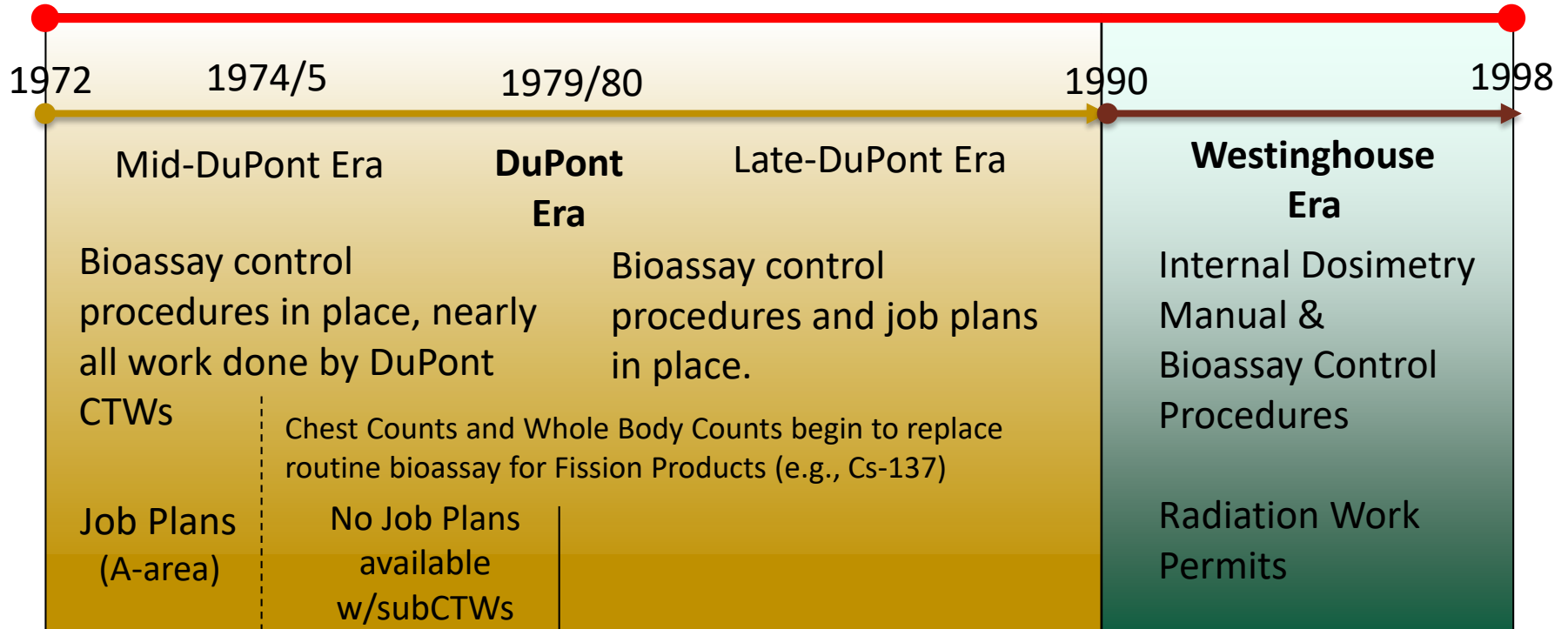
DuPont Era handling of subCTWs

“DuPont handled the subs pretty similar to how they handled the in-house workers.”

SC&A February 9, 2018

<https://www.cdc.gov/niosh/ocas/pdfs/abrwh/2018/wgtr020918-508.pdf> p. 83

RPRT-0092 timeline expanded (not to scale)



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

SC&A Finding 2

NIOSH Response to SC&A Finding 2

NIOSH believes that, prior to 1990, the radiological source terms at SRS were adequately characterized with sufficient accuracy for dose reconstruction purposes. There is significant evidence that SRS characterized radiation work environments in multiple ways.

SRS maintained inventories and monitored work

- SRS maintained inventories of radioactive materials
 - Isotope production records
 - Transuranic radionuclides and enriched uranium controlled as special nuclear materials
 - Monthly Works Technical Reports from 1953–1989
- SRS HP monitored routine and non-routine work
- SRS HP monitored contamination incidents
- Bioassay Control Procedures

