MEETING NOTES

Waste Management Area A-AX HFFACO Appendix I Performance Assessment Workshop with Ecology on Initial Soil and Residual Inventory Assembly

MEETING DATE: February 28, 2017

LOCATION: Ecology Conference Room 3, Richland, WA

ATTENDEES:

Jim Alzheimer (Ecology)	Dib Goswami (Ecology)	Kristin Singleton (WRPS)
Marcel Bergeron (WRPS)	Bob Hiergesell (WRPS)	Maria Skorska (Ecology)
Jan Bovier (DOE-ORP)	Jeff Lyon (Ecology)	Cindy Tabor (WRPS)
Joe Caggiano (Ecology)	Sunil Mehta (INTERA)	Arun Wahi (INTERA)
Damon Delistraty (Ecology)	Alex Pappas (WRPS)	Jerry Yokel (Ecology)
Kathy Dunbar (WRPS)	Anna Radloff (WRPS)	Usama Zaher (INTERA)
Jim Field (WRPS)	Beth Rochette (Ecology)	

PURPOSE OF WORKSHOP: The purpose of the workshop was to provide WA Dept. of Ecology with a summary of the data and information assembled by the WMA A-AX PA project team to describe and estimate the soil and anticipated tank residual radionuclide inventories for the WMA A-AX Tank Farm and to describe the approach and strategy in making inventory calculations. A second purpose was to both inform and solicit feedback and comments from Ecology and accommodate any concerns at an early time. It is stressed that the radionuclide inventory estimates are preliminary and will likely be updated as more data become available and more refined estimates can be realized.

BACKGROUND INFORMATION: WRPS has initiated a project to conduct a Performance Assessment of the WMA A-AX Tank Farm in FY 2017. One of the first tasks of this investigation was to assemble the relevant information related to Tank leaks in WMA A-AX such that an initial estimate of radionuclides in the soil might be calculated. Additionally, the information needed to make an initial estimate of residual radionuclide activity expected to remain following tank retrieval was assembled and an initial estimate was calculated. The assembled data will be documented in two Data Package reports that will be issued later this FY. The Data Packages will be provided to Ecology for their review and comment prior to issuance.

Mr. Field (WRPS) presented both the soil and residual radionuclide inventory material. The PowerPoint slides from his presentation have been reviewed and approved for release. Copies of the slides are attached at the end of the meeting notes.

QUESTIONS AND DISCUSSIONS: The following questions and discussions occurred during and after the soil inventory presentations by Mr. Field.

Mr. Caggiano inquired about the status of non-RCRA wells that appear on maps of the WMA A-AX Tank Farm. WRPS responded that groundwater monitoring information was being investigated and that we would report back on the status of non-RCRA wells.

Mr. Goswami inquired about whether we will be looking for the presence of mobile contaminants as well as non-mobile ones. J.F. responded that we will look at mobile contaminants, as well, but that since the mobile constituents have escaped, the non-mobile ones will form the basis for estimating leaked

inventories. He asked when the laterals beneath A-105 were last measured. The answer was in 2005, and nothing was found at that time.

Mr. Lyon and Mr. Goswami inquired about what information might be available for A-105 during the period from 1968 to 1970 since there is a time gap in information. Mr. Wahi and Mr. Field answered that there isn't much information about that time period, but we are still investigating it.

There were questions about whether Cs-137 beneath the perimeter leaks of A-105. Mr. Field explained that the soil between the laterals and the base of the tank are assumed to be at full saturation at 4E+07 pCi/L. Cs-137 only detected at very low levels in the drywells close to A-105, suggesting it did not migrate laterally at the time of the steam event. Mr. Goswami asked whether liquid levels in A-105 were measured from '65-'68? Mr. Field mentioned that they were measured but they were erratic.

A question was asked as to whether there was any leaking of raw water lines nearby A-105. The answer was leaking between A-101 and A-105 of about 60K gal, and that there could have been chronic, low volume leaks that have not been detected or reported.

Mr. Caggiano asked if any soil samples been collected to evaluate whether fusion of silica particles in soils might have occurred (considering the elevated temperatures), suggesting that this could be a means to establish bounding temperatures that occurred during and after the steam event at A-105. Mr. Alzheimer added that if extremely high temperatures actually did occur, they might have driven contaminants downward.

Mr. Caggiano inquired about what the basis for determining the releases of chemicals at the time of the A-105 event was and what chemicals were they? Mr. Field stated that it was mostly NO_3 that was released (and some Cr). He added that all released chemicals will be reported.

There was discussion of the nature of the residuals (sludge) in A-105. Mr. Field mentioned there were 37 Kgals with much of it below the bulged base liner. Mr. Caggiano asked if this will be retrieved or not and the response was that it remains to be determined if it can/will/should be retrieved.

The following questions and discussion occurred during and after the second presentation on the A-AX tank residuals by Mr. Field.

Mr. Field indicated that it is estimated that 37K gal. of waste remain within A-105. Mr. Caggiano asked how much how much of that is below the liner and whether an effort would be made to retrieve from below the liner. Mr. Field responded that that is yet to be decided.

Ms. Skorska asked for an explanation of the templates that are used to establish tank residuals. Mr. Field stated that they are a means to estimate A-AX tank residuals based on tank residuals in other WMAs. They do not estimate volumes, however. Mr. Goswami asked if they are based on process knowledge isn't the uncertainty higher? Mr. Field responded that it was, but not necessarily so in all cases.

Ms. Skorska requested clarification on the uncertainties of estimating residuals in A-105. Mr. Field responded that the same rules for estimation apply to A-105 as other tanks, some residual is under the bulge, though, and there is (or will be) uncertainty in the analytical data. A question was asked about the uniformity of compositions of the residual sludge. Mr. Field indicated that there is uncertainty there but that the uncertainty of what is in the tank when few samples are available is more of a concern.

Mr. Lyon stated that he expects WRPS will eventually need to talk to us about A-105 retrieval and its anticipated retrieved inventory. He expressed the opinion that 360 gal is not a reasonable estimate and inquired about what will be done to evaluate what the final residuals will be. He further indicated that there should be some "lessons learned" from WMA C to draw upon in. Ms. Skorska asked if a "no retrieval" case will be evaluated, adding that such a case will have uncertainty associated with it, as well. The response was that it would be fully evaluated.

Ms. Skorska further inquired whether we need to retrieve to as low as 360 gal in the other tanks. Mr. Bergeron responded that we expect to look at a range of cases as we evaluate each of the WMA A-AX tanks. Mr. Lyon requested that we provide a list of tanks and what we think are reasonable assumptions for each one. Mr. Alzheimer commented that he expects that what we will learn from our analysis is that we can probably ignore the other 9 tanks (other than A-105) in WMA A-AX.

Mr. Wahi inquired of Ecology what the basis for determining a final volume for a retrieved tank might be. Mr. Lyon responded that WRPS should come up with an estimate, although Ecology has some thoughts.

Mr. Lyon inquired as to when the first estimates of the tank residual inventories and added that Ecology would like another meeting before we proceed with analyses of the residual sources for each tank in WMA A-AX. Mr. Field responded that we don't have a technical basis yet but that such a basis will be developed.

Mr. Alzheimer commented that a focus should be how much should be, or can be retrieved.

Mr. Lyon. inquired about how inventories associated with ancillary equipment and surrounding facilities will be evaluated. Mr. Field responded that ancillary equipment starts inside the fence lines, half of the connecting pipe lengths to connected facilities are included.

The meeting was concluded at this point.

EXPECTATIONS, AGREEMENTS, AND ACTIONS: Refer to the tables below.

NEXT MEETING: The next Workshop meeting was tentatively set for the afternoon of March 22, 2017.

Jan B Bovier	Jan B Bovier	6/6/2017
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J. Lyon		6/7/2017
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

DATE	AGREEMENTS
2/28/2016	A second workshop is planned in the late March timeframe to present information on the WMA A-AX Engineered System, including the tank farm infrastructure and history, infiltration and recharge associated with tank source term releases. WRPS is looking to establish dates for this workshop. The preparation of material for Workshops 1 and 2 is underway. Data packages describing the information presented in both workshops will be made available for Ecology to review following the Workshops.

ACTIONS			
Action Number	**Actionee**	**Description**	**Status**
2016-10-25-1	Marcel Bergeron/Bob Hiergesell	Define the purpose of the WMA A/AX PA in a short white paper. In this paper, describe how the PA will assist closure, etc. If possible, articulate this in a 1-page summary.	Completed
2016-10-25-2	Marcel Bergeron	Define what the DQO RFI process is for the WMA A/AX PA	Completed
2016-10-25-3	Marcel Bergeron/Bob Hiergesell	Make a plan for scheduled meetings for the remainder of the FY.	Completed

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Inventory Estimates for Waste Released to the Soil in WMA A-AX

Publish to OSTI? ☐ Yes ☑ No

Information Category:
☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☑ Visual Aid ☐ Software
☐ Full Paper ☐ Report ☐ Other

Trademark/Copyright "Right to Use" Information or Permission Documentation	Yes	NA
	☐	☑

Document Number: TOC-PRES-17-0217 -VA Revision 0 Date: February 2017

Author: Field, Jim G

Part II: External/Public Presentation Information

Conference Name: WMA A-AX Performance Assessment Workshop

Sponsoring Organization(s): ORP

Date of Conference: January 2017 Conference Location: Richland, WA

Will Material be Handed Out? ☐ Yes ☑ No Will Information be Published? ☐ Yes ☑ No *(If Yes, attach copy of Conference format instructions/guidance.)*

Part III: WRPS Document Originator Checklist

Description	*Yes*	*N/A*	*Print/Sign/Date*
Information Product meets requirements in TFC-BSM-AD-C-01?	☐	☑	
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	☐	☑	
If product contains pictures, safety review completed?	☐	☑	

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	02/23/2017	Field, Jim G IDMS Data File att.
Responsible Manager	WRPS	01/23/2017	Rutland, Paul L IDMS Data File att.
Other:			

Part V: IRM Clearance Services Review

Description	*Yes*	*No*	*Print Name/Signature*
Document Contains Classified Information?	☐	☒	If Answer is "Yes," ADC Approval Required Print Name/Signature/Date
Document Contains Information Restricted by DOE Operational Security Guidelines?	☐	☒	Reviewer Signature: Print Name/Signature/Date
Document is Subject to Release Restrictions? *If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:*	☐	☒	Document contains: ☐ Applied Technology ☐ Protected CRADA ☐ Personal/Private ☐ Export Controlled ☐ Proprietary ☐ Procurement – Sensitive ☐ Patentable Info. ☐ OUO ☐ Predecisional Info. ☐ UCNI ☐ Restricted by Operational Security Guidelines ☐ Other (Specify)
Additional Comments from Information Clearance Specialist Review?	☐	☒	Information Clearance Specialist Approval APPROVED By Janis Aardal at 3:59 pm, Feb 23, 2017 Print Name/Signature/Date

When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part VI: Final Review and Approvals

Description	*Approved for Release*		*Print Name/Signature*	
	Yes	*N/A*		
WRPS External Affairs	☒	☐	IDMS Data File att.	McKenna, Mark
WRPS Office of Chief Counsel	☒	☐	IDMS Data File att.	Page, Brad
DOE – ORP Public Affairs/Communications	☒	☐	IDMS Data File att.	Marshall, Richard
Other: ORP SME	☒	☐	IDMS Data File att.	Bovier, Jan
Other: DOE OCC	☒	☐	IDMS Data File att.	Zelen, Benjamin

Comments Required for WRPS-Indicate Purpose of Document:

Presentation for WMA A-X Performance Assessment workshop. Presents RPP-RPT-58291

APPROVED
By Janis Aardal at 3:59 pm, Feb 23, 2017

Approved for Public Release; Further Dissemination Unlimited

Information Release Station

Was/Is Information Product Approved for Release? ☒ Yes ☐ No

If Yes, what is the Level of Releaser? ☑ Public/Unrestricted ☐ Other (Specify) _____

