



Evaluation of INL Burial Ground/RWMC Post-1970 (SEC00219)

Timothy Taulbee

Mitch Findley

INL/ANL-W Work Group Teleconference Meeting | March 25, 2019

Overview

- Background
- Changes in Mission
- Waste Retrieval Projects
- Bioassay Monitoring
- Conclusion

Burial Ground Evaluation (March 2017)

- Will continue to evaluate Burial Ground exposures outside current SEC00219 evaluation period (post 1970)
- Why?
- Large scale drum retrieval operations in the later 1970s through present
- If needed we will pursue expanding the class under the 83.14 process.

Burial Ground Evaluation (1977)



INEEL 77-1262



INEEL 77-2632

Radioactive Waste Management Complex

- New facility name in 1970s due to multiple operations
- RWMC composed of:
 1. Subsurface Disposal Area (old Burial Ground): buried waste
 2. Transuranic Storage Area (TSA): “above” ground waste
 3. Administration and operations area
- RWMC gets its own dosimetry designation (Area 815) in 4Q 1975



SRDB 172427, page 54

TSA Pad in 1973

Burial Ground in 1970 (end of SEC00219 evaluation period)



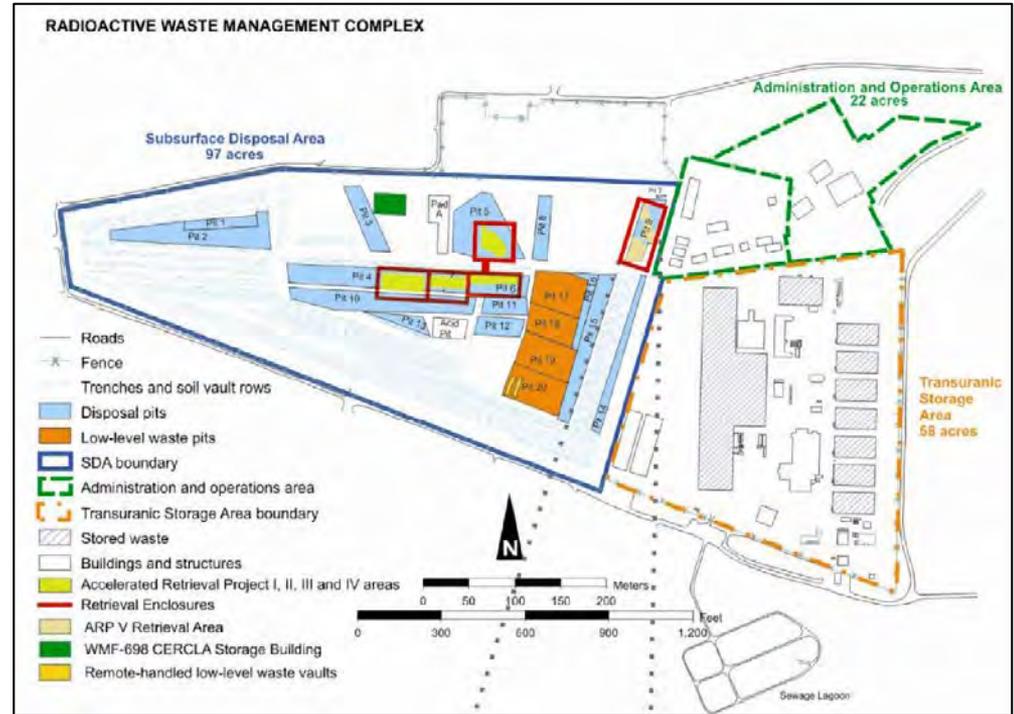
RWMC Buildings in 1976



RWMC 1995



RWMC Today



SRDB 167963, page 29

Waste Retrieval Projects

From 1970 through 1978 INL conducted three waste retrieval investigations within the Burial Ground/RWMC:

1. Solid Waste Retrieval Test (1971)
2. Initial Drum Retrieval (1974-1978)
3. Early Waste Retrieval (1976-1978)

Production scale retrieval programs: Long-term stored waste retrieval project (waste on TSA pads) and buried waste retrieval projects (still active today) initiated after the above waste retrieval projects.

I. Solid Waste Retrieval Test

In 1971, the AEC requested a series of solid waste retrieval tests on Rocky Flats waste buried in the SDA to gain insight into problems that may arise from a large-scale retrieval operation.

First phase: AEC requested retrieval of three specific drums that were suspected of containing excessive amounts of plutonium.

- One of the three specific drums was located.
- Several hundred drums moved looking for the specific drums.
- Collected soil samples to determine soil contamination concentrations. Most samples were < 10 pCi/g however some were as high as 6 nCi/g.

