Summary of Dose Reconstruction Feasibility for Subcontractor Construction Trades Workers (CTWs) at the Savannah River Site (SRS) – *SEC00103*

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Key Dose Reconstruction Documents for Unmonitored Subcontractor Construction Trades Workers (sCTWs)

- DCAS-IG-006: *Criteria for the Evaluation and Use of Co-Exposure Datasets (March 2020)*
  - Section 2.0 Data Adequacy and Completeness
    - Completeness: *"determine if there are sufficient measurements to ensure that the data are either bounding or representative of the exposure potential for each job/exposure category at the facility"*
    - Guidance also indicates that there should be consideration for temporal gaps in the data and provides an example with respect to completeness from the Nevada Test Site (NTS)
- ORAUT-OTIB-0081: *Internal Dosimetry Co-Exposure Data for the Savannah River Site (September 2020)*
  - 9 Radionuclide models for both CTWs and non CTWs

Job Specific vs. Routine Bioassay Samples

- *"The purpose of the job-specific bioassay sampling program is to collect bioassay samples from workers whose routine bioassay program does not include some or all of the radionuclides present at the work site or who are not on a routine program." (SRDB# 167757)*
- Most workers, including subcontractor Construction Trades Workers (sCTW), were on a routine bioassay schedule.
- 1997 DOE Notice of Violation (NOV) indicated only 21% (68/324) compliance of submitting job-specific bioassays. The workers who did not submit job-specific bioassays (79% or 256/324 workers) were followed-up and none indicated an internal exposure. *(SRDB# 167497)*
- At SRS in 1997 there are over 6,000 *routine* non-tritium bioassays. This indicates that job-specific bioassays comprises a relatively small fraction (≈5%) of the overall internal monitoring program and likely has an insignificant impact on co-exposure models.

Documentation Evaluating Subcontractor CTW Monitoring for Completeness and Representativeness

- RWP Analysis - ORAUT-RPRT-0092: *Evaluation of Bioassay Data for Subcontracted Construction Trade Workers at the Savannah River Site*
- NOCTS Data Evaluation – ORAUT-RPRT-0094: *Bioassay for Subcontractor Construction Trade Workers at the Savannah River Site from 1972 to 1997*
- Plutonium Bioassay Logbook Analysis: 11,316 bioassay samples from 7,028 subcontractors CTWs between 1972-1990 *Response to SCA Finding #3*
- *Savannah River Site Plutonium Construction Trade Worker Stratification Refinement 2019 White Paper*
- *Analysis of Uncertainty in Co-Exposure Models 2021 Bootstrap White Paper*
- *Practical Implications of the Bootstrap Uncertainty Analysis on Co-Exposure Models 2021 Practical Implications White Paper*

Conclusion - Weight of the Evidence

- Weight of evidence from evaluations, stratification, & uncertainty analysis
  - Robust subcontractor CTWs monitoring in the 1990s
  - Acceptable subcontractor CTW monitoring (>50%) in the 1980s
  - Limited monitoring data in the 1970s (DuPont CTWs are bounding)
- We do not see any evidence where subcontractor construction trades workers were not monitored to a degree that would bias the current co-exposure models
- Based on the weight of the evidence, NIOSH believes that the co-exposure models are bounding and representative of the exposures that would be received by an unmonitored subcontractor construction trades worker
- NIOSH concludes that dose reconstruction is feasible

Questions?