Date Information Product Stamped/Marked for Release: 02/23/2017

Was/Is Information Product Transferred to OSTI? ☐ Yes ☒ No

Forward Copies of Completed Form to WRPS Originator

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TOC-PRES-17-0217 -VA
Revision 0

Inventory Estimates for Waste Released to the Soil in WMA A-AX

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

washingtonriver protectionsolutions

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Inventory Estimates for Waste Released to the Soil in WMA A-AX

J. G. Field
Washington River Protection Solutions

Date Published
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ORP
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Published in
NA

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Assistant Secretary for Environmental Management

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Office of River Protection under Contract DE-AC27-08RV14800

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APPROVED
By Janis Aardal at 4:00 pm, Feb 23, 2017

Release Approval Date

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Inventory Estimates for Waste Released to the Soil in WMA A-AX

Jim Field

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Soil and Residual Inventory Working Session
January 18, 2017

Topics of Discussion

- Purpose and Scope
- Site Description
- Past Releases
  - Process to Estimate
  - A-Farm Releases
  - AX-Farm releases
- Discharges to surrounding facilities
- Inventory Summary
- Uncertainties

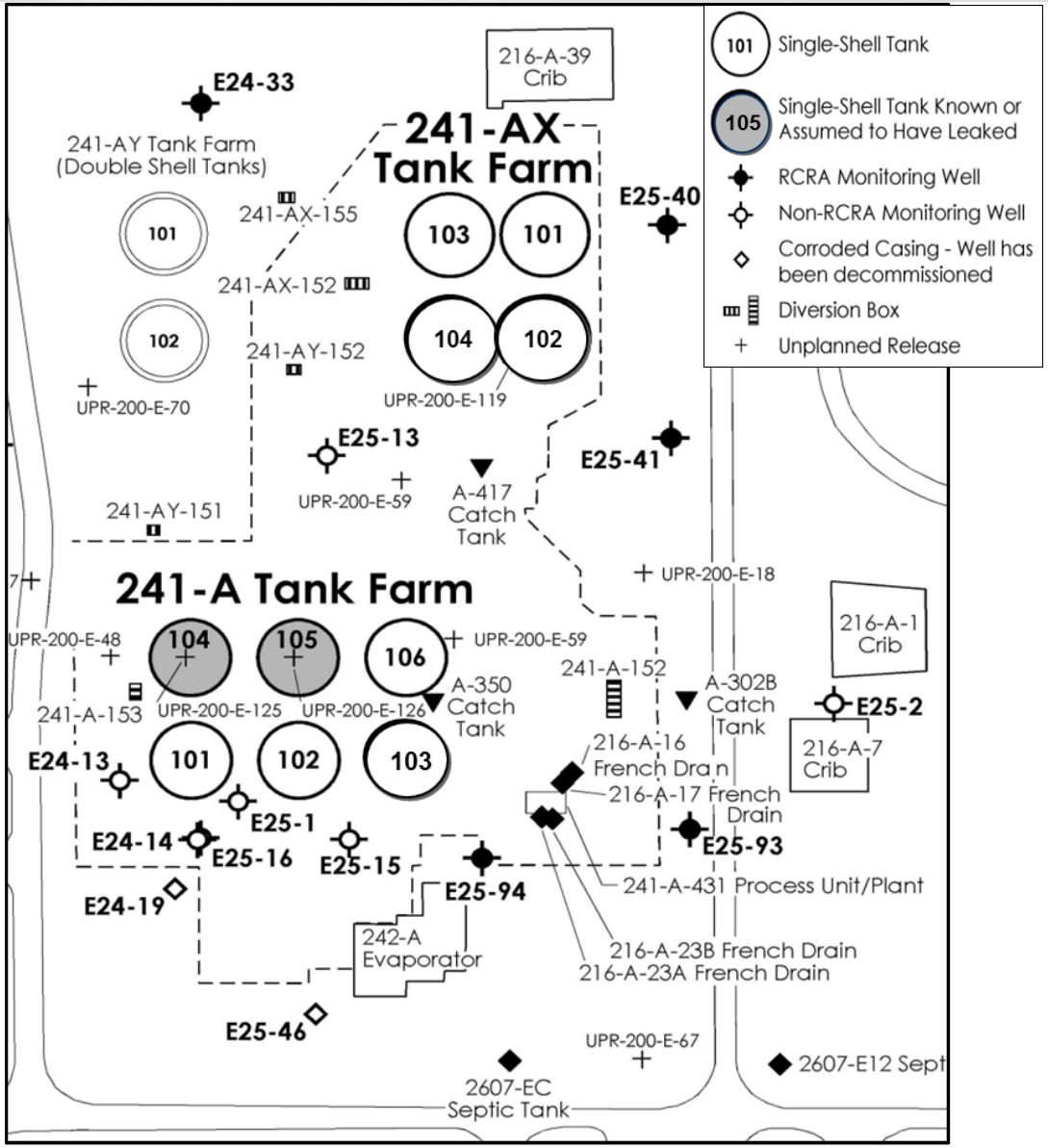
Purpose and Scope

- **Purpose**
  - Provide Soil inventory estimates for WMA A-AX Performance Assessment.
- **Scope**
  - Past leaks and releases to the vadose zone
    - RPP-RPT-58291, Hanford WMA A-AX *Soil Contamination Inventory Estimates*.
    - RPP-RPT-37956, *Hanford 241-A and 241-AX Tank Farms Leak Inventory Assessments Report.*
- **Not in Scope**
  - Extent of contaminants released (ie. distribution and migration)
  - Conceptual models
  - Modeling parameters
  - Constituents of concern for modeling

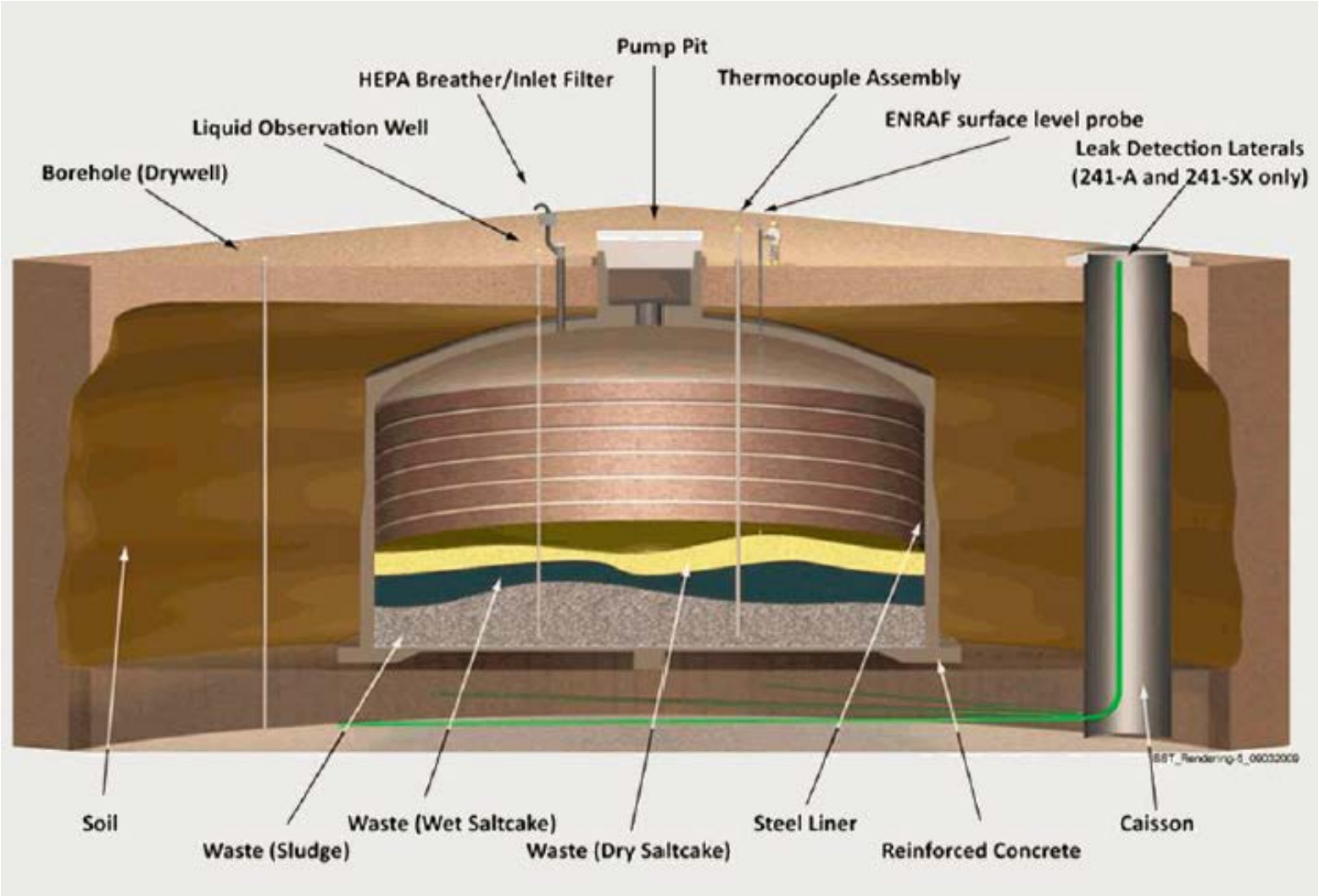
Waste Management Area A-AX

Summary Description of WMA A-AX

- 241-A (A) Tank Farm contains six 1,000,000-gal capacity Single Shell Tanks (SSTs)
- 241-AX (AX) Tank Farm contains four 1,000,000-gal capacity SSTs
- 75 ft diameter tanks, flat bottom tanks
- The WMA includes catch tanks, diversion box, pipelines, drains and unplanned release sites
- Losses of waste from tanks and equipment have contaminated the soil