Examples of actinide radionuclides of interest (Rol) and routine bioassay

Building or facility	1971		1977		1985		1989	
	Rol	Bioassay	Rol	Bioassay	Rol	Bioassay	Rol	Bioassay
221-F Canyon ^{ab}	Pu, FP, Am	Pu, FP, Am	Pu, FP, Am	Pu, FP, Am	Pu, FP, Am	Pu, FP ^c , Am	Pu, Am	Pu, Am ^c
221 H B-Line ^a	Pu, FP, Am, Np	Pu, FP, Am	Pu, FP, Am, Np	Pu, FP, Am	Pu, Am, Np	Pu, Am ^c , Np ^c	Pu, Am, Np	Pu, Am ^c , Np
221 H-Canyon	Pu, FP, U	Pu, FP, U	Pu, FP, U	Pu, FP, U	Pu, FP, U	Pu, FP ^c , U	Pu, FP, U	Pu, FP ^c , U
321-M	Pu, U, Np	Pu, U	Pu, U, Np	Pu, U	Pu, U	Pu, U	Pu, U	Pu, U

a – workers in selected locations (does not apply to all locations within listed location)

b – does not include outside facilities such F A-Line

c – in vivo measurement performed after positive bioassay result or after contamination incident

d – PuFF was placed in operation in 1977; Np billet line was operated on 1971

Examples of actinide radionuclides of interest (Rol) and routine bioassay (cont.)

Building or facility	1971		1977		1985		1989	
	Rol	Bioassay	Rol	Bioassay	Rol	Bioassay	Rol	Bioassay
235-F P ²³⁸ PuO ₂ Fuel Form Facility (PuFF)	NA ^d	NA ^d	Pu, Np	Pu, Np ^c	Pu, Np	Pu, Np	Pu, Np	Pu, Np
772-F Laboratories ^a	Pu, FP, U, Am	Pu, FP, U, Am	Pu, FP, U, Am	Pu, FP ^c , U, Am	Pu, FP, U, Am	P, U, Am ^c	Pu, FP, U, Am	Pu, FP ^c U, Am ^c

a – workers in selected locations (does not apply to all locations within listed location)

b – does not include outside facilities such as F A-Line

c – in vivo measurement performed after positive bioassay result or after contamination incident

d – PuFF was placed in operation in 1977; Np billet line was operated on 1971

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.

This finding challenges the completeness of the data for subCTWs, primarily between 1972-1979, since only SWPs or Job Plans were only found for 773-A.