NIOSH December 2020 Presentation on Dose Reconstruction Feasibility

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

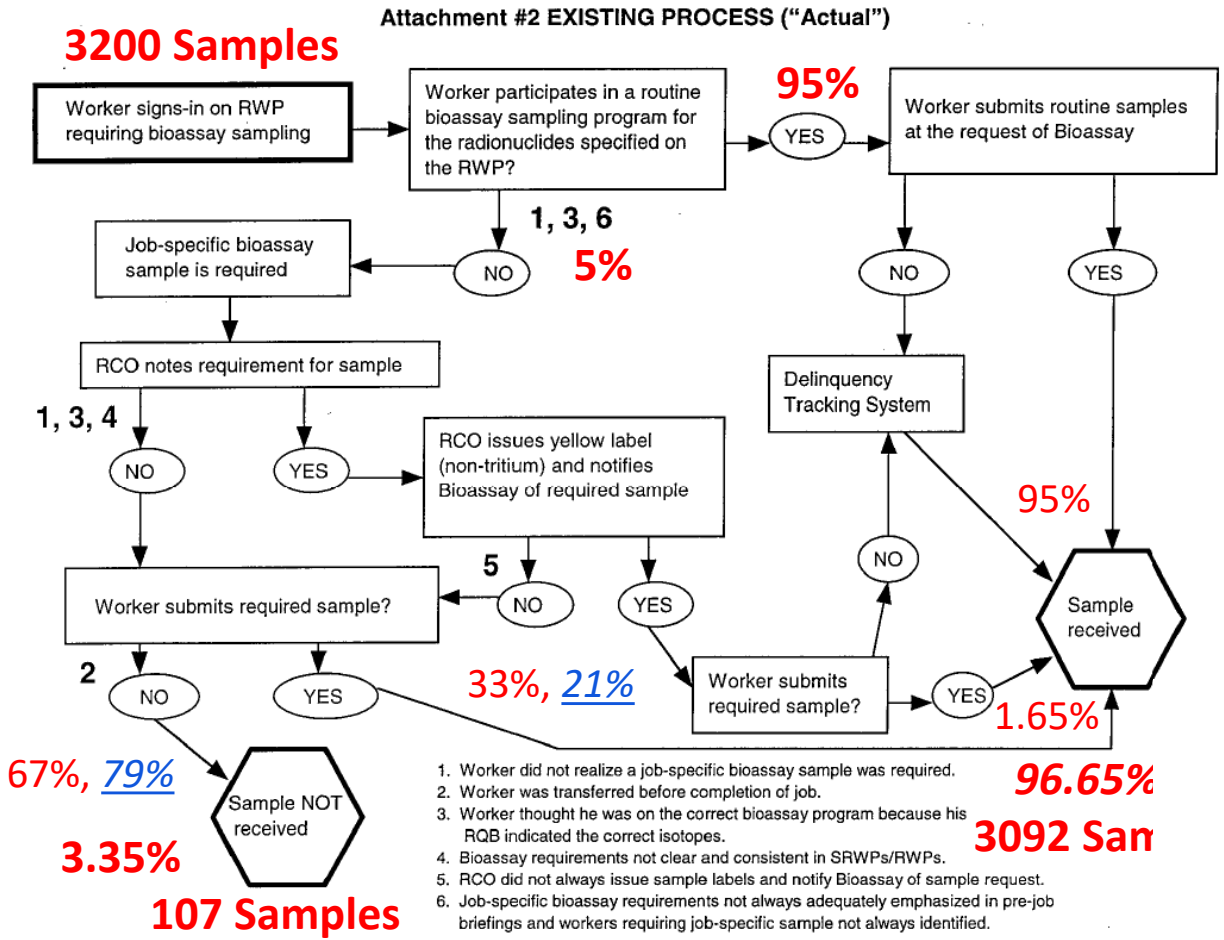
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Extra Slides

These slides are for clarification purposes to assist in answering potential questions

Subcontractor Monitoring

- Limited assessment of 3200 bioassay requirements – 33% compliance on Job-specific bioassay
- *Full assessment –"about 21% compliance" on Job-specific bioassay*
  - *≈ 324 Job-specific*
  - *≈ 6481 total bioassay*
- *1997 Total # of samples **NOT** received was 256*
- *100% follow-up of 256 workers indicated no intakes*

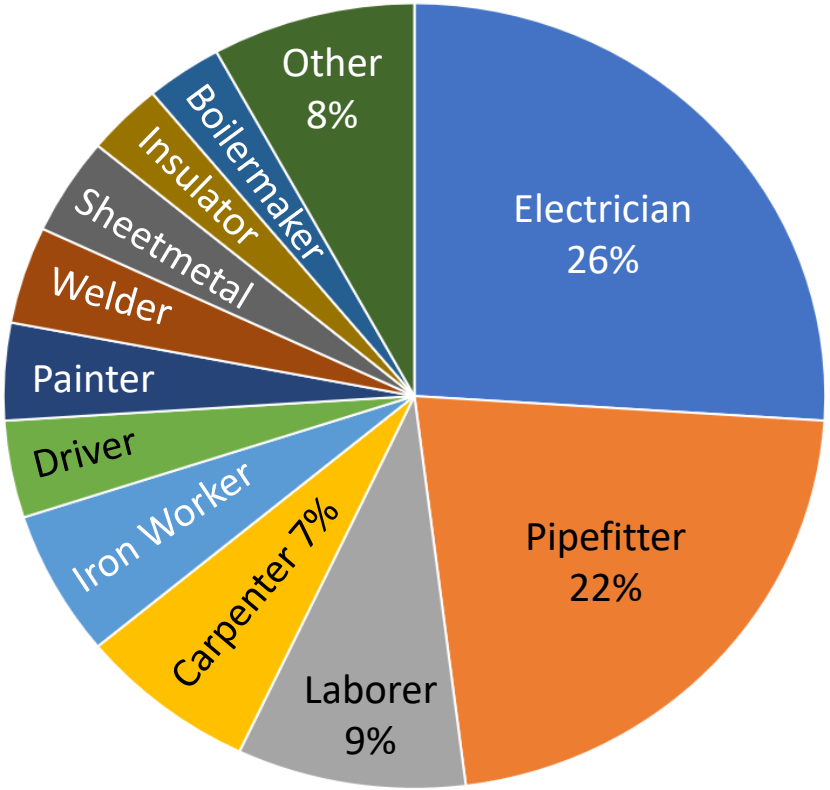


SRDB# 167757

Subcontractor CTW monitoring in NOCTS

- Only NOCTS data (Claimant Data)
  - 6097 Total SRS Claimants
  - 886 (15%) Subcontractor CTWs
  - Most, if not all, subCTW job titles are represented