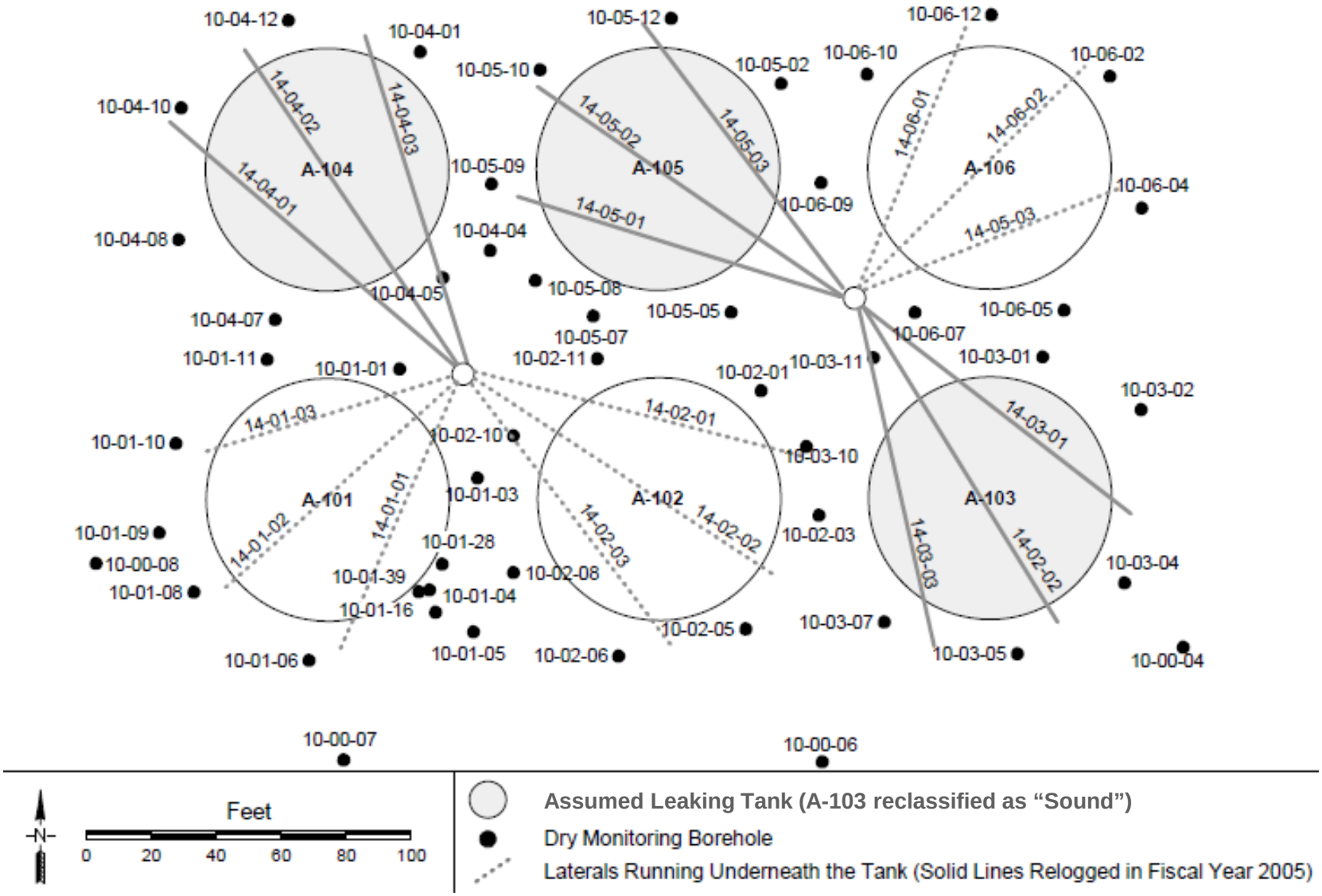


Leak Detection Monitoring Systems: A Farm Schematic



Source: HNF-EP-1082

Leak Detection Monitoring Systems: A Farm



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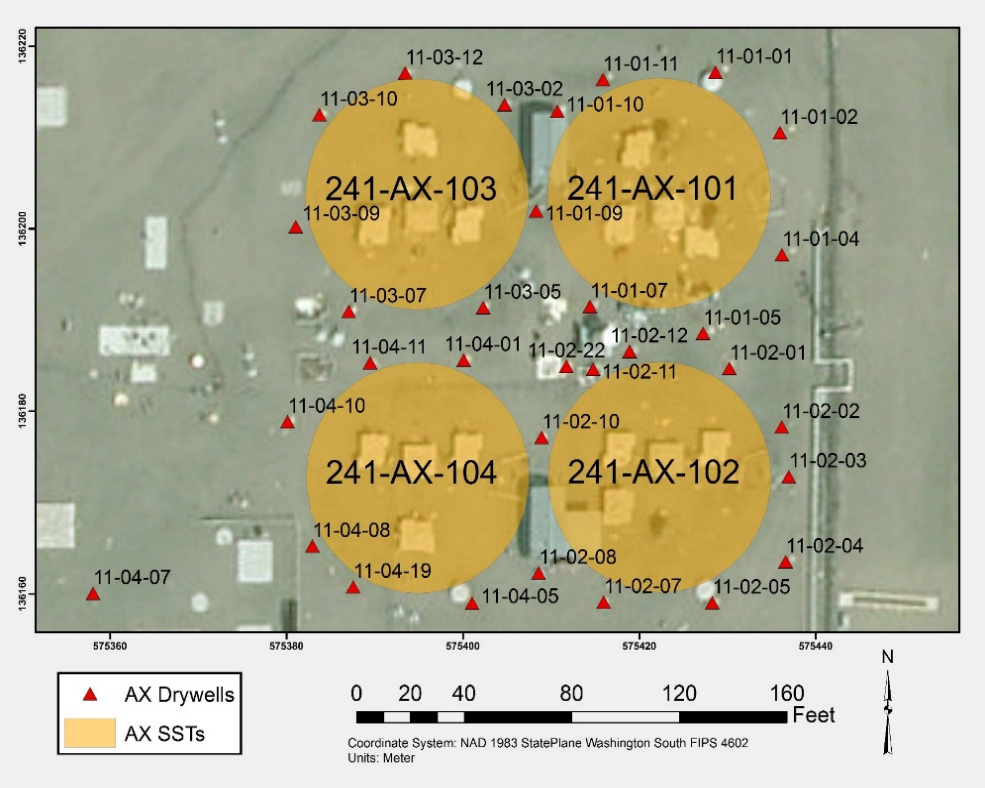
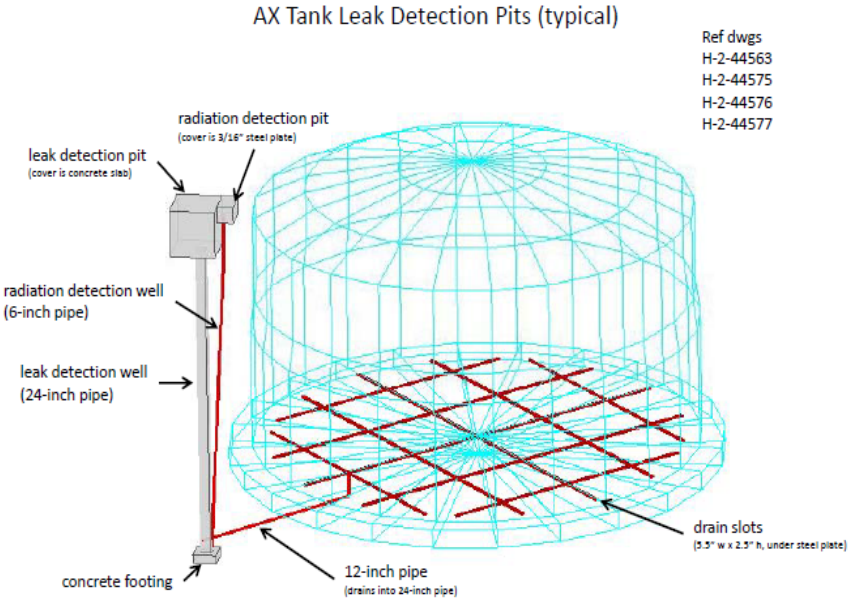
Leak Detection Monitoring Systems: AX Farm

DRYWELLS



LEAK DETECTION PITS



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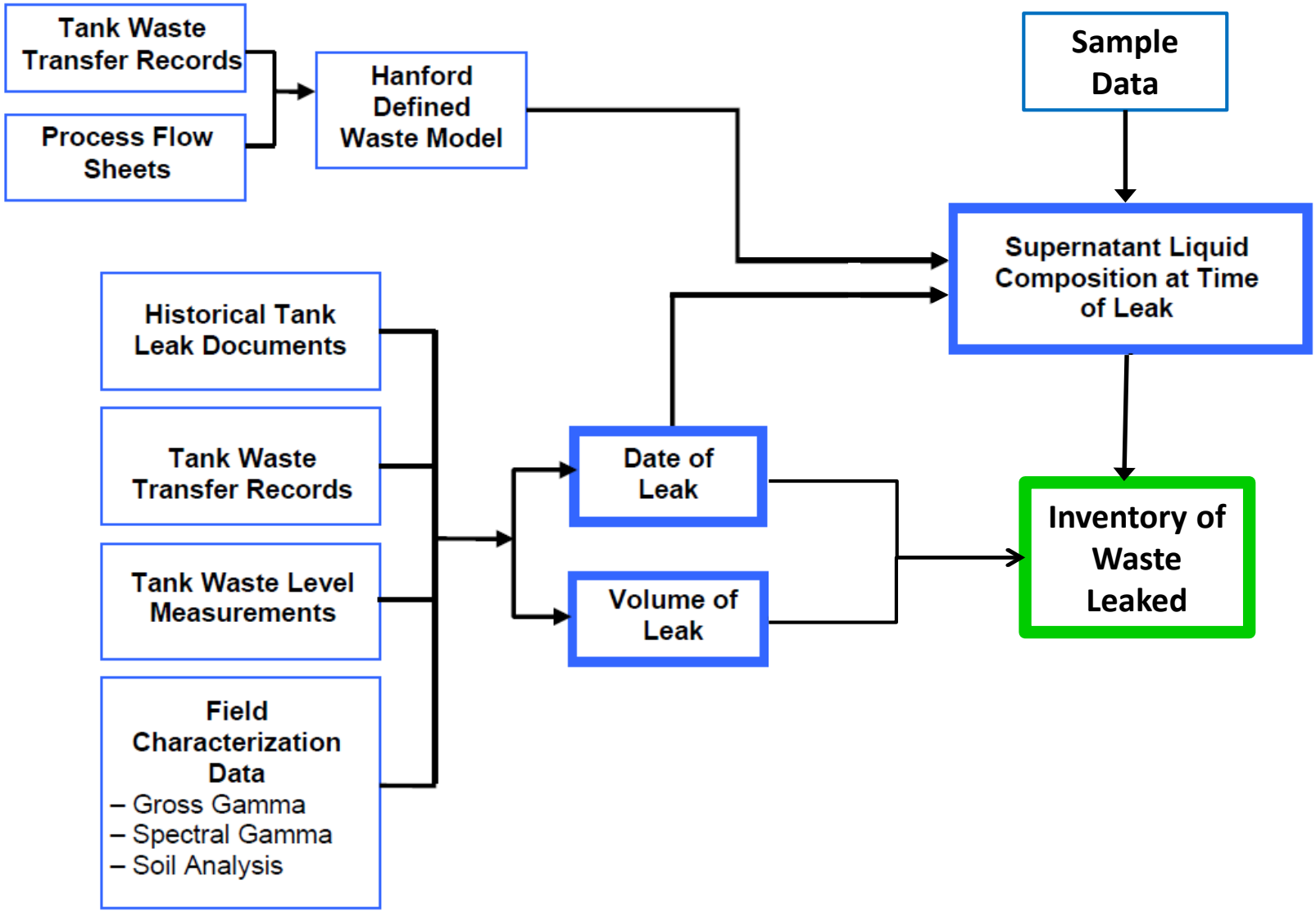
Waste Types Received by A and AX Tanks

Year	A-101	A-102	A-103	A-104	A-105	A-106	AX-101	AX-102	AX-103	AX-104
1956	P OWW	OWW P	P OWW							
1957						P OWW				
1958				P OWW						
1959										
1960										
1961										
1962					P					
1963										
1964			Sluiced							
1965			OWW				P OWW FP	P	OWW	P
1966			Sluiced							
1967										
1968			CSR		Sluiced CSR				SRR B	
1969	Sluiced			Sluiced				B		
1970	P			Water		Sluiced			P	
1971					Water	P				
1972				AR/CSR/ SRR					SRR	
1973	SRR	Sluiced							PSS AR	PSS
1974		AR/SRR/ B	Sluiced			AR/B		Sluiced		
1975	Sluiced		AR/PSS	Sluiced						
1976	A-SltCk	Sluiced	Sluiced			Sluiced	Sluiced		Sluiced	
1977		A-SltCk	A-SltCk			A-SltkCk	A-SltCk		A1-SltCk	Sluiced
1978								A-SltkCk		
1979										
1980										
1981										

AR = Water washed Plutonium Uranium Extraction (PUREX) sludge
B = 221-B Plant high-activity waste
CSR = B-Plant Cesium Recovery ion exchange waste
FP = Fission product waste

OWW = Organic Wash Waste from PUREX Plant
P = PUREX high-level waste
PSS = PUREX Sludge Supernate
A-SltCk = Saltcake from the 242-A Evaporator
SRR = Strontium Recovery Waste

