

# **Evaluation of Available Survey Data for the Central Facilities Area at Idaho National Laboratory**

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**Contractor to:**

**Advisory Board on Radiation and Worker Health/ABRWH**

**Center For Disease Control and Prevention**

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# Introduction and Background

- At the July 8, 2015, INL WG Meeting, SC&A presented a status update on their evaluation of the INL SEC Petition Evaluation Report for SEC-00219, originally issued by NIOSH on March 14, 2015, and revised on July 21, 2015.
- SC&A recommended that the available survey data for the Central Facilities Area (CFA), both during operations and prior to demolition and dismantlement (D&D), be evaluated to determine the actinide to Sr-90 and actinide to Cs-137 ratios and compare these ratios to the values in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5.
- This presentation provides a summary of NIOSH's proposed methods for bounding operational period internal doses for the CFA, a review of the available survey data, and a comparison of the derived values to the values in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5.

# Proposed Methodology to Assess Actinide Intakes

- Section 7.2.5.2, SEC-00219 ER - describes NIOSH's methods for bounding operational period internal dose for CFA
- Potential missed intakes of uranium, thorium, and plutonium for CFA workers are of particular interest
- Proposed method uses mixed fission product (MFP) and mixed activation product (MAP) intakes determined from the beta-gamma bioassay data to assess actinide intakes using the actinide to Sr-90 and actinide to Cs-137 ratios and Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5

# Maximum Ratios from Tables 5-22 and 5-23

Radionuclide*	Actinide to Sr-90 Ratios (Table 5-22)	Actinide to Cs-137 Ratios (Table 5-23)
Ac-227	2.30E-10	2.10E-10
Th-228	2.30E-07	2.10E-07
Pa-231	3.80E-09	3.5E-09
U-234	1.40E-03	1.30E-03
Np-237	3.70E-06	3.5E-06
Pu-238	1.50E-02	1.40E-02
Am-241	1.40E-04	1.30E-04
Cm-244	4.90E-05	4.70E-05

\* The actinide isotopes listed are the predominant alpha-emitting actinides in the source term.

# CFA Survey Data

- Conducted a search of the SRDB for radiological surveys of the CFA facilities
- 1954–1956 Contamination Surveys of CFA-669 Hot Laundry and CFA-674A Chemical Engineering Lab (SRDB 139224)
- Post D&D soil sample results from excavation of the contaminated sanitary sewer line on the north side CFA-669 (SRDB 088224)