(SRDB# 150785, pg 41, 54)

Solid Waste Retrieval Test In-Ground Drums (1971)



I. Solid Waste Retrieval Test (cont.)

Second phase: Retrieval of multiple waste drums (16) for transport to the ARA-I Hot Cell for detailed sorting and sampling studies. All retrievals were focused on removing drums from:

Pit 2 (12 year old stacked waste)

Pit 5 (7 year old dumped waste)

Pits 10 & 11 (18 month old stacked waste).

Collected soil samples to determine soil contamination concentrations.

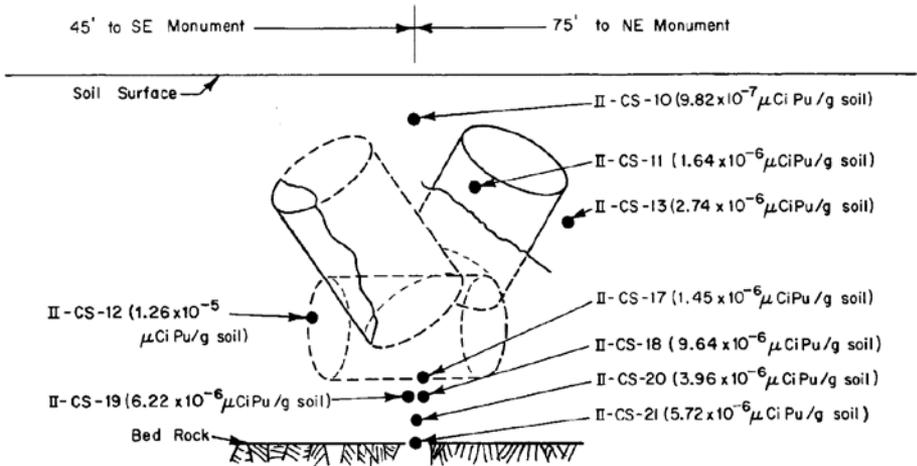


Fig. 24 Pit 5 excavation and sample location.

Solid Waste Retrieval Test Bagged Drums (1971)



Solid Waste Retrieval Test Monitoring

- Anti-C clothing (coveralls, shoe covers, and cotton gloves).
- Air samplers were utilized continuously with one sampler placed upwind and one downwind. The filters were changed daily and analyzed for gross alpha.
 - Only one excavation site (Pit 5) had airborne concentration of *“detectable significance.”* (SRDB# 150785, pg 51)
 - 6.75×10^{-12} uCi Pu/cc (3.375 DAC) over the 3.75 hours worked
 - Respirators worn by workers and *“whole body counts of principal workers at the site showed no detectable Pu uptake.”*
 - Only site where detectable contamination was found on shoe covers (500cpm).

Solid Waste Retrieval Test Monitoring

- Health Physics noted in the summary report the following:
 - *Eberline instruments (PAC-1S) were inadequate to measure contamination in the field. Smears counted in a scintillation crystal detector were required for detection of most of the contamination encountered. Half-face respirators were satisfactory in preventing worker inhalation of Pu. Whole-body counting using special detectors for Pu showed no detectable Pu intake for the main workers. (SRDB# 150785, pg 59)*
- Drums to ARA-I Hot Cell: highest smear outside drum was 100 cpm.
- Concluded that best approach was to use dedicated teams.

II. Initial Drum Retrieval Project

- IDR was designed and implemented to demonstrate safe retrieval, packaging, and transfer to interim storage of drums containing TRU waste buried from 1968 to 1970. All drums from Pits 11 and 12.
- 83-gal over-pack drums then changed to over-pack cargo containers that held 72 drums. This change reduced costs and improved productivity.
- 20,262 drums exhumed/retrieved



SRDB 172427, page 104

Cargo containers (white) on TSA Pad

Inside ASWS During IDR (1976)



Health Physics Monitoring on IDR (1976)



SRDB 172427, page 97



SRDB 172427, page 121 (enlarged)

Initial Drum Retrieval Monitoring

- ASWS erected over all retrieval areas
- Anti-C clothing (coveralls, shoe covers, and gloves). Carried half-faced respirators.
- Instrumentation included alpha and beta/gamma portable survey instruments, a portable gas-proportional counter, Stabilized Assay Meter (SAM-II), CAMs, and area radiation monitors.
- All workers included in initial RWMC bioassay measurements.