- NIOSH Evaluation
  - External Monitoring
  - Internal Monitoring
    - Tritium bioassay
    - non-tritium bioassay (actinides)
    - Whole Body Counting (fission products)

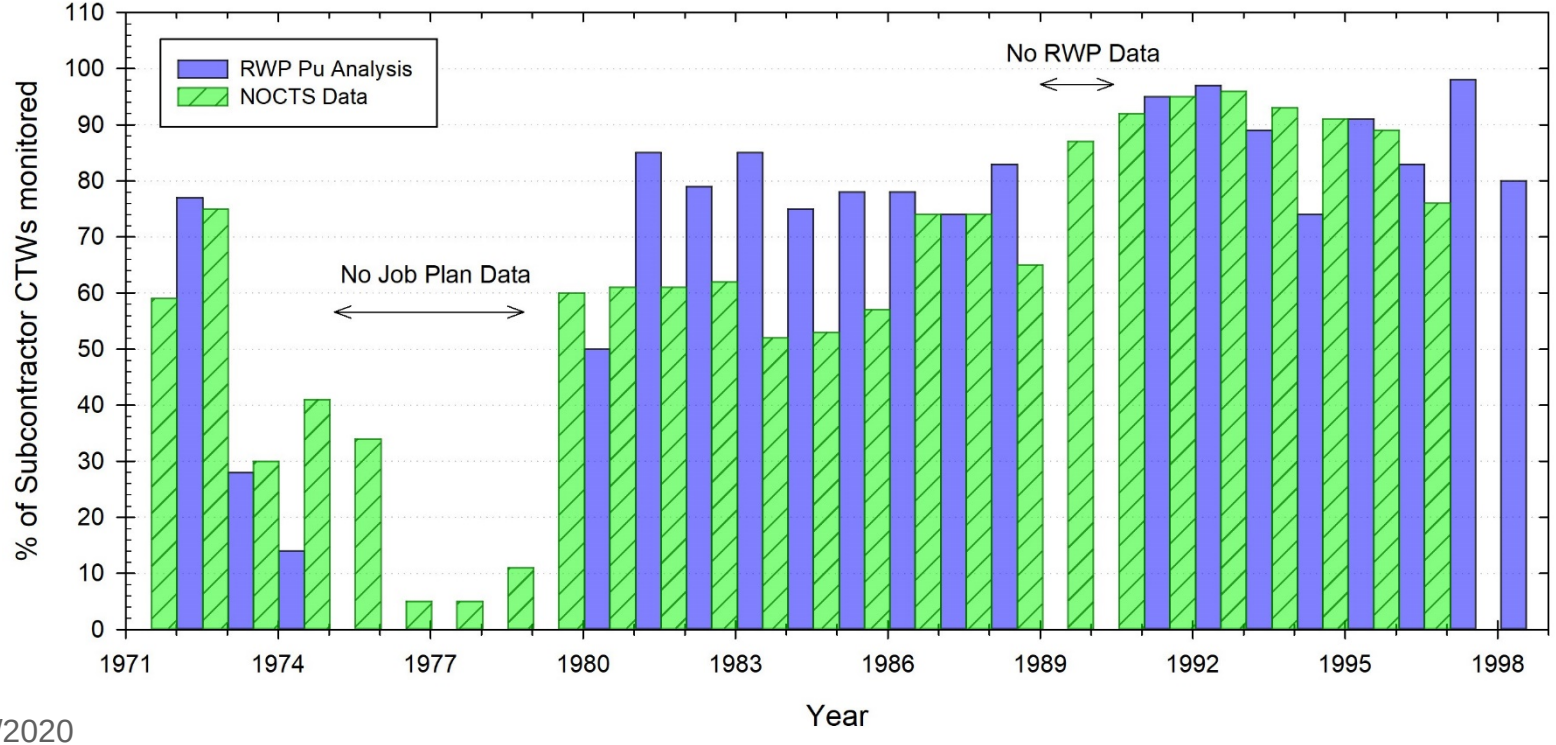


Why the simplistic internal monitoring approach?