SC&A Finding 3

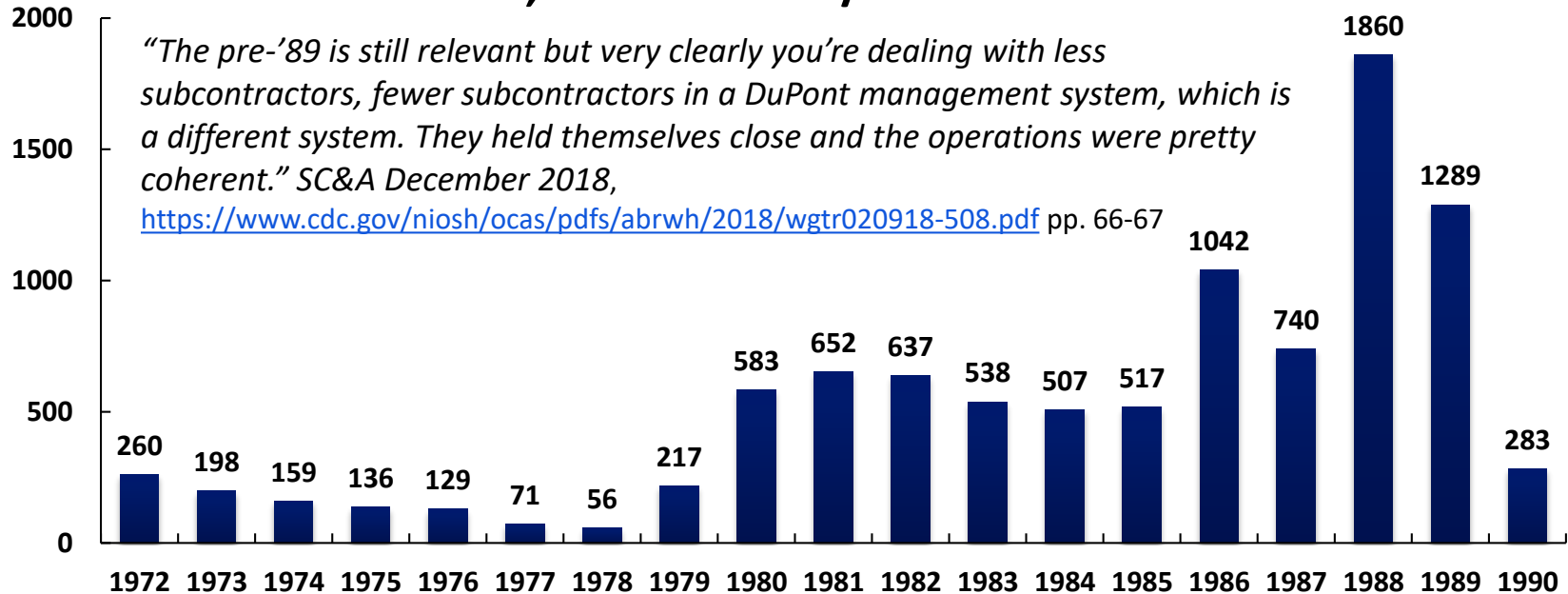
NIOSH Response to SC&A Finding 3

- NIOSH believes that subCTWs were adequately monitored in areas outside 773-A between 1972 and 1990. Additional reviews of the plutonium logbooks support the representativeness called for in the co-exposure implementation guide.
- NIOSH reviewed available plutonium logbooks (1972-1990) in order to determine a more complete picture of bioassay monitoring practices for subCTWs. At least 11,316 bioassay samples from at least 7,028 subCTWs were identified from 1972 through 1990 in at least 23 areas at the site.

SRS # subCTWs identified from Pu bioassay logbooks (1972-1990)

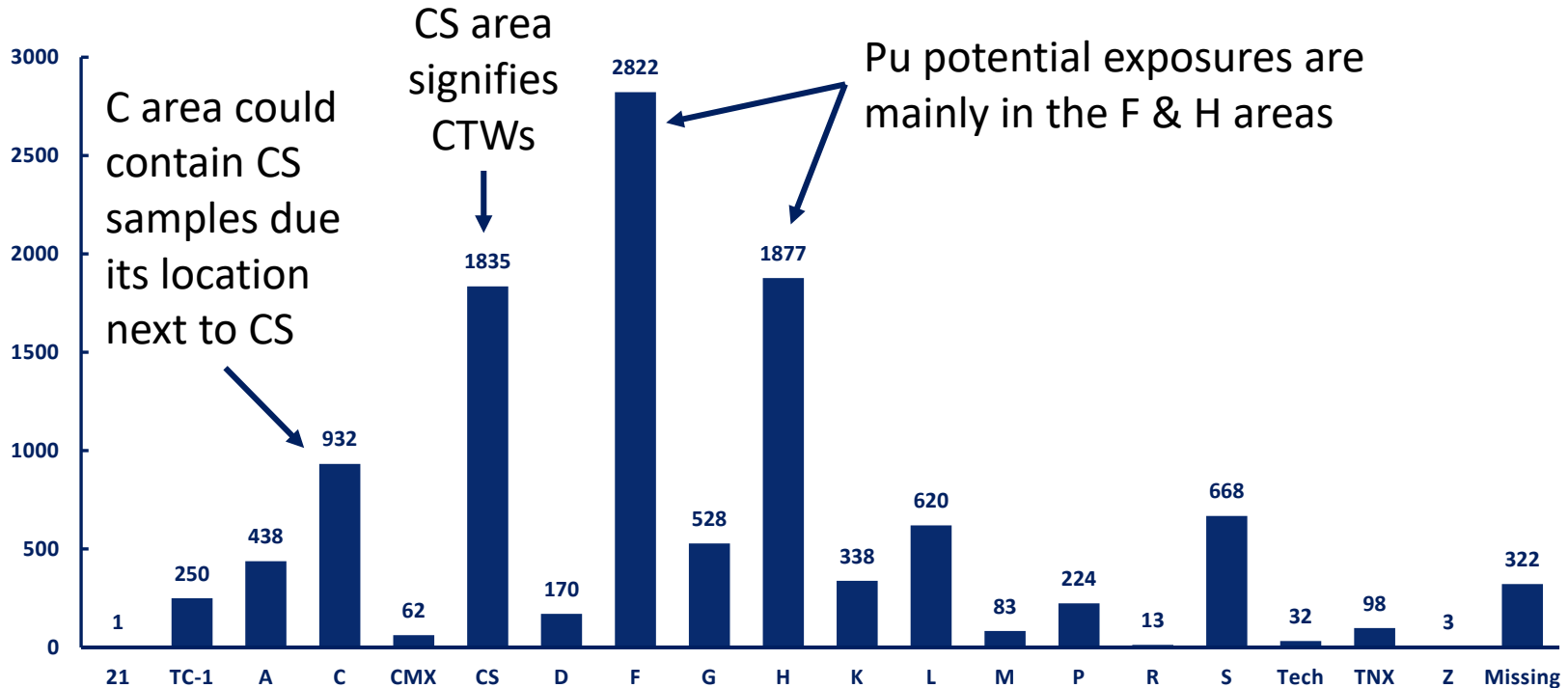
7,028 unique subCTWs

11,316 records b/w 1972-1990



Approximate # Pu bioassay samples for subCTWs by Area (1972-1990)

N=11,316



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.

This finding points out the difference between routine and special bioassay procedures. The latter demanded more attention and therefore would likely lead to better follow-up/completeness. SC&A suggests these data will give a false sense of data completeness applicable to co-exposure models.