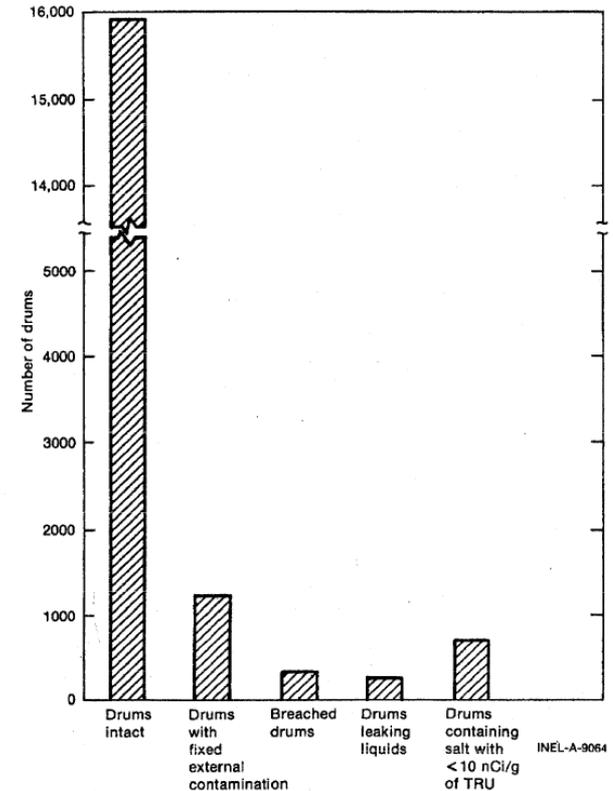


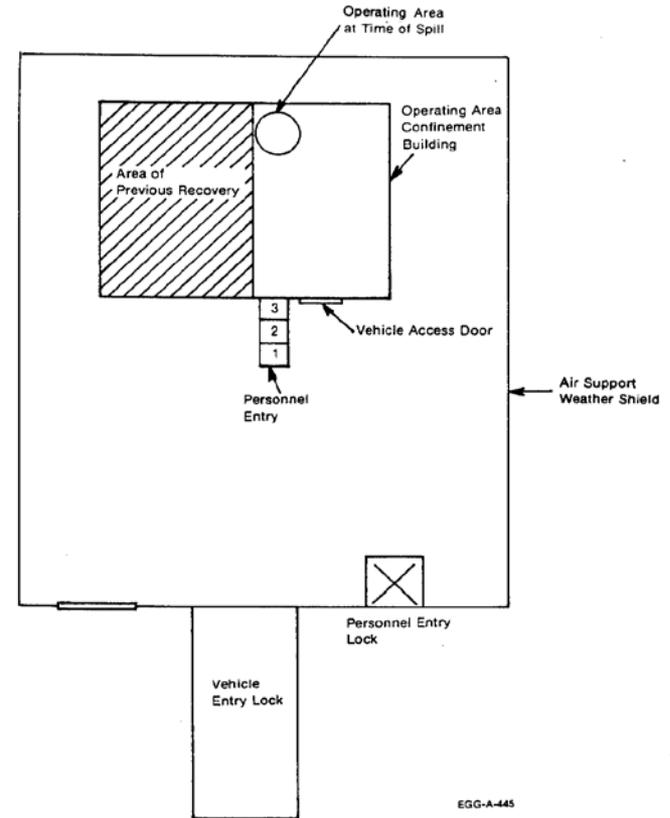
Fig. 4 IDR retrieval drum integrity summary.

III. Early Waste Retrieval Project

- Investigate problems associated with large scale removal of TRU waste from primarily Pits 1 and 2. Develop methods and equipment for safe retrieval of TRU waste, develop repackaging methods, and determine risks and hazards for long-term waste exhumation projects.
- Pit 2 was chosen because it was open during the 1962 flood and was expected to reflect the worst possible conditions for retrieval. 306 drums retrieved with 205 (67%) being severely breached.
- *“Although alpha-contamination levels greater than 2×10^6 cpm were frequently encountered, available equipment and established safety and operating procedures were effective in protecting personnel and the environment.”* (SRDB 144000, page iii)

EWR Layout

- Air Support Weather Shield (ASWS): inflated fabric building
- Operating Area Confinement (OAC): modular metal building within which actual waste retrieval was performed
- “three cell change booth system”
- 10 CAMs operated continuously
 - 6 inside OAC, 2 inside ASWS, 2 HEPA



Early Waste Retrieval Project (1977)



Backhoe Operation Inside OAC (1977)



Early Waste Retrieval Operation Inside OAC (1977)



Example of Waste Encountered on EWR Project (1977)



Movement of Operating Area Containment Building (1977)



EWR OAC Contamination Surveys

- The Operating Area Confinement (OAC) building was surveyed as conditions warranted and also when it was moved.

1-18-77 Finished surveys of bldg and items and moved everything out of OAC. Operation secured during move. Surveyed sticky step off PAD - no detectable BSA. Surveyed crew at end of day - OK.