- Radionuclide specific internal monitoring depends on where the worker conducted their work *(SRS is a Very Large Site)*
  - Subcontractors in reactor areas likely didn't need plutonium monitoring, but may have needed tritium or fission products
  - Subcontractors in plutonium areas likely didn't need tritium monitoring
  - Subcontractors in tritium areas likely didn't need plutonium or fission product monitoring
- ***Fundamental question: Are subcontractors sufficiently represented or bounded in the co-exposure models?***

Comparison RWP Analysis and NOCTS Claimant Data

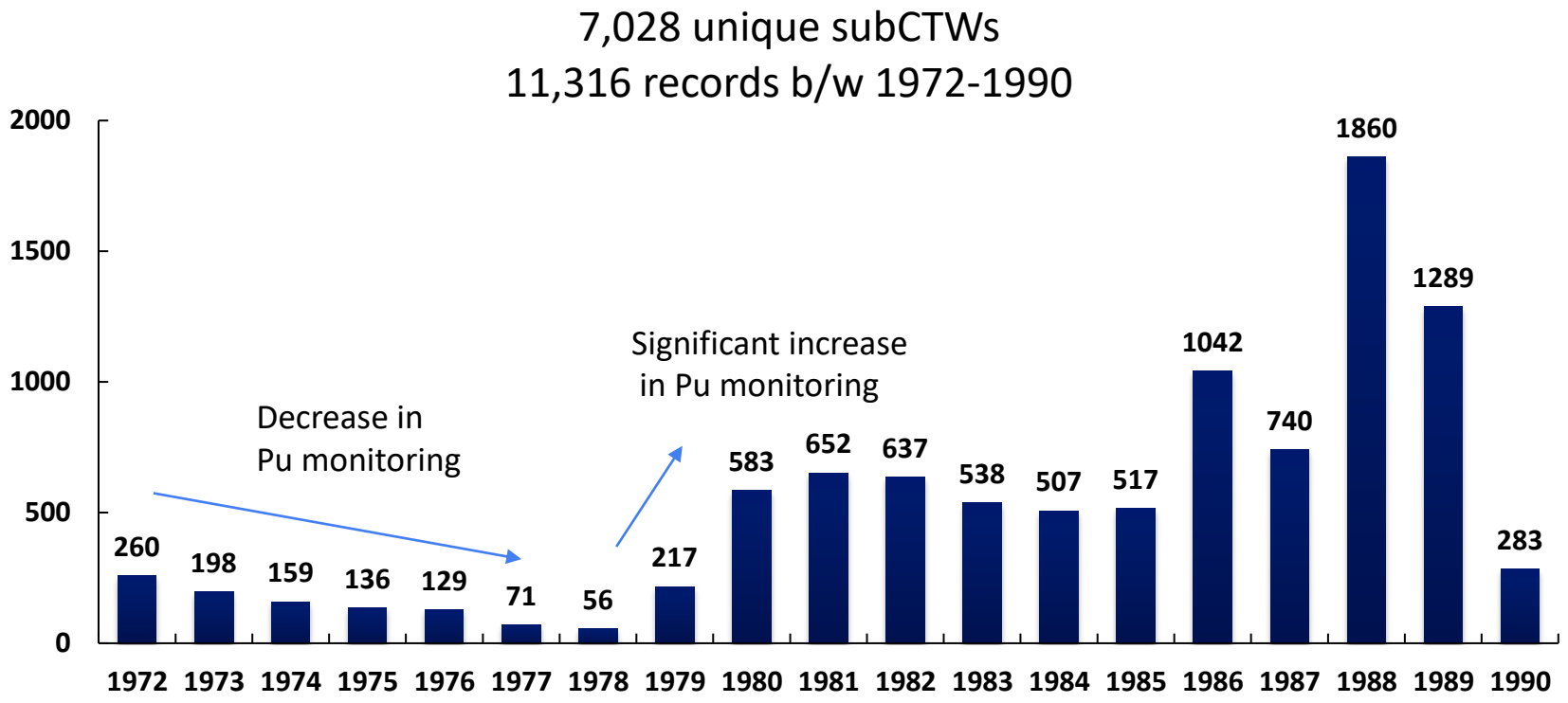
NOCTS Data from Table 5-4



Effect of limited monitoring on Co-exposure models

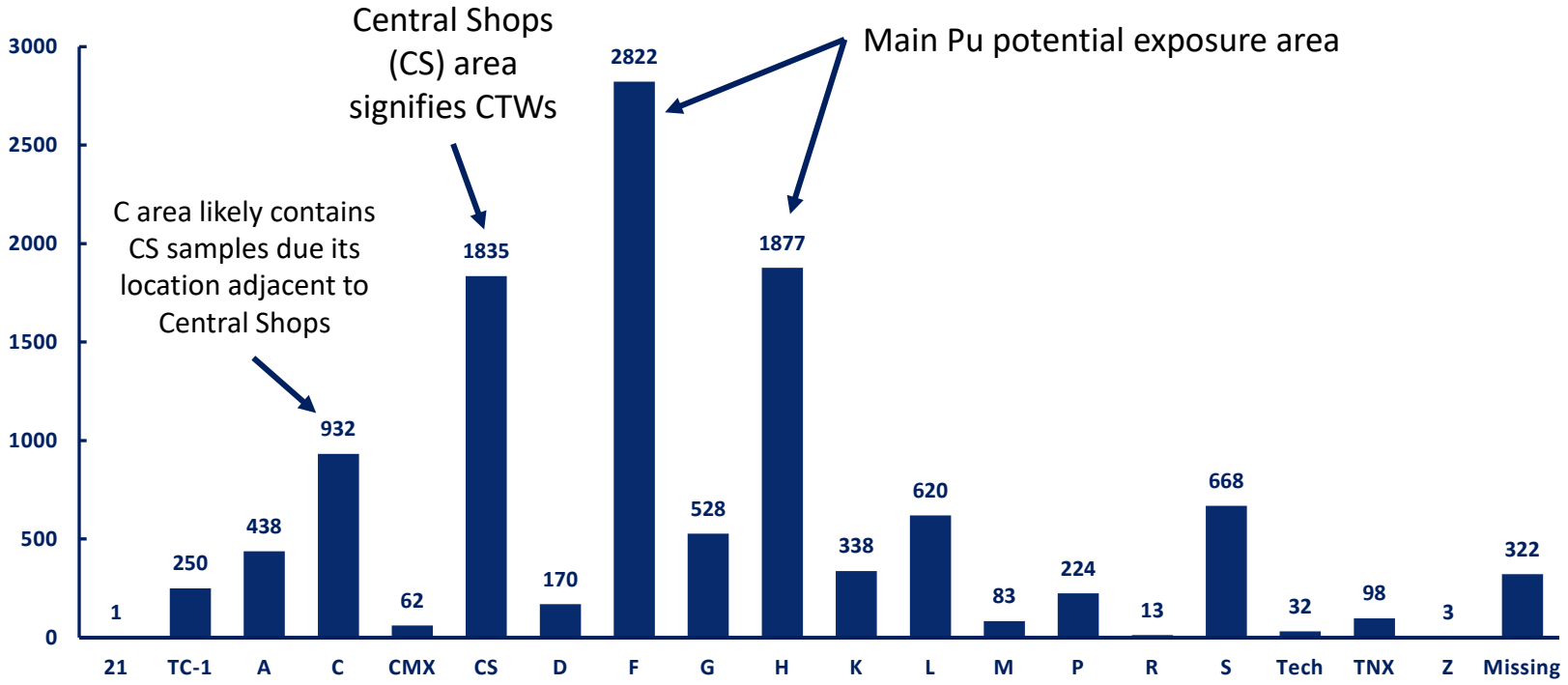