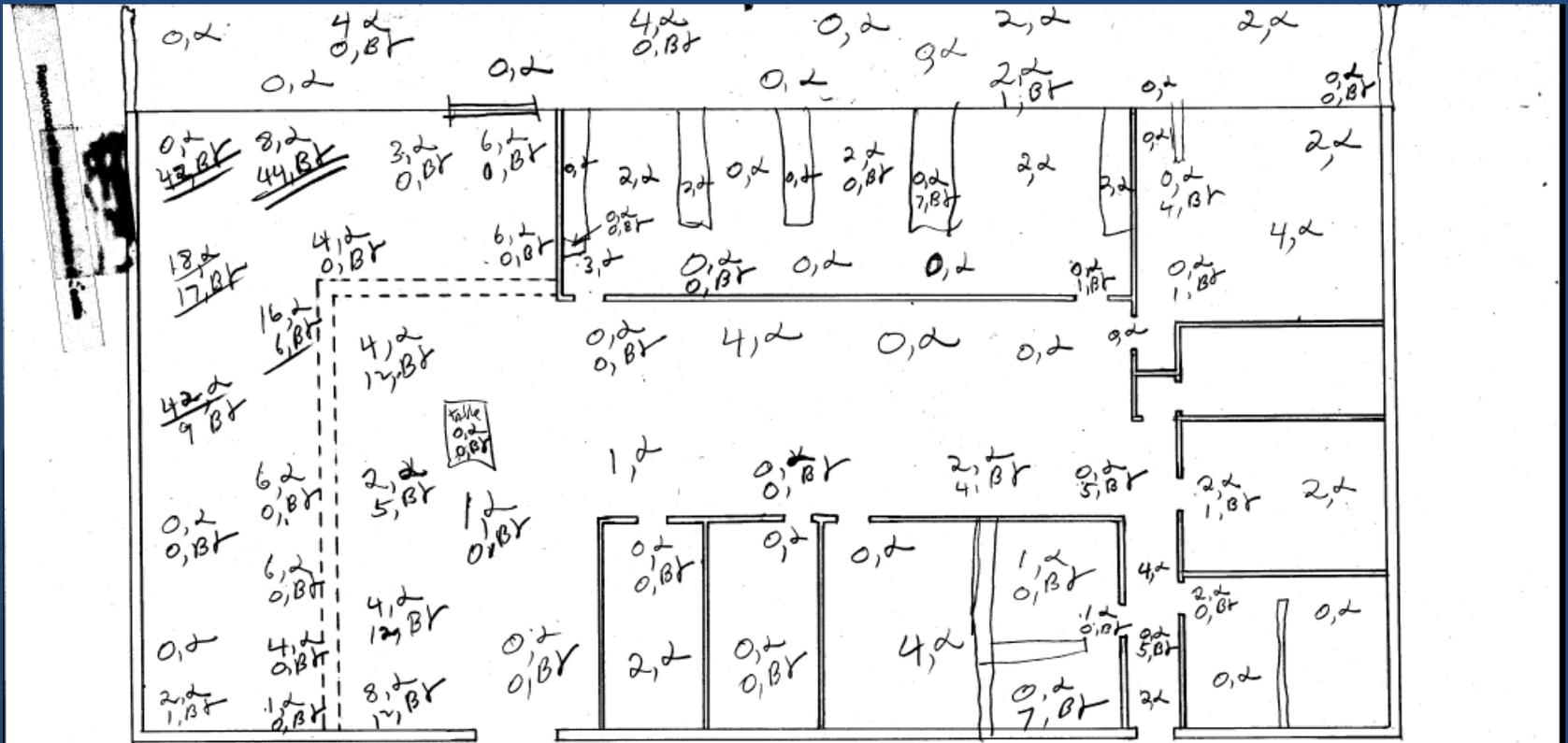
# Contamination Survey Data

- Only beta-gamma and alpha results greater than background levels (beta-gamma and alpha) at the same sample location were considered.
- Eighty-five contamination survey results were found that met our criteria (listed in Appendix A of report).
- Six smear results from April 12, 1954, are not consistent with the other results and may have the alpha and beta-gamma results transposed. They were not included in the analyses.
- Original survey results are given in units of cpm.

## Contamination Survey Data (continued)

- 1972 interoffice memo states smear counting equipment in use was acquired 1952–1958 (SRDB 143623)
- 1970 results datasheets show the “counter yield” for beta-gamma and alpha results as 0.08 and 0.27, respectively (SRDB 138318)
- Assuming the counting equipment used in 1970 is similar to the equipment used for the original surveys, SC&A applied the counter yield to original cpm results to obtain activity results in dpm/100 cm<sup>2</sup>

# Chemical Engineering Lab Survey



Chem. Eng. Lab.  
 Smeared By *G.A. Picard*  
 Date *6/20/52* Time *9m*  
 Sheet #

$\alpha = c/m$  at 50% G  
 $\beta \delta = \text{net } c/m$  at 10% G  
 $\beta K_{7d} \approx 30 \text{ } \mu\text{m}$