Process to Estimate Inventory of Past Releases

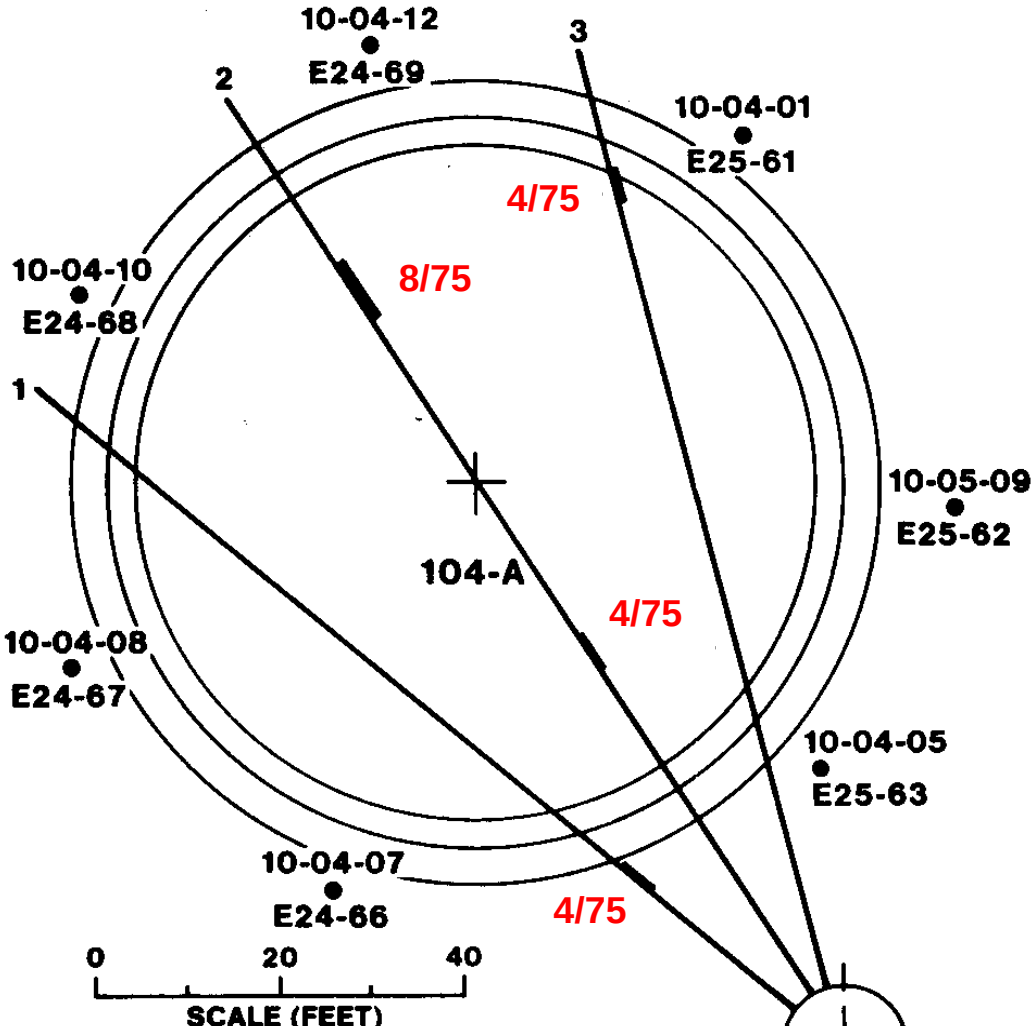


Past Releases in WMA A-AX

- **Tank Leaks/Releases**
  - A-104
  - A-105
  - AX-101 (near surface)
  - Integrity status changed to sound for:
    - Tank A-103: liquid level decreases due to gas releases
    - Tanks AX-101 and AX-102:
      - Dry well activity not likely from a tank leak.
      - No evidence of leak in leak detection pits.
      - Very low gamma activity, no inventory estimated.
- **Other Waste Releases**
  - 241-A-01B Sluice Pit
  - 241-A and AX farm surface releases
  - Other documented releases, but no basis to quantify.
- **Releases to Discharge Facilities**

241-A-104 Tank Leak

- Increased radioactivity detected in laterals April 1975.
- No reported liquid level decreases.
- High heat tank, up to 427 F (Feb 1963)
- In 1975 tank contained PUREX supernatant (P1); 1.2 Ci/gal of ^{137}Cs in 1975.
- Leak volume appears to be small (~2000 gal) based on no measured liquid level decrease and low activity in laterals.

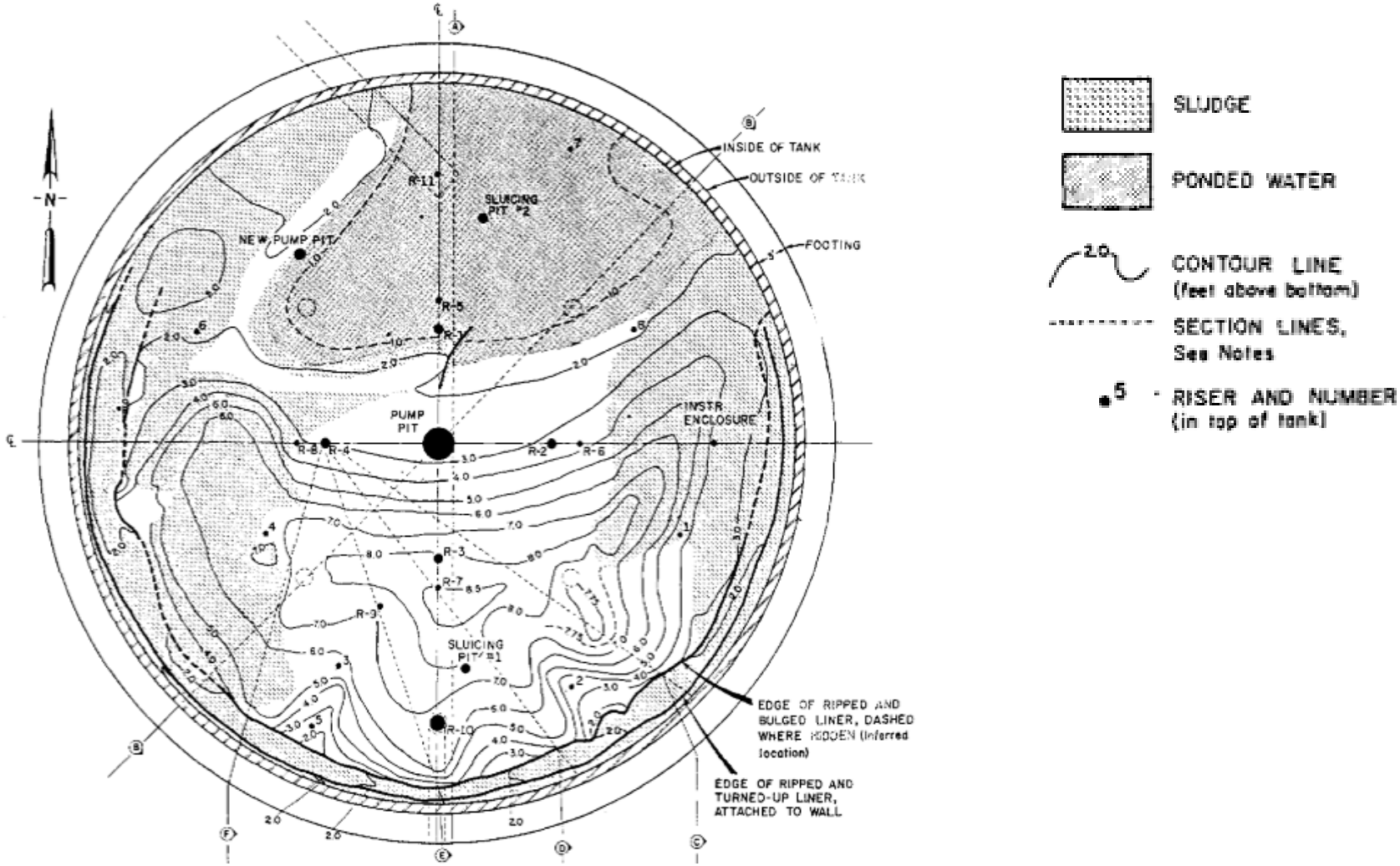


241-A-105 Tank Leak

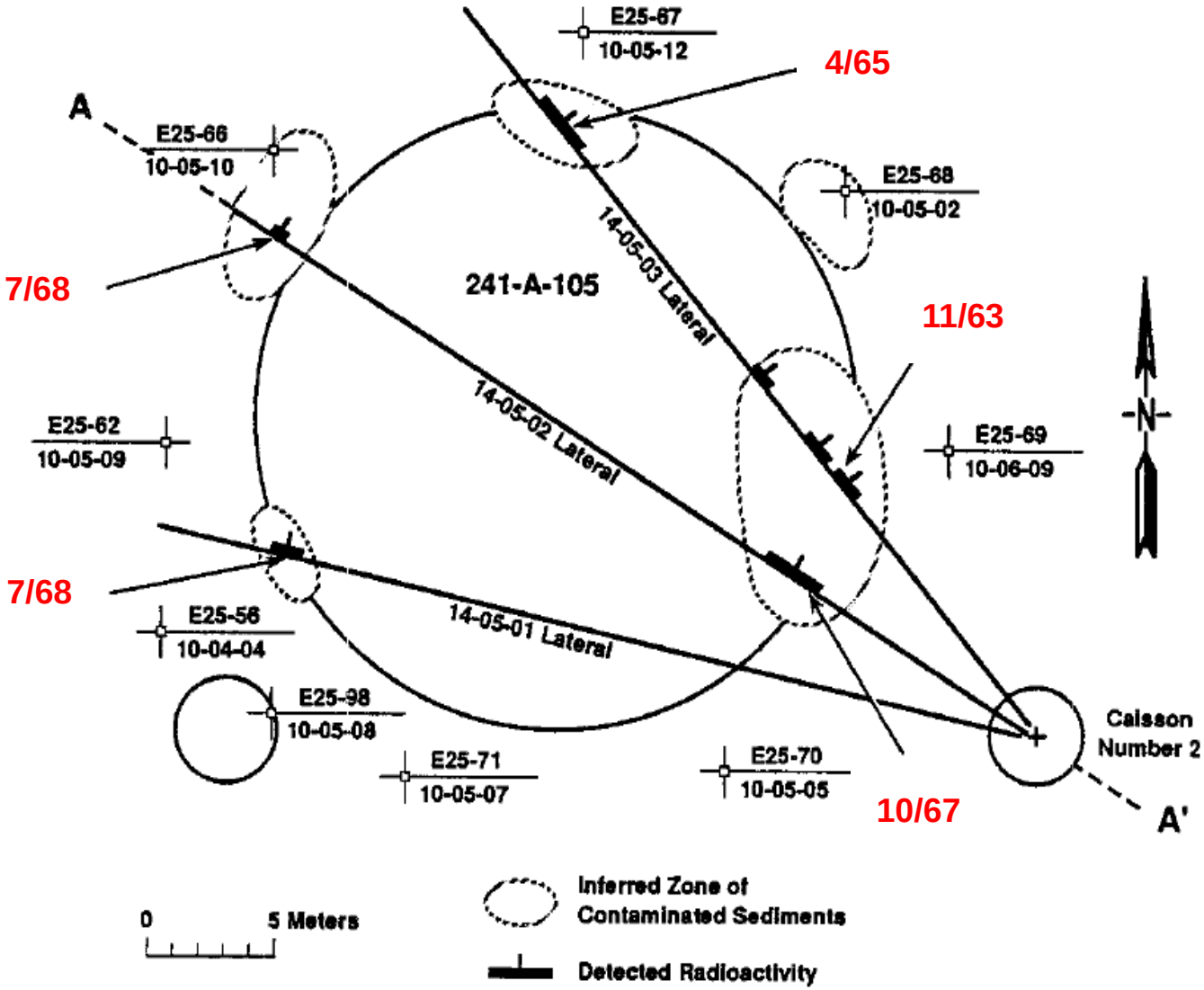
- Increased radioactivity detected in laterals in 1963
- Steam event occurred Jan. 8, 1965.
  - ½ hour steam event.
  - At the time A-105 was filled with PUREX High level waste.
  - Steel liner bulged upward 8.5 ft.
  - ¾ of bottom liner circumference ripped.
  - ~15 kgal of waste below the liner.
- Tank was kept full until it was sluiced from 1968 to 1970 using CSR supernatant.
- 610 kgal cooling water added between 1970 and 1978.
- Laterals indicate multiple leak events.