SC&A Finding 4

NIOSH Response to SC&A Finding 4

- NIOSH acknowledges the purpose for collecting routine vs. special bioassays are different.
- NIOSH contends that incident-based/special bioassay sampling was an integral component of the SRS bioassay program for both prime and subCTWs and cannot be disconnected from the routine monitoring program **for co-exposure modeling and completeness.**
- *Criteria for the Evaluation and Use of Coworker Datasets* states: “Coworkers are considered to be workers at the same site whose radiation monitoring measurements are considered to be representative or **plausibly bounding** of those received by one or more workers with no individual monitoring data.” (emphasis added)

Evaluation criteria of data for coexposure models

*In general, three types of monitoring programs have been employed at sites covered under EEOICPA. These programs, listed in hierarchical order of preference for use in coworker modeling are: 1) routine, representative sampling of the workers; 2) routine measurement of workers with the highest exposure potential; and 3) **the collection of samples after the identification of an incident**. Because they are not representative of the overall distribution of exposures, programs that rely on measurement of the highest exposed workers or are incident-based require more careful consideration.*

*- Criteria for the evaluation and use of coworker datasets, DCAS-IG-006,
Rev 00*

Routine vs. Incident-based bioassay

- Routine bioassay was used to verify and validate workplace controls.
- Special sampling was performed as a direct result of failure of one or more controls, identified by
 - Visual observation
 - HP instrument measurement
 - Elevated routine bioassay sample results
- Incident-based/special bioassay data include positive results making the co-exposure model **more bounding or claimant favorable**.

Example: Skin and Nasal Contamination Logbook entry from 8/2/72 incident (1 of 2)

Date	Name	P.R.#	Dept	Description of Incident	Work Location
8-2-72	[REDACTED]	[REDACTED]	Const	WORKING INSIDE AIR TUNNEL to 294-H Sand filter when the	294 H
"	[REDACTED]	[REDACTED]	HP	AIR PRESSURE DROPPED TO 90PSIG ON THE MANHOLD THAT WAS	↓
"	[REDACTED]	[REDACTED]	Const	SUPPLYING THEM FRESH AIR TO THEIR PLASTIC SUITS	↓
"	[REDACTED]	[REDACTED]	Sep.	↓ ↓ ↓ ↓	↓
"	[REDACTED]	[REDACTED]	Const		

SRDB 53411, PDF 20

Skin and Nasal Contamination Logbook entry from 8/2/1972 incident (2 of 2)

<u>Location, Type, and Quantity of Contamination</u>	19 Docu ^{ment} ed by	
	Self	HP
Nasal contamination to 13595 d/m BZ WS Const.	✓	
Nasal contamination to 4135 d/m BZ HP	-	
Nasal contamination to 496 d/m BZ subCTW	✓	
Nasal contamination to 1415 d/m BZ Separations	✓	
Nasal Contamination to 3468 d/m BZ subCTW	✓	

SRDB 53411, PDF 21

Pu Logbook Bioassay Data for 2 of 5 workers involved in an incident on 8/2/72 (1 of 2)

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8-15-72

#	Name	Vol	Pr #	type	area	Recd	Bath	time
1	(WS contractor)	950		Spec	H	8-2	8-2	
2	Worker who had 13,959 dpm nasal contamination	300		FU	H	8-2	8-2	4 PM
3		1000		"	H	8-2	8-3	Same person
4		350		"	H	8-2	8-7	
5		1,415 dpm nasal contamination (Sep Operator)	350		Spec	H	8-15	8-3

SRDB 56722, PDF 172

Pu Logbook Bioassay Data for 2 of 5 workers involved in an incident (2 of 2)

8-15-72

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<i>d/m dia</i>	<i>d/m 1.5l</i>	<i>Report</i>	<i>Remarks</i>
.031	.159		
.037 .060	.213 .409	0.3	.258 AVG. d/m/1.5l
.090	.692		
.039 .042	.228 .252	0.4	.382 AVG. d/m/1.5l
.020	.059		
.045 .010	.280 0	0.1	.104 " " "
.032	.168		
.050 0	.063 0	LIP	→ no color change
.007	0		
.021	.291	<0.1	

13,595 dpm
Same
person

1,415 dpm

Pu Logbook Bioassay Data for 3 of 5 workers involved in an incident on 8/2/72 (1 of 2)

#	Name	Val	PA#	Area	Acid	Boat	Type	Time
7	3,468 dpm nasal contamination (both of these are subCTWs)	600	[REDACTED]	H	8/7	8-3	Spec	8 ⁰⁰ /A
11	496 dpm nasal contamination	925	[REDACTED]	"	"	8-2	Spec	-