# D&D Soil Samples

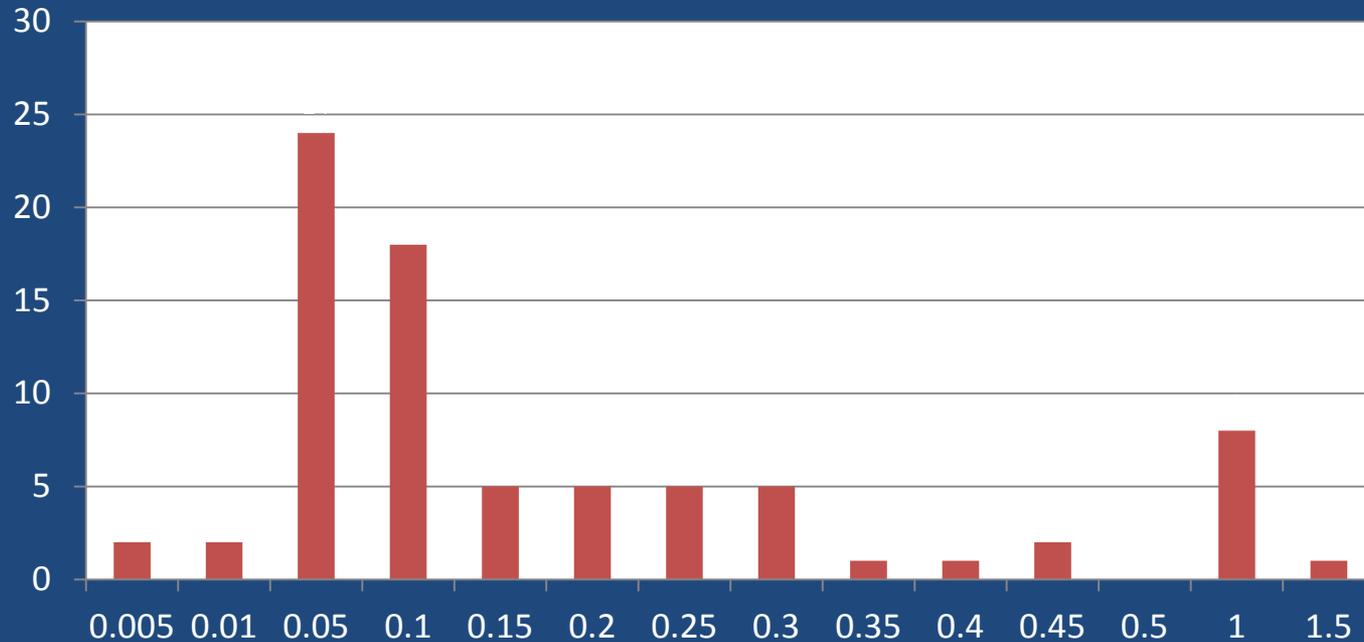
- 19 soil samples from the excavation of the contaminated sanitary sewer line on the north side CFA-669
- Analyzed for alpha and gamma spectrum and strontium-90
- The U-234 and Th-228 levels were not significantly different from environmental levels

# Comparison of Sr-90 and Cs-137 with Actinide Results

	Cm-244	Pu-238	Sr-90	Cs-137
Soil Sample Mean (pCi/g)	2.78E-02	3.83E-02	3.59E+00	5.41E-01
Actinide/Sr-90	7.72E-03	1.07E-02	N/A	N/A
Actinide/Cs-137	5.13E-02	7.09E-02	N/A	N/A

# Contamination Survey Results

Frequency Distribution of Alpha/Beta-Gamma Ratios



- 35% are between  $<5.0E-03$  and  $5.0E-02$ ; same order of magnitude as the maximum intake ratios for Pu-238 and U-234 from Tables 5-22 and 5-23.

# Soil Sample Results

## Comparison of Maximum Intake Ratio and Soil Sample Ratios

	SC&A		NIOSH		SC&A/NIOSH	
	Cm-244	Pu-238	Cm-244	Pu-238	Cm-244	Pu-238
Actinide/Sr-90 Ratio	7.72E-03	1.07E-02	4.90E-05	1.50E-02	1.58E+02	7.13E-01
Actinide/Cs-137 Ratio	5.13E-02	7.09E-02	4.70E-05	1.40E-02	1.09E+03	5.06E-01

- SC&A's Cm-244 values are 2 to 3 orders of magnitude higher than the NIOSH values.
- SC&A's Pu-238 values show relatively good agreement, within 50% of the NIOSH values.

# Summary

- Analyses of the smear data and soil sample results indicated general agreement in the magnitude of the maximum contamination ratios for U-234 and Pu-238 given in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5.
- There are several limitations in the data used:
  - The survey data found was very limited and from period of early operations.
  - The survey data is written given in units of cpm. Instrument parameters uncertain.
  - The soil samples were collected during D&D operations. Prefer characterization survey, prior to D&D.

**Comments and Questions?**