241-A-105 Tank Leak

WCC Project 1397A-0300



241-A-105 Tank Leak



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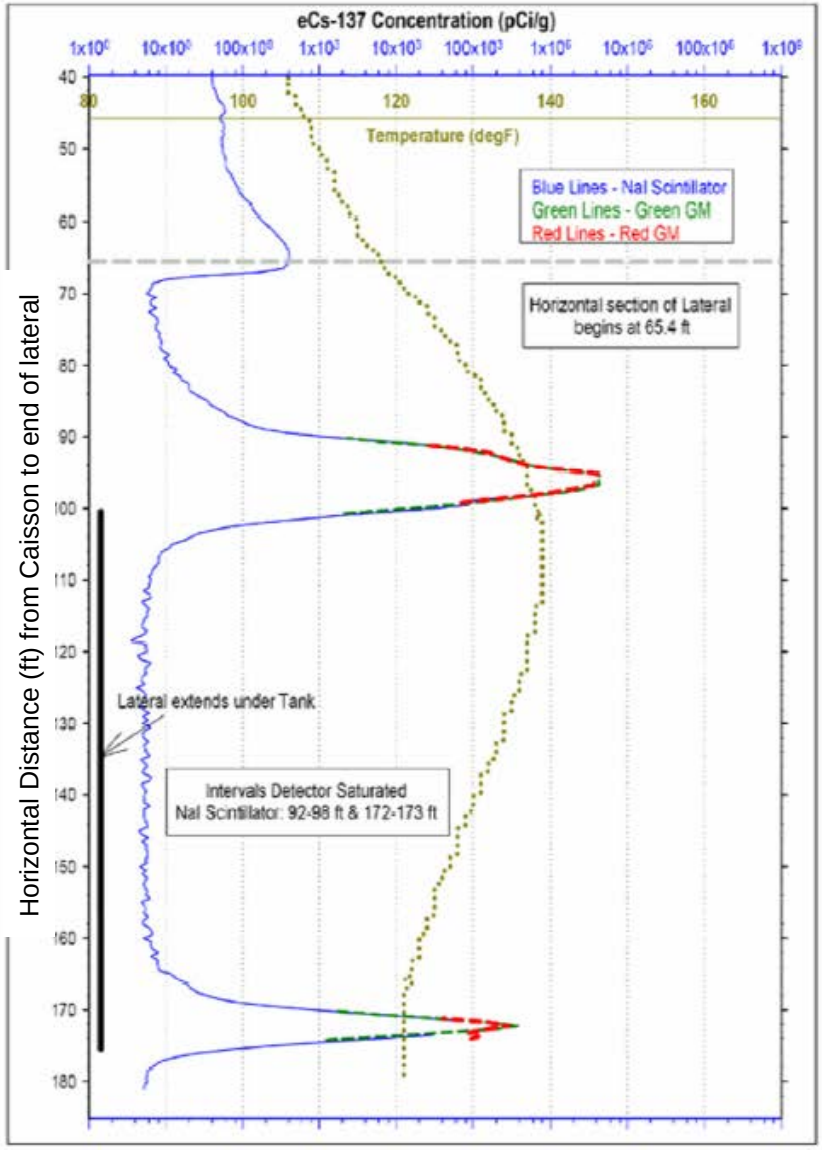
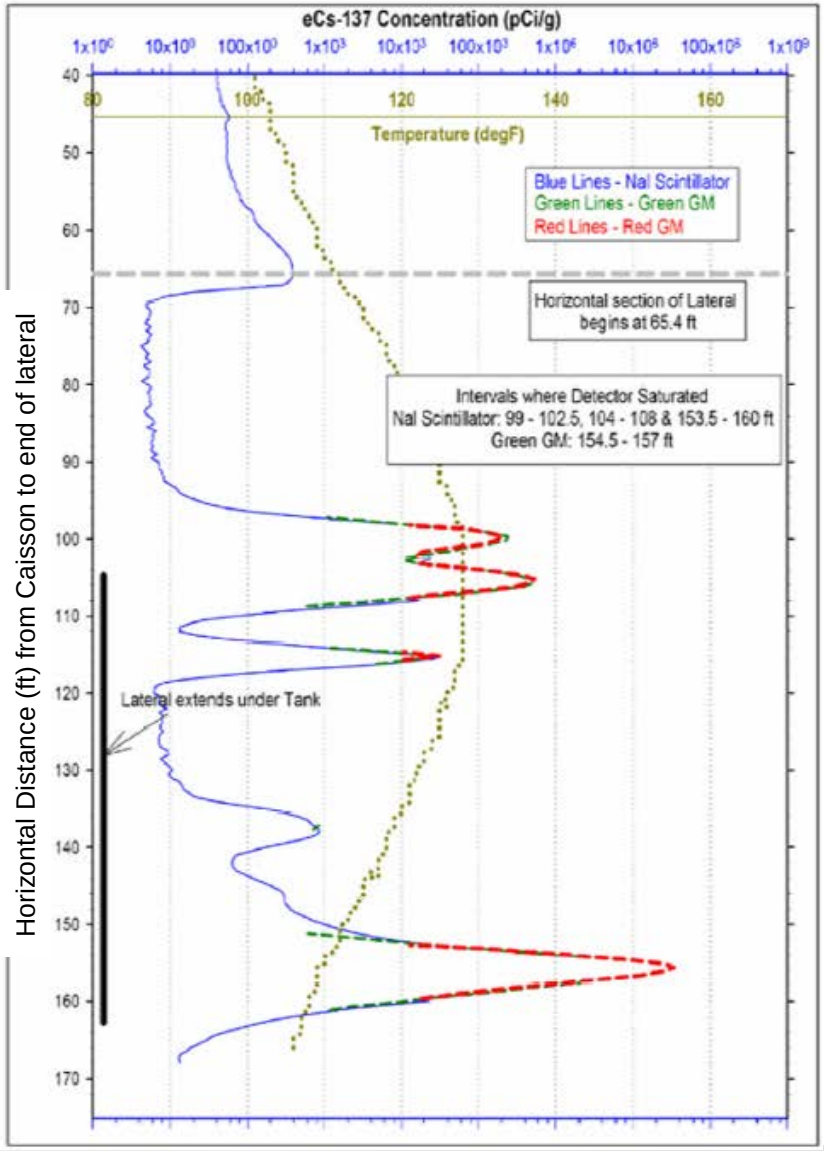
A-105 Lateral Results (2005)

Lateral 14-05-02L



Lateral 14-05-03L



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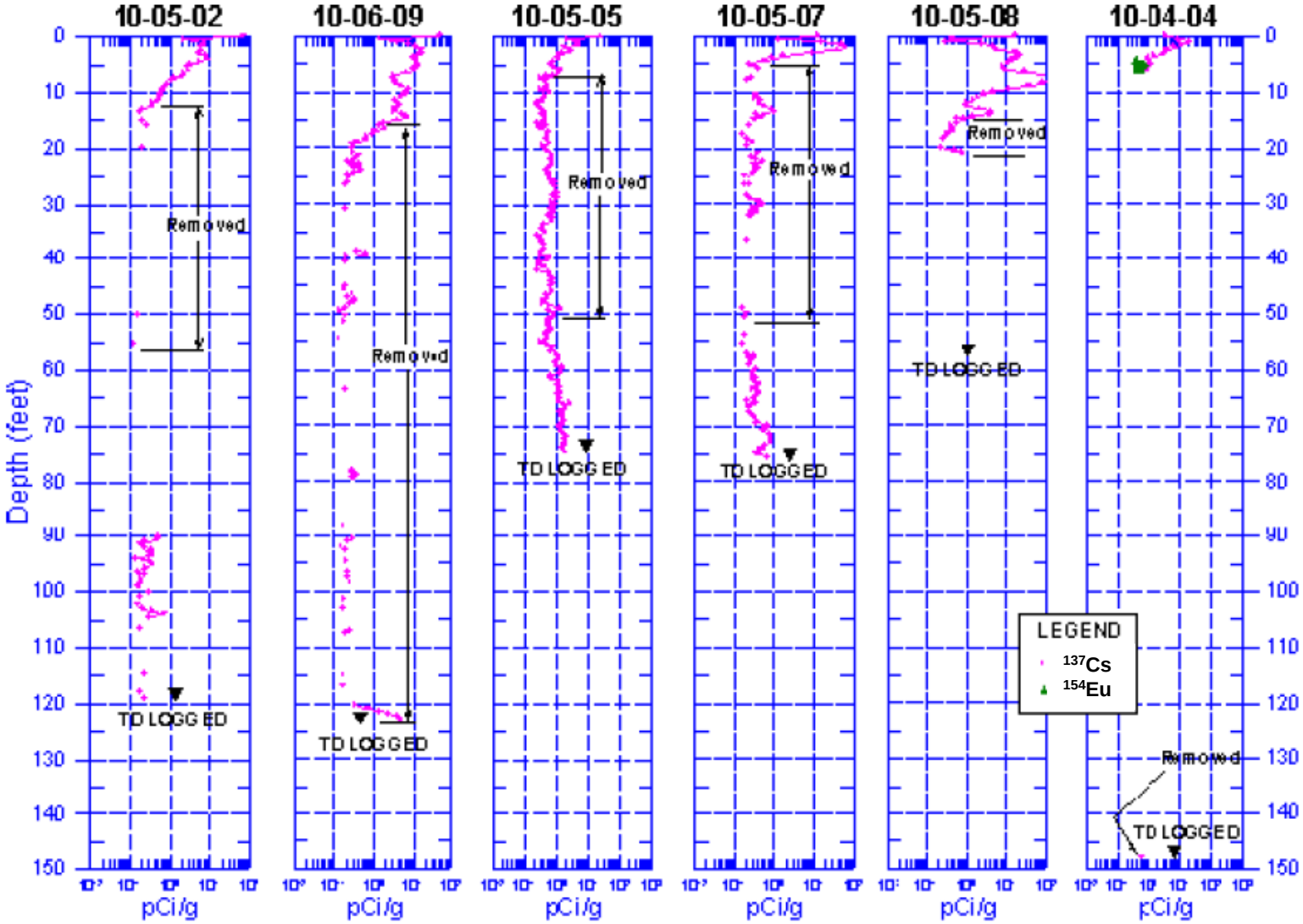
241-A-105 Tank Leak (1996)