SRDB 172320

- Per personnel interviews it would take weeks to move the OAC to a new excavation area due to the time required to perform adequate contamination surveys on the building and equipment:

Conducted 12 Worker Interviews

- 2 Heavy Equipment Operators (HEO)
- 1 Laborer
- 2 Health Physics Technicians
- 1 Health Physicist
- 3 Engineers
- 2 Managers
- 1 Scientist

Summary Of Interviews

- Consistent responses on questions on waste retrieval projects
- Small dedicated workforce
- Work performed with focus on safety
- PPE use and radiological monitoring modified based on anticipated hazards
- Continuous Health Physics coverage for any work activities at RWMC
- High reliance and confidence in Health Physics staff
- RWMC was actually a preferred facility to work

RWMC Bioassay Program Implementation

- 1977: “First round bioassay screening program” which lead to a second round eventually leading to a routine program.
 - Initial 16 of 59 analyses (9 workers) statistically positive at 3σ . INL concluded the results *“do not indicate any cause for alarm or need for further modification of the program. There are insufficient data to make meaningful assessments of dose or a judgement of the effectiveness of contamination controls.”* SRDB 160667, page 8-9
- 1978: 3 month “data gathering program” recommended based on initial low-level positive results. Sample all 18 RWMC workers: The 12 EWR/IDR workers were the top priority.

Bioassay Data for 18 RWMC Workers

- Results of “first round bioassay screening” (9 workers) *(SRDB 160667, page 8)*

	Pu-238		Pu-239		Am-241		
	Urine	Feces	Urine	Feces	Urine	Feces	Total
# Analysis	8	11	8	12	8	12	59
#>DL	1	3	0	5	1	6	16

- Highest urine result: 0.24 ± 0.06 dpm/sample (Am-241)
 - Highest fecal result: 6.22 ± 0.44 dpm/sample (Am-241)
- Fecal bioassay as high as 30 dpm (Pu239/240) from April 1978
(SRDB 160933, page 2)

Assumptions for Calculation of Intakes

- Highest activities detected via in-vitro bioassay was Am-241.
- Intakes calculated using Am-241 as indicator radionuclide with an 8:1 α Pu:Am-241 ratio per Table 5 of ORAUT-TKBS-0006-5 (actual ratio 7.62)
- Ratio of Pu-239/240 to Am-241 in highest activity fecal sample for largest intake was 7:1 which substantiates ratio assumption
- Assume chronic inhalation of Type S, 5 μm AMAD material from 1/1/1971 to 12/31/1980
- Five intakes calculated but the top two were clearly larger than the rest. Both were HPs during the drum retrieval projects.
 - Highest urine result: 0.24 ± 0.06 dpm/sample (Am-241)

Top Five Internal Doses

- Internal Doses for Type S 10-year old Weapons Grade Plutonium (WGPu) material vs. Type S 20-year old WGPu provided for comparison purposes
- Less than 100 mrem Total Effective Dose for all workers except top two.

Worker #1	10 yr WGPu (mrem)	20 yr WGPu (mrem)
1971-1980 Total Eff Dose	303	202
Equivalent Dose – Bone Surface	3414	2294
Equivalent Dose – Lung	1697	1138
Worker #2	10 yr WGPu (mrem)	20 yr WGPu (mrem)
1971-1980 Total Eff Dose	246	164
Equivalent Dose – Bone Surface	2776	1856
Equivalent Dose – Lung	1378	923
Worker #3	10 yr WGPu (mrem)	20 yr WGPu (mrem)
1971-1980 Total Eff Dose	32	22
Equivalent Dose – Bone Surface	360	242
Equivalent Dose – Lung	180	120
Worker #4	10 yr WGPu (mrem)	20 yr WGPu (mrem)
1971-1980 Total Eff Dose	28	19
Equivalent Dose – Bone Surface	313	210
Equivalent Dose – Lung	155	104
Worker #5	10 yr WGPu (mrem)	20 yr WGPu (mrem)
1971-1980 Total Eff Dose	24	16
Equivalent Dose – Bone Surface	272	183
Equivalent Dose - Lung	135	91

Summary

- Solid Waste Retrieval Tests (SWRT)
 - No bioassay but air monitoring indicating a few DAC in one area
 - Project conducted during current SEC class
 - All externally monitored workers (1970-1974)
- Initial Drum Retrieval (IDR) and Early Waste Retrieval (EWR)
 - Small dedicated workforce
 - Bioassay monitoring of workforce for (Pu, Am)
 - Low internal doses

Conclusion of RWMC 83.14 Determination Evaluation

- NIOSH does NOT plan to pursue an 83.14 evaluation for the Burial Ground/RWMC post-1970. This conclusion was drawn after exhaustive document review, bioassay data review, personnel interviews, and a review of photographic images which clearly demonstrate that the waste retrieval projects were performed with a heightened sense of awareness of internal exposure potential due to the nature of the work.
- With bioassay data available, we believe internal dose reconstruction is feasible.