SRDB 56722, PDF 182

13	(HP)	100	[REDACTED]	"	8/27		Spec.	
14	4,135 dpm nasal contamination	550	[REDACTED]	"	"	8-16	"	2 ⁴⁵ /A

SRDB 56722, PDF 184

Pu Logbook Bioassay Data for 3 of 5 workers involved in an incident on 8/2/72 (2 of 2)

d/m/date	d/m/1.5L	Report	Remarks
014	009	1.0	3,468 dpm = <0.1
035 258	191 392	156 147	0.2
			avg <u>221</u> Fully RCC - JH 9/21
			496 dpm = 0.2
			SRDB 56722, PDF 183
	0	<0.1	4,135 dpm = <0.1
			SRDB 56722, PDF 185

The incompleteness of SRS dose records for 1972 - 1990 is substantiated by the acknowledged destruction of subcontractor records and first hand 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.

SC&A Finding 5

NIOSH Response to SC&A Finding 5

- NIOSH respectfully disagrees that dosimetry records for workers were destroyed or lost.
- *SC&A Review of RPRT-0092 states: “The cited inability to readily compile radiation exposure data obtained prior to 1990, as well as key radiation control records (e.g., SWPs and job plans), is traceable to a longstanding SRS policy in the DuPont era that limited onsite retention of all but exposure histories. Records were only retained for up to 2 years and then shipped to the Federal Repository, for which retrieval of complete records can be difficult, as noted by the DOE assessment team and illustrated by NIOSH’s survey results for the 852 boxes retrieved”*
[SRDB Ref ID: 179239, PDF p. 37].

Record Availability Concerns

- The DOE Tiger Team's 1990 assessment of the SRS radiological safety program does not mention destruction of dosimetry records. The report indicated that there was an issue with the availability of dosimetry records, not that they were destroyed.
- SC&A review of ORAUT-RPRT-0092: [SRDB 179239] *“Radiation exposure history records are maintained in the dosimetry files in Bldg. 735A. All other records are boxed, inventoried, and sent to the Federal Repository in Atlanta, after an interim storage period of up to 2 years onsite...”* [PDF p. 37]
- SRS provided external monitoring data for 74% of subCTW claimants and bioassay monitoring data for 56% for subCTW claimants for the period 1972-1990 [ORAUT-RPRT-0094 (SRDB Ref ID 178283)].

6. For the period 1980–1989, only 20 percent 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).

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 percent. If a urinalysis sample taken during 1991 as a result of an incident in a different SRS location (and is not currently used in the SRS coworker model) is removed, the effective monitored population drops to 26.5 percent.

SC&A Findings 6 & 7

NIOSH Response to SC&A Findings 6 & 7 (1 of 3)

- These findings are combined because they both address the percent of subCTWs monitored for Am either by urinalyses or chest count methods.
- NIOSH agrees with SC&A Finding 6 (20% monitored in the 1980s)
- NIOSH respectfully disagrees with SC&A Finding 7 (33% effectively monitored)
 - NIOSH answered the question what percentage of the subCTWs were effectively monitored by either method? (which was the intent of RPRT-0092)
 - SC&A answered the question what percentage of the subCTWs were effectively monitored that could be used to develop a co-exposure model? They stated that “...chest counts are not used in coworker development...” and deleted these data in their calculations. [SRDB 179239; PDF p. 47]
 - NIOSH may use chest count data for co-exposure modelling if needed.

Effectively monitored subCTWs for Am-241 (2 of 3)

(assumed separated Am-241; <2 years from exposure date)

Am Analysis	# bioassay results from job plans*	# bioassay results from "coworkers"	Total	Comments
Urinalysis (in vitro)	17 (11%)	20 (13%)	37 (24%)	
Chest count (in vivo)	13 (9%)	<u>35 (23%)</u>	48 (32%)	<u>SC&A excluded these data because they answered a different question than what was presented in RPRT-0092</u>
	30 (20%)	55 (36%) <u>20 (13%)</u>	85 (56%) <u>50 (33%)</u>	Effectively monitored subCTWs

* A total of 151 Am bioassay results from 35 job plans were reviewed between 1980 and 1989. Data extracted from Table 4 [SRDB 179239; PDF p. 47]

NIOSH Response to SC&A Findings 6 & 7 (3 of 3)

- Some subCTWs were routinely monitored for americium-241 (Am-241).
 - 15 separated Am-241 found in logbooks in 1979
 - 66 mixed Am/Pu urinalyses found in logbooks between 1972 – 1987
- Intakes of separated Am-241 were only plausible in F-Wing of 773-A and in the MPPF in F Area.
 - Type M clearance limits the use of chest count data to <2 years
- Mixed Am/Pu exposures occurred in the canyons and reactor areas.
 - Type S or Super S clearance may allow the use of urinalysis or chest count data beyond 2 years.