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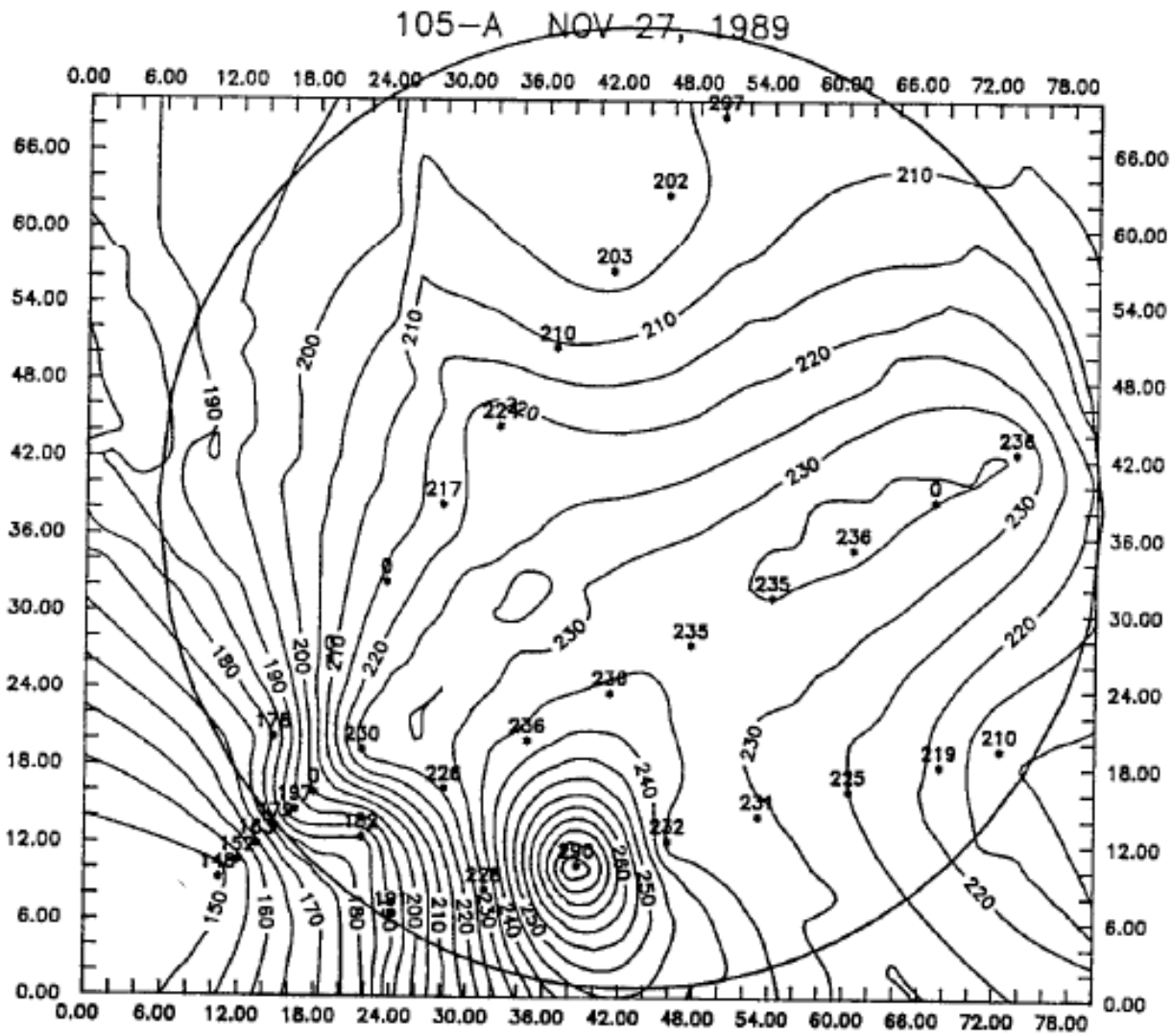
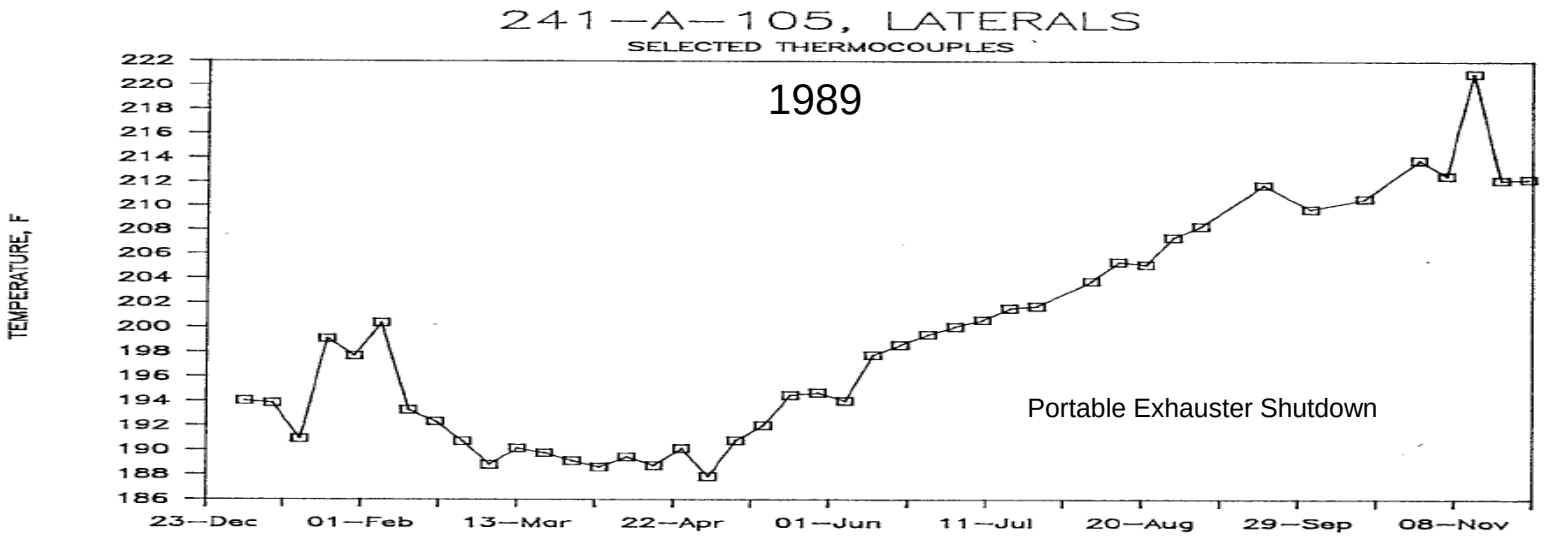
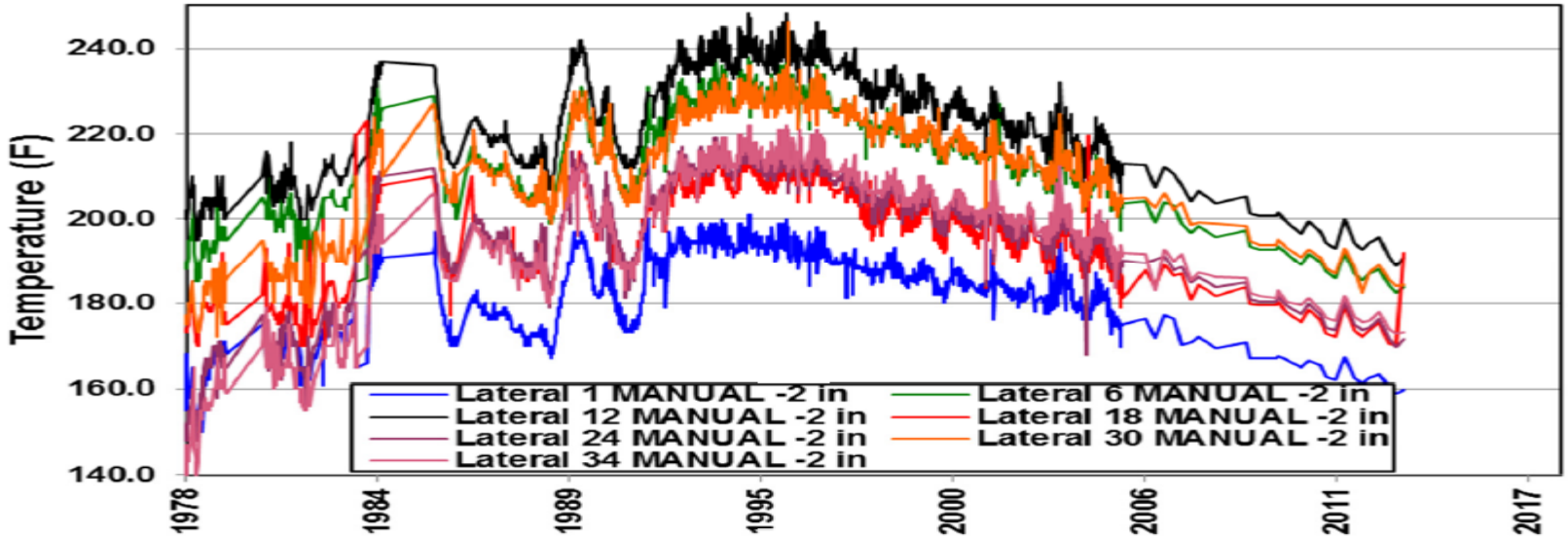
A-105 Lateral Temperatures



A-105 Lateral Temperatures

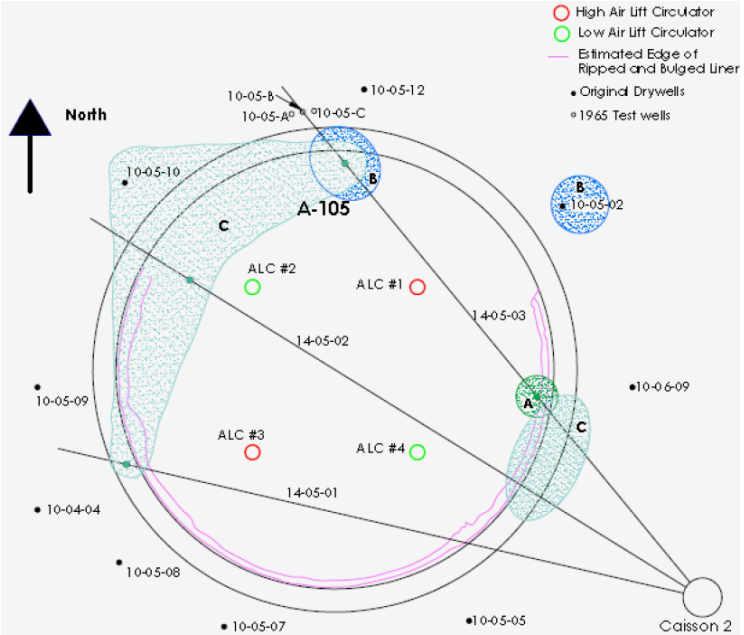


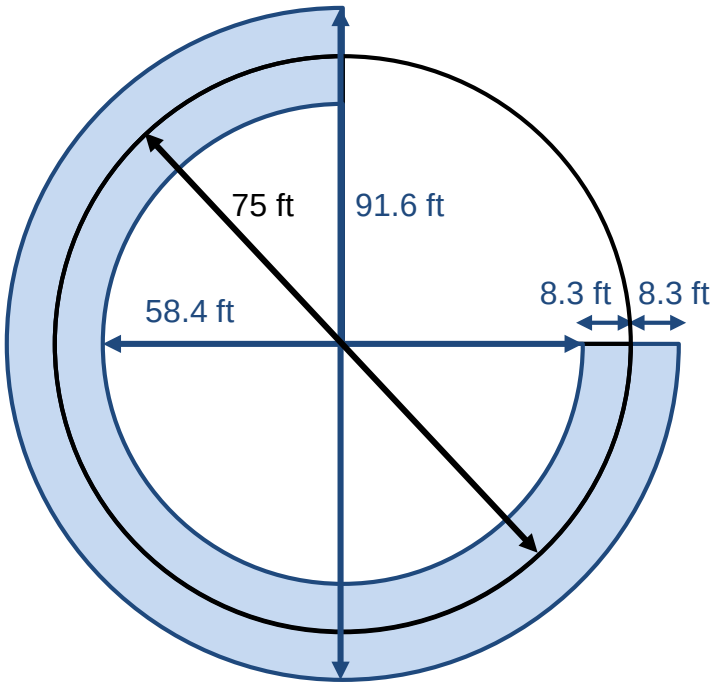


241-A-105 Leak Volume Estimate

- Estimated size of ^{137}Cs plume released, ~ 29,000 ft^3
  - Assume leak around ¾ tank circumference
  - Assume ^{137}Cs does not extend below laterals (~10 ft below tank)
    - » ^{137}Cs concentration at laterals below 4E7 pCi/g (^{137}Cs saturation capacity).
  - Assume ~16.6 ft width, based on average length of release along laterals.
- Estimated mass of release 56,000 Ci ^{137}Cs at time of release
  - Assumes entire plume was at ^{137}Cs saturation capacity (4E7 pCi/g) at time of release.
- Release Volume estimates:
  - Waste type is uncertain
    - » ~2,000 gal if all PUREX supernatant (30.7 Ci/gal ^{137}Cs)
    - » ~40,000 gal if all B-Plant IX waste (CSR) (1.38 Ci/gal ^{137}Cs)
    - » Probably a combination of waste types.
  - Volume estimate for inventory, does not include cooling water
    - » Cooling water released = 0 to 230,000 gal based on evaporation estimates (impacts driving force, not chemical or radionuclide inventory).