- Based on NOCTS data analysis (RPRT-0094) there are six years (1974-1979) where the percentage of internal monitoring via non-tritium and WBC is less than 50%
- To bias the co-exposure models, exposures to *unmonitored* subcontractor CTWs would have to be significantly higher than the *monitored* subcontractor CTWs
  - Considering the zero-intake policy and defense in depth approach to radiological protection, coupled with the Health Physics coverage of the construction jobs, we don't believe this is plausible especially considering that for most years the *monitored* subcontractors outnumber the *unmonitored* subcontractors

Subcontractor CTWs identified from SRS Pu bioassay logbooks



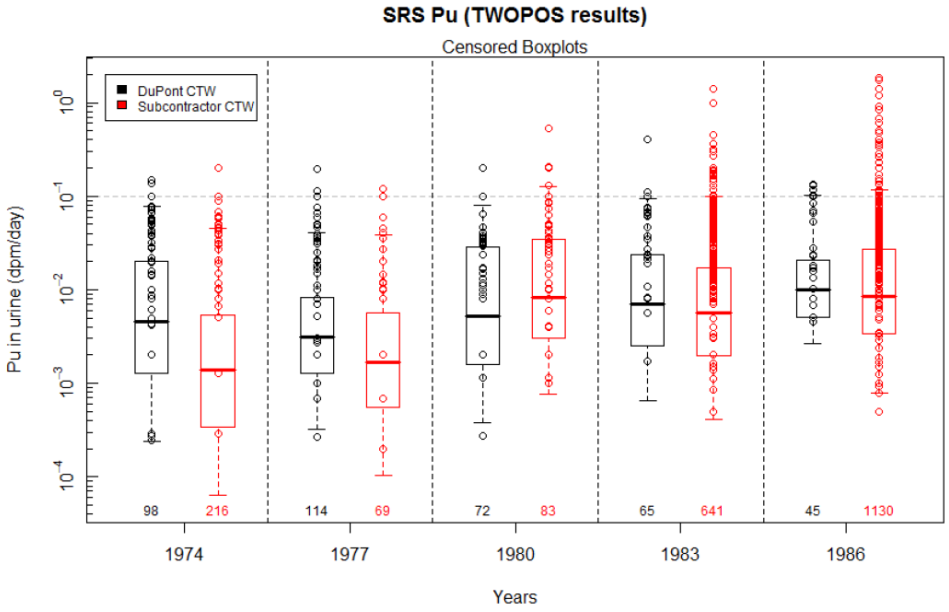
Approximate # Pu bioassay samples for subCTWs by Area (1972-1990)