Many of the workers (around 70–73 percent) 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.

SC&A Finding 8

NIOSH Response to SC&A Finding 8

NIOSH believes there are sufficient data to reconstruct FP doses for unmonitored subCTWs.

- Actual fission product urinalysis results reported for individual subCTWs will be used to reconstruct fission product doses.
- Co-exposure models are stratified to CTW (prime plus subcontractor).
 - Prime CTWs were routinely monitored during the entire period while subCTWs were monitored by special urinalysis up to 1982.
 - **By 1976**, WBCs replaced FP urinalysis to detect FP intakes.
 - The co-exposure model may use all applicable bioassay data, including results from special and routine bioassay samples, if needed.
 - The model is valid for subCTWs as the data for all CTWs are sufficient for dose reconstruction purposes.

Dose Reconstruction for fission products

Year	Sub CTW	Prime CTW	Total
1972-73	4	50	54
1974	0	70	70
1975	0	88	88
1976	2	60	62
1977	3	92	95
1978	3	88	91
1979	6	60	66
1980	3	78	81
1981	1	90	91
1982	8	77	85

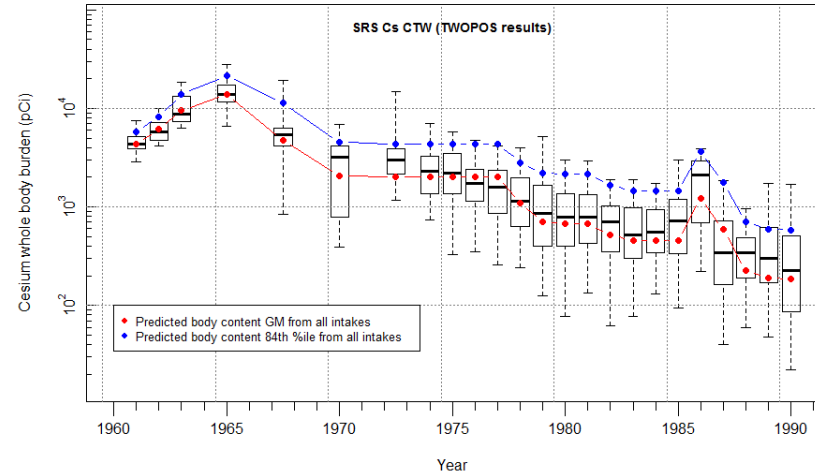
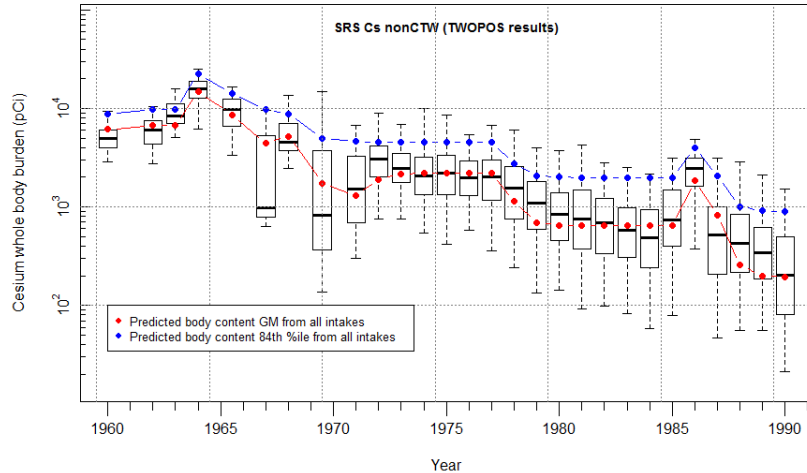
- Although subCTWs are underrepresented in the fission product co-exposure model until 1983, the model is still valid for subCTWs because the data included for prime CTWs are sufficient to reconstruct doses.

Dose Reconstruction for fission products (cont.)

Year	Sub CTW	Prime CTW	Total
1983	23	69	92
1984	17	52	69
1985	18	37	55
1986	20	42	62
1987	127	53	180
1988	194	46	240
1989	162	78	240
1990	302	86	388

Fission Product Co-exposure Model for nonCTWs and CTWs

SRDB 175614, PDF pp. 82 & 83



Analysis of NOCTS WBC data performed in accordance with the current version of ORAUT-RPRT-0053 [SRDB 136245] using the TWOPOS method and the multiple imputation method from ORAUT-RPRT-0096 [SRDB 175396].

SC&A does not find that the data collected as part of the 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 percent) or, alternately, appropriately represented in the derived coworker models for SRS (around 13 percent).