A-105 Leak Estimate (Calculations)





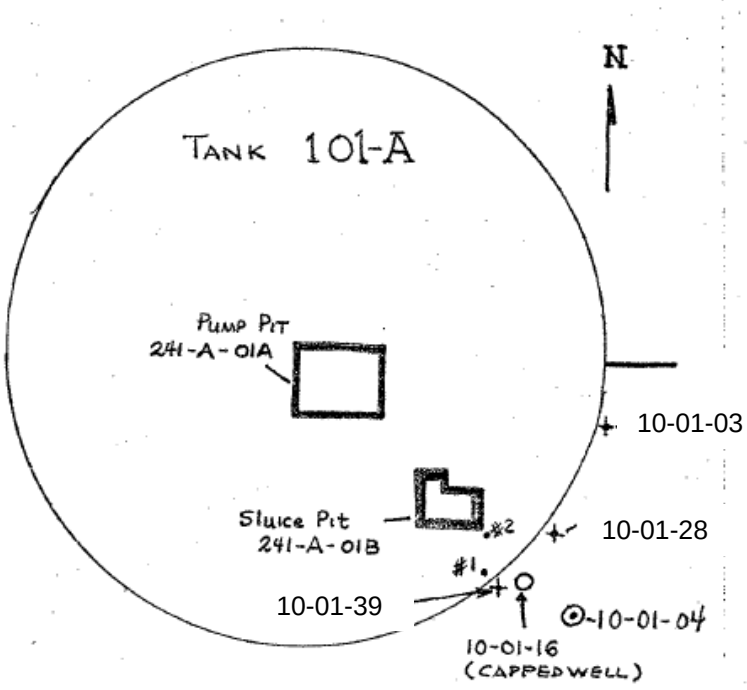
Area of ¾ circle (outer edge) = ¾ * π * (0.5 * 91.6 ft)^2 = 4940 ft^2
Area of ¾ circle (inner edge) = ¾ * π * (0.5 * 58.4 ft)^2 = 2010 ft^2
Volume from base of tank to laterals = (4940 ft^2 - 2010 ft^2) * (10 ft) ≈ 29,000 ft^3

Ci ^{137}Cs = 29,000 ft^3 × 1.7 g/cm^3 × 4 E7 pCi/g × 1 Ci/10^{12} pCi × 28,320 cm^3/ft^3

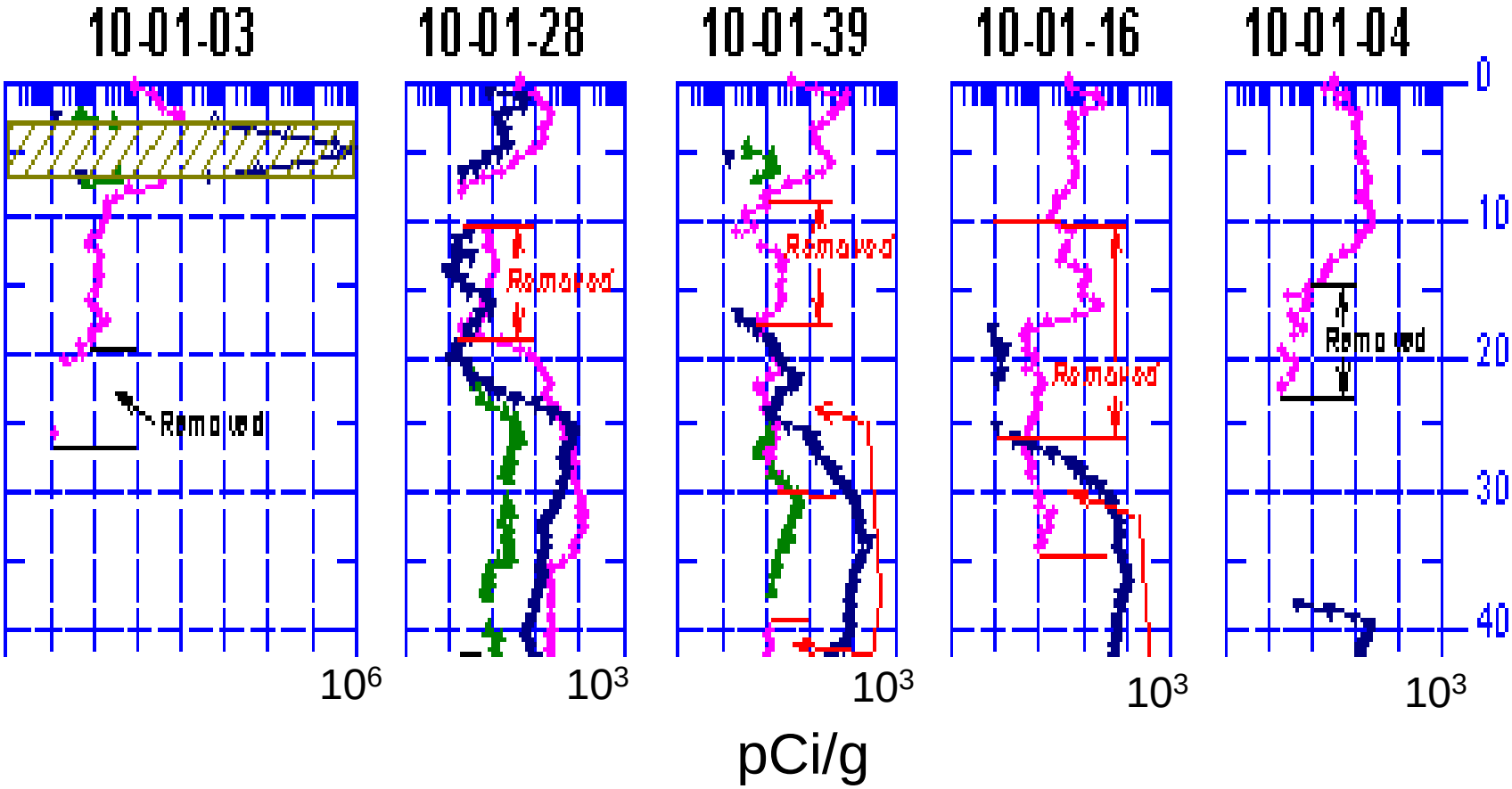
≈ 56,000 Ci ^{137}Cs

241-A-01B Sluice Pit Release

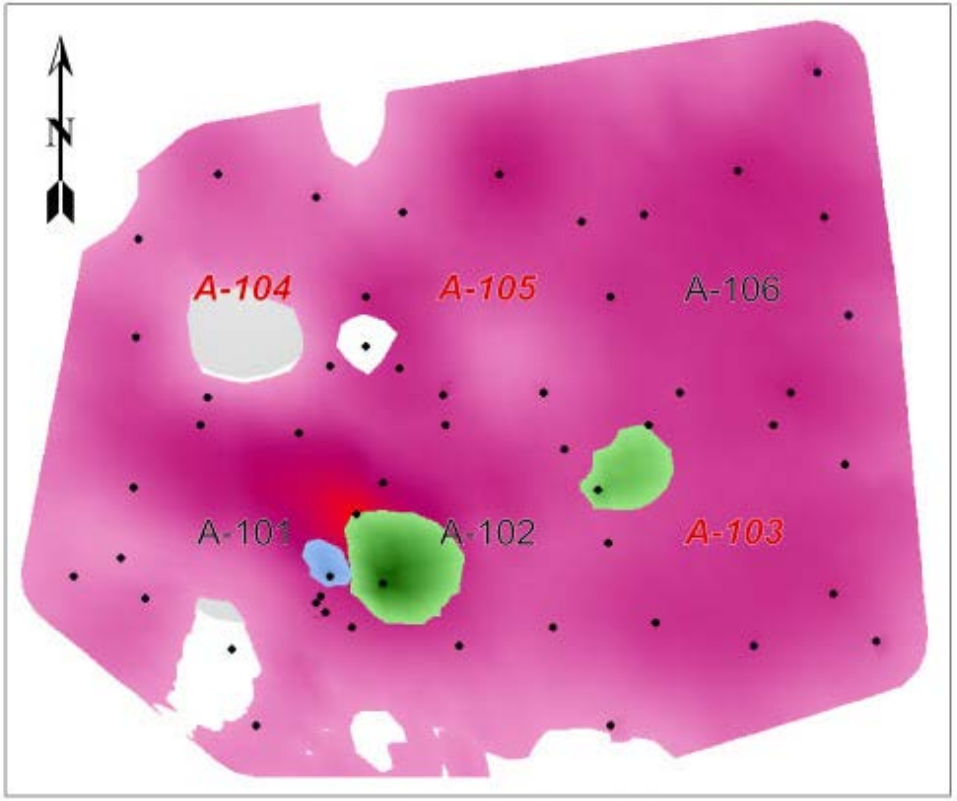
- Release near tank A-101
- Attributed to releases from the 241-A-01 B pit
- Drywell activity first detected July 1980.
  - Reported in OR-81-03.
- Release estimate based on spectral gamma logging data (SGLS) and waste sample concentrations.
  - Peak concentration of ^{137}Cs was 1E6 pCi/g
  - Plume visuals and SGLS data indicate ~10 ft radius and 10 ft depth.
  - ~ 170 Ci of ^{137}Cs released (decay to 2020)
  - Sample concentrations in 1980 were ~0.4 Ci/gal to 3 Ci/gal.
    - At the minimum concentration the release volume would be about 640 gal.
    - Waste release likely more dilute and greater volume.
    - Assume A1-SltCk



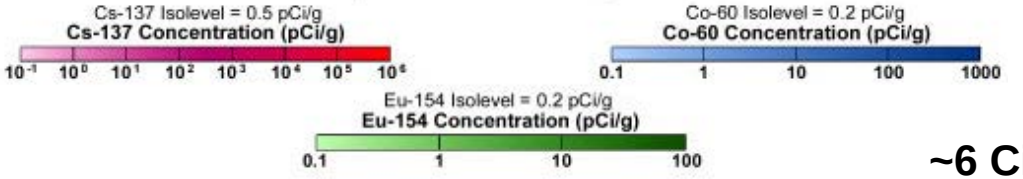
241-A-01B Sluice Pit Release 1997 and 1999 SGLS/HRLS



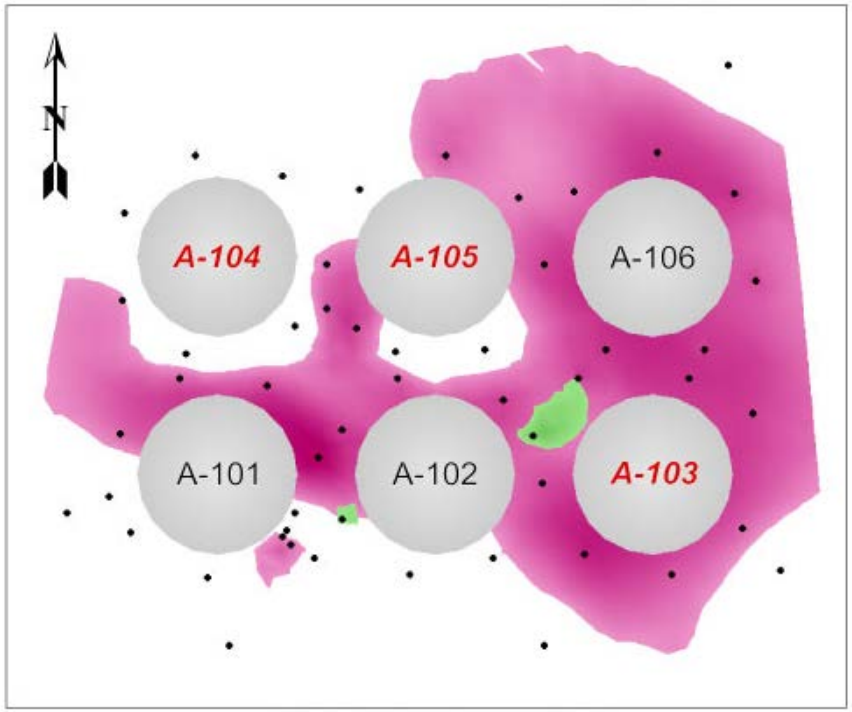
A-Farm Surface Contamination based on Dry Well Measurements