N=11,316



Plutonium Sub-stratification analysis

- Over 95% of the plutonium bioassay data is below the reportable level of 0.1 dpm/day
- Bioassay data from DuPont or prime CTWs (Roll 2) appear to be slightly greater than subcontractor CTWs (Roll 4, 5, and 6)
- When co-exposure models are developed, the Pu intakes for the two populations are quite similar



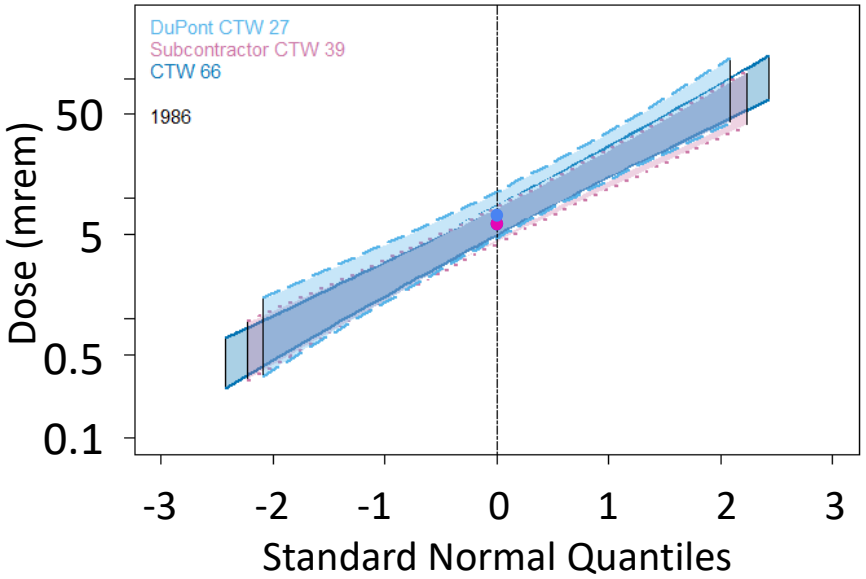
Sub-stratification Type-S Plutonium Intake Results

Year	prime-CTW 50th % (dpm/d)	subCTW 50th % (dpm/d)	prime-CTW 95th % (dpm/d)	subCTW 95th % (dpm/d)
1973-1978	**15.71**	6.97	268.7	169.4
1979-1987	**26.38**	22.65	279.2	326.1

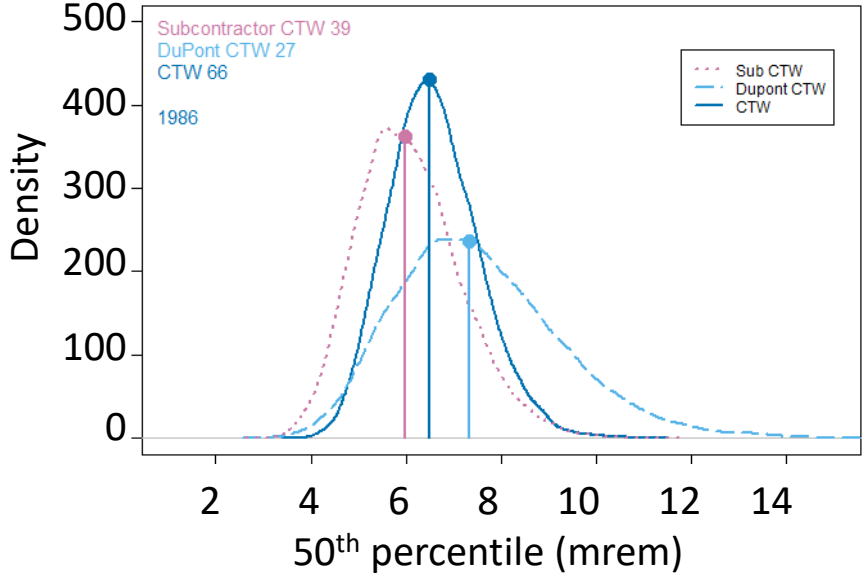
Bold denote higher 50th% Intakes
Underline denote higher 95th% Intakes

Analysis of Uncertainty *(Bootstrap analysis of 1986 tritium co-exposure model confidence bands and density plots)*