SC&A Finding 9

NIOSH Response to SC&A Finding 9

- NIOSH respectfully disagrees with SC&A Finding 9 conclusion regarding the total of effectively-monitored workers for potential Am-241 exposures.
- The effectively-monitored calculation is the total of the directly-monitored (20%) and the indirectly-monitored or coworkers (36 %), which includes “coworkers” chest counts made within two years from the date of the job plan, for a total effectively-monitored worker of 56%, according to SC&A calculations.
- NIOSH reaffirms its position that subCTWs performed work and were monitored similarly to prime CTWs. Therefore, the developed co-exposure model can be used to estimate unmonitored subCTWs doses.

Effectively monitored subCTWs for Am-241

(assumed separated Am-241; <2 years from exposure date)

Am Analysis	# bioassay results from job plans*	# bioassay results from "coworkers"	Total	Comments
Urinalysis (in vitro)	17 (11%)	20 (13%)	37 (24%)	
Chest count (in vivo)	13 (9%)	<u>35 (23%)</u>	48 (32%)	<u>SC&A excluded these data because they answered a different question than what was presented in RPRT-0092</u>
	30 (20%)	55 (36%) <u>20 (13%)</u>	85 (56%) <u>50 (33%)</u>	Effectively monitored subCTWs

* A total of 151 Am bioassay results from 35 job plans were reviewed between 1980 and 1989. Data extracted from Table 4 [SRDB 179239; PDF p. 47]

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.

SC&A Finding 10

NIOSH Response to SC&A Finding 10

- NOCTS data indicates that 89% of the subcontractor claimants working in 1990 have in vitro or in vivo internal monitoring data.
- NIOSH believes that 88% direct monitoring for subCTWs (Pu, Sr, U, Am, Np) is not demonstrably incomplete; these data can be categorized in the 1990 to 1998 time frame. [SRDB 176739, Table 4.5]

Extracted from Table 6 in RPRT-0092 Response Paper
% subCTWs with monitoring data in NOCTS

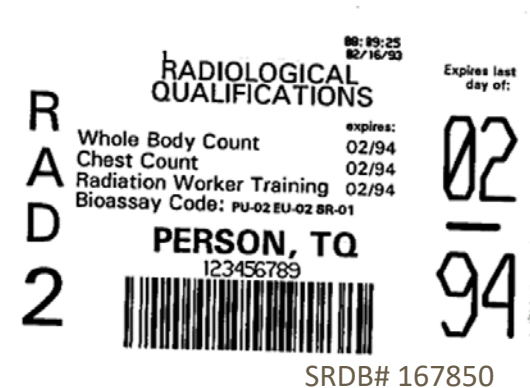
Year	NOCTS	external data	in vitro or in vivo data	both
1988	17%	75%	77%	59%
1989	16%	85%	73%	63%
<u>1990</u>	<u>17%</u>	<u>94%</u>	<u>89%</u>	<u>85%</u>
1991	15%	96%	91%	89%
1992	13%	94%	94%	90%

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 percent to 77 percent (in comparison to 76–96 percent in RPRT-0092), and effectively monitored workers ranged from 55 percent to 89 percent (in comparison to 85–99 percent in RPRT-0092).

SC&A Finding 11

NIOSH response to SC&A Finding 11

- The original intent of this work was to determine if subCTWs were monitored working in the same environments as other workers.
- The sampling plan for the Westinghouse era (1990-1998) considered a worker as monitored if they had **at least** one bioassay results.
 - Worker leaves bioassay based on either their routine schedule or job-specific requirement
- NIOSH stands by the results given for effectively monitored workers. There is sufficient data to reconstruct doses using a coexposure model.



The back application of assumptions regarding work permits, job-specific bioassays, and target radionuclides to conduct a completeness review for 1972–1998 is not plausible given the significant changes in radiological policies, procedures, and practices that occurred in the early 1990s.

Observation 1

NIOSH Response to SC&A Observation 1

- NIOSH did not assume the monitoring practices in the 1990s regarding work permits, job specific bioassays, and target radionuclides was applicable to the 1972-1989 timeframe for completeness evaluations.
- Radiological practices were consistent with DOE Orders in place at the time. However routine bioassay requirements remained similar from 1972 through 1998 despite changes in the internal monitoring policies.
 - DOE Order 5480.1 (1981): 10% quarterly dose limit for external and internal exposures
 - DOE Order 5480.11 (1989/90): Annual effective dose is 100 mrem or greater

During the 1972–1974 period, RPRT-0092 only evaluates one job plan/worker combination (Job Plan 46) for potential americium exposure. However, attachment D, table D-1 indicates at least one other job plan (Job Plan 47) requiring americium monitoring during this period. Neither of the workers were directly monitored nor had an appropriate coworker monitored for americium.