Confidence Bands for all CTWs, sub-CTWs, and DuPont CTWs



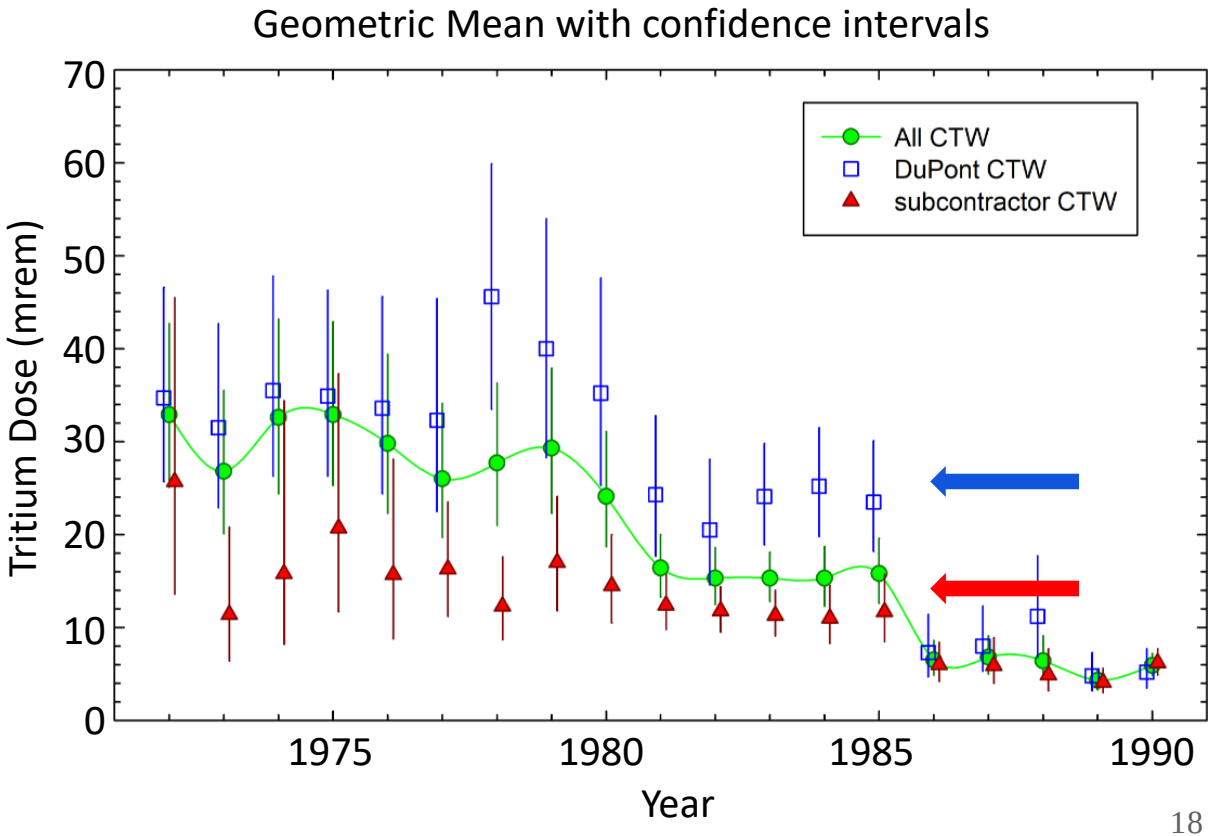
Density Plots of the 50th percentile



Uncertainty Analysis of Tritium Co-exposure Models

Subcontractor CTWs exposures were generally lower than DuPont CTWs between 1972 and 1990.

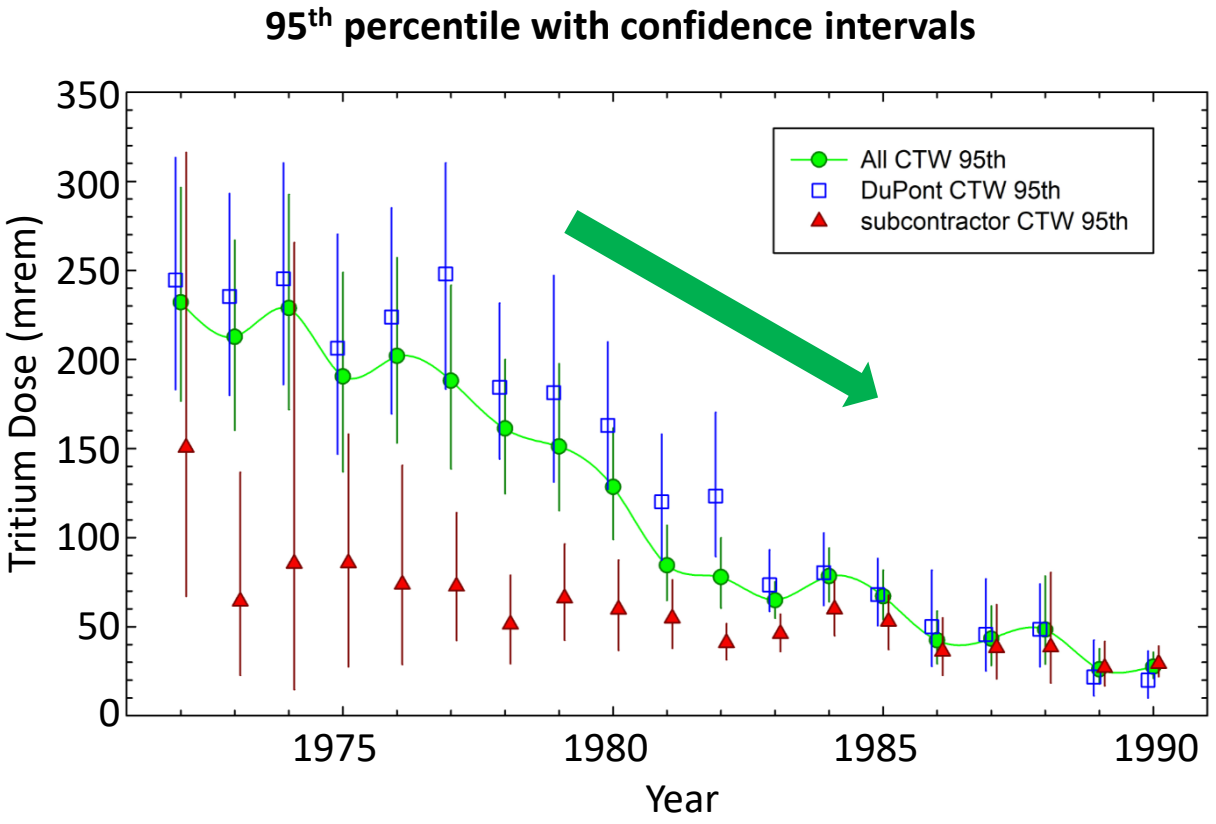
There is no practical difference between the two groups and the current combined CTW model.



Analysis of Uncertainty: Downward trend in tritium dose

Downward trend in tritium doses between 1972 and 1990.

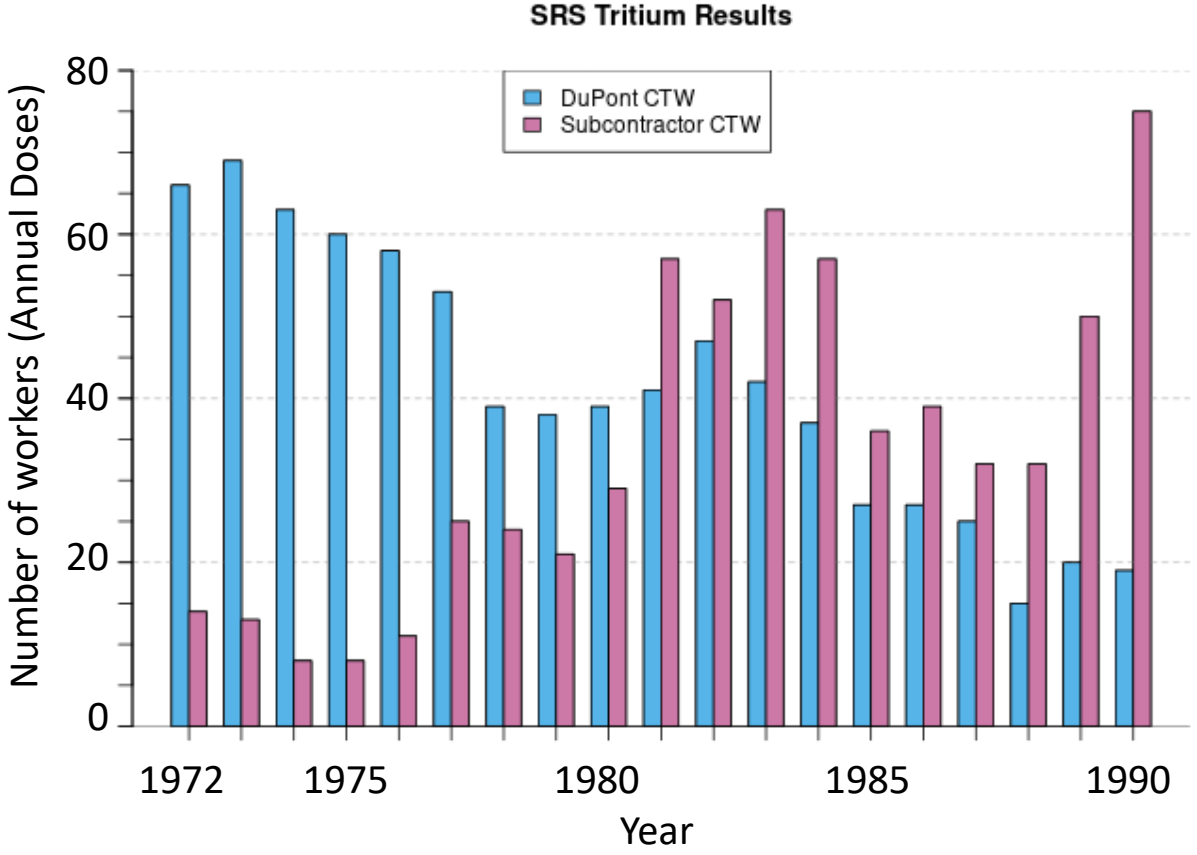
Typical of improved radiological controls and decreased exposure potential over time.



Analysis of Uncertainty: Representativeness

Smaller number of subCTWs than DuPont CTWs in the 1970s

Larger number of subCTWs than DuPont CTWs in the 1980s



NOCTS Percent subCTWs with dosimetry data and monitored for tritium exposures (adapted from Table 5-3)