Observation 2

NIOSH Response to SC&A Observation 2

Job Plan No.	Job Date	Wing/Room	Pu	Am/Cm	SRDB Ref ID	PDF Page
46	7/10/1973	F wing	A	A	173830	106
47	8/10/1973	HLC	A	<u>No</u>	173830	107

- Table D-1, Job Plan No. 47 indicates “A” or assumed for Am, but should have been marked “No” because the work was performed in the high-level cave. Job Plan No. 46 indicates “A,” which is correct because the work was performed in the F Wing.
- This will be corrected in the next revision of RPRT-0092.

Only 13 percent of the subcontractor-job plan combinations (17 total) had americium urinalysis performed that could be considered relevant to coworker modeling. Eleven of the 17 urinalysis data points represented a single worker who had a single sample taken in 1991 as a result of an incident that occurred in a different area (M Area) during that year (i.e., representative of a different area and different period).

Observation 3

NIOSH response to SC&A Observation 3

- NIOSH acknowledges SC&A observation that 11 of the 17 urinalysis data points represent a single worker who had a single sample taken in 1991.
- A unique RWP worker was the combination of a single worker and job; as such a subCTW can be more than one RWP worker. However a single bioassay can be applied to more than one unique RWP worker pairing.
- Three issues to consider
 - Original intent of RPRT-0092 (Did unmonitored workers work in the same environment as monitored workers?) – NIOSH believes the answer is yes.
 - Application to Individual Dose Reconstruction
 - Multi-year window for Am-241 allows for the use of these data for earlier time periods (e.g., 1980s).
 - Applicable to co-exposure models, if needed. Coexposure models are not done by area.

SC&A's analysis indicates that identified coworker matches may not be sufficiently representative of the subCTW intakes in all cases unless strict criteria are applied, such as the same craft designation as well as the same date and time of the work performed.

Observation 4

NIOSH Response to SC&A Observation 4 (1 of 3)

- NIOSH believes that subCTWs can be sufficiently matched for coexposure modeling but re-iterates its position that there is no need to further stratify CTWs between prime- and sub-CTWs
- NIOSH considers the following criteria for matching coworkers:
 - An RWP as a small work activity
 - An RWP on the same day and time
 - Similar time periods (i.e., morning or afternoon)
 - Not the same craft, but the same exposure environment
 - Exposure environment variation depending on the RWP work

NIOSH Response to SC&A Observation 4 (2 of 3)

- There were no significant differences noted in the effective percent monitored between subCTW plutonium bioassays by craft for 1990–1998 as shown in the table below.

NIOSH Response to SC&A Observation 4 (3 of 3)

Craft	Bioassay Required	No. of RWPs	subCTWs Monitored	Percentage with Bioassay	SubCTWs Matched to Coworkers	Effectively Monitored %
Boilermaker	27	12	24	89%	2	96%
Carpenter	79	33	71	90%	7	99%
Electrician	56	24	49	88%	2	91%
Insulator	17	9	16	94%	0	94%
Iron/Sheet metal	137	33	122	89%	12	98%
Laborer	174	70	147	84%	14	93%
Millwright	15	6	13	87%	2	100%
Painter	22	12	17	77%	4	95%
Pipefitter	102	42	94	92%	4	96%
Other	15	8	14	93%	0	93%
Totals	644 ^a	140	567	88%	47	95%

Bioassay data in the 1990s are not entirely free of the earlier data issues. The implementation of methods used to correct for the bioassay deficiencies seen in the 1970s and 1980s did not take place immediately with the change in the contracting company in 1990. It was not a step function that took place in 1990; instead, it took a number of years to identify, address, and effectively implement the changes. For example, there was only one RWP with one subCTW listed for 1990 in RPRT-0092, and specific radionuclides were not required on the RWPs until the mid-1990s.

Observation 5

NIOSH Response to SC&A Observation 5

- NIOSH acknowledges it took time for the Westinghouse Era (1990 – 1998) to fully implement new radiation control protocols. While several deficiencies were identified by self-assessment and audit during this era, NIOSH believes that none of these were consequential to operation of the Routine Bioassay Program or our ability to reconstruct doses with sufficient accuracy for compensation purpose.
- In response to 1990 Tiger Team concern RP.7-1 (i.e., the site-wide internal dosimetry program does not comply with the requirements of DOE 5480.11), SRS stated:
 - *“The SRS program like many in the DOE complex is based on years of experience, awareness of what has constituted good practice in the past, common sense, and conservative assumptions for determining employee doses. To conclude that a sound technical basis for the existing program does not exist is somewhat excessive. It is true that a formal technical basis for the SRS bioassay program has yet to be established. However, the SRS is already well into the process of creating a rigorous, systematic technical basis document for the internal dosimetry program consistent with the requirements of the Order and appropriate guidance”* [DOE 1990a, PDF p. 432].

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

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