Depth of Horizontal Planar Slice @ 3 ft BGS



3 ft bgs



Depth of Horizontal Planar Slice @ 10 ft BGS

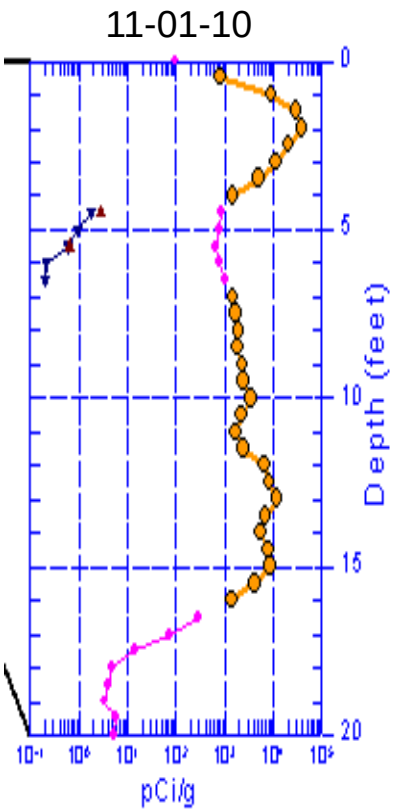
10 ft bgs

~6 Ci of ^{137}Cs Contamination from spills and releases in top 10 ft of soil. Assume A1-SltCk

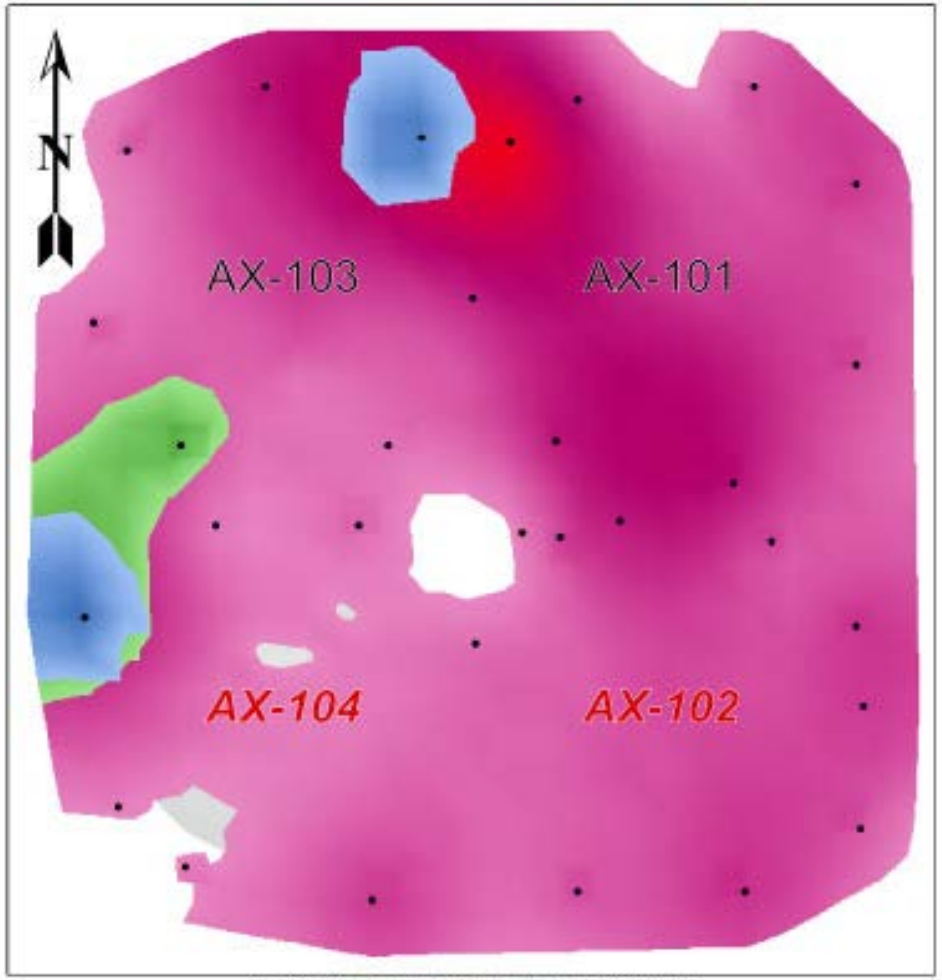
241-AX-101 Surface Spill

- Gamma activity detected at drywell 11-01-10.
  - Gamma activity attributed to 10/31-1975 surface spill near AX-101.
- Release estimate based on:
  - 1999 logging data:
    - Peak ^{137}Cs concentration in soil ~ 1E5 pCi/g
  - Assumed distribution of ^{137}Cs plume:
    - Plume visuals and gamma data indicate ~20 ft radius and 20 ft depth.
    - Volume ~ 25,000 ft^3
  - 1980 AX-101 ^{137}Cs sample concentration (1.9 Ci/gal).

– Estimated ^{137}Cs in soil in 1999 = 130 Ci
– ^{137}Cs sample concentration decayed to 1999 = 1.2 Ci/gal
  – Released volume ~110 gal (130/1.2).
  – Given the extent of ^{154}Eu and ^{60}Co measured in the soil, the waste released was likely more dilute and the volume greater.
– Assumed waste type: A-SltCk.



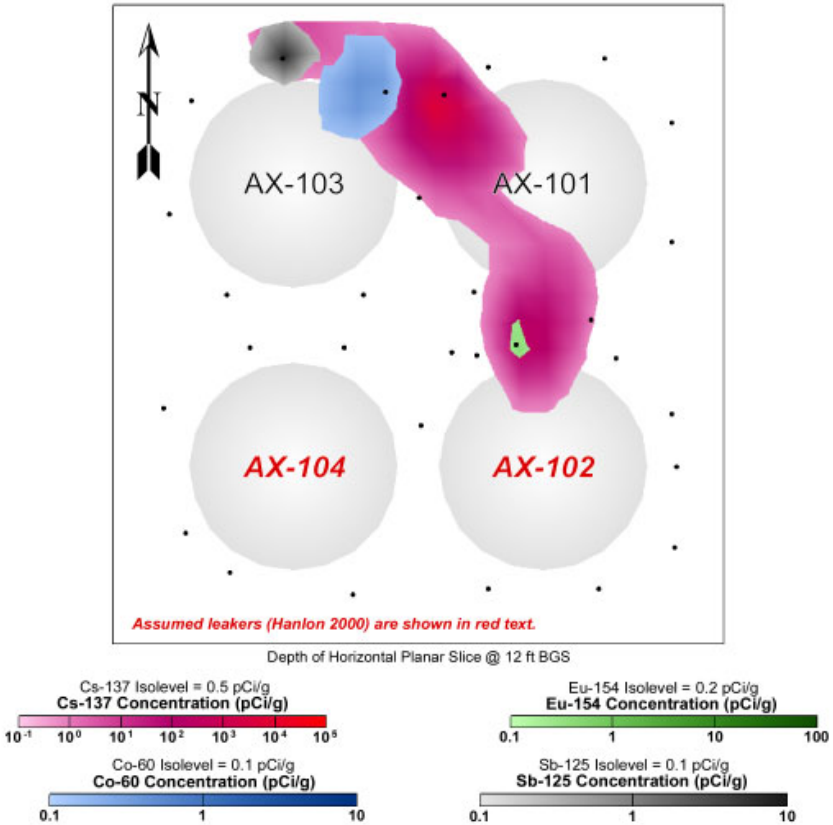
AX-Farm Surface Contamination based on Dry Well Measurements



Depth of Horizontal Planar Slice @ 3 ft BGS

3 ft bgs

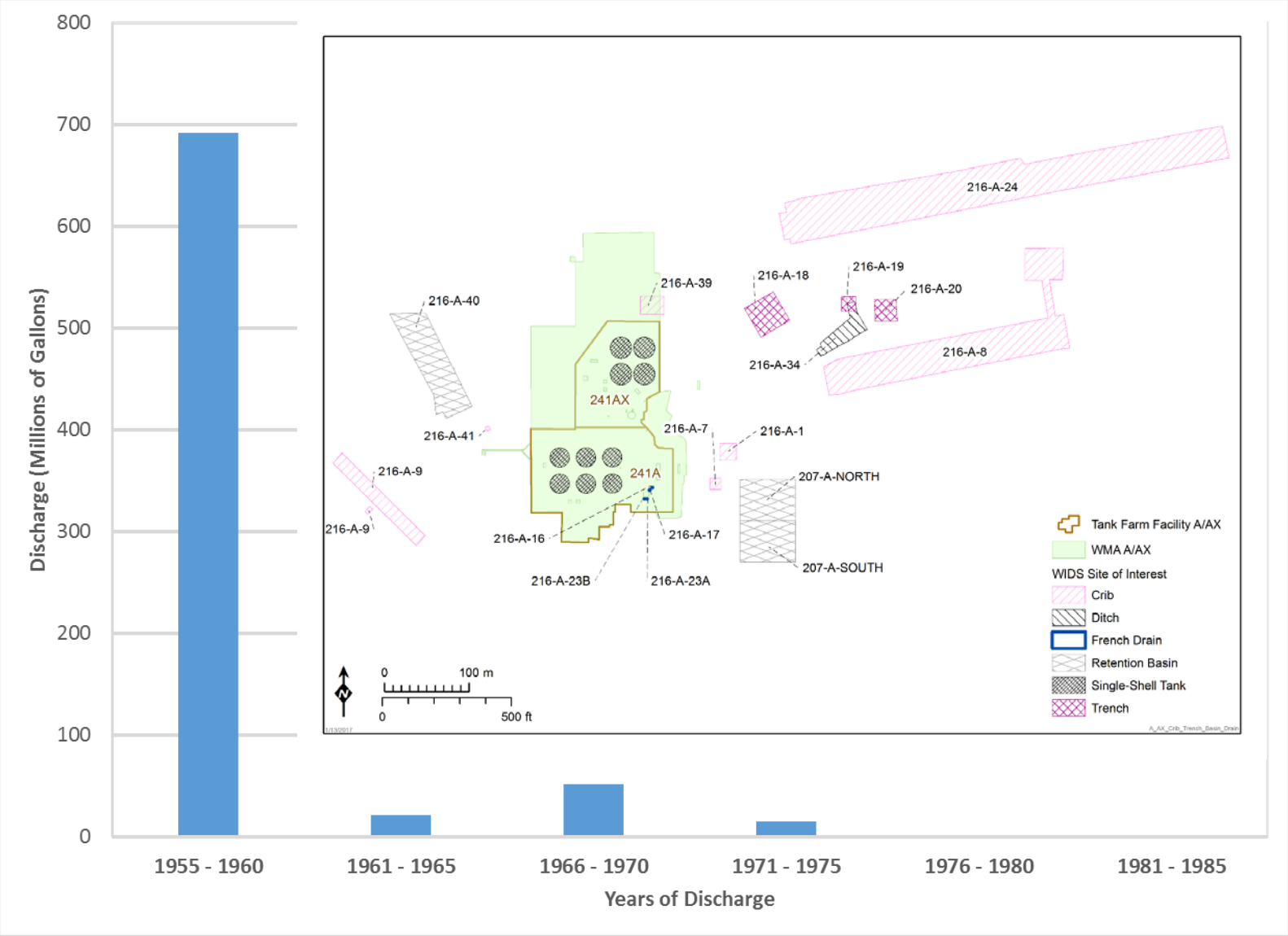
Note: AX-102 and AX-104 reclassified as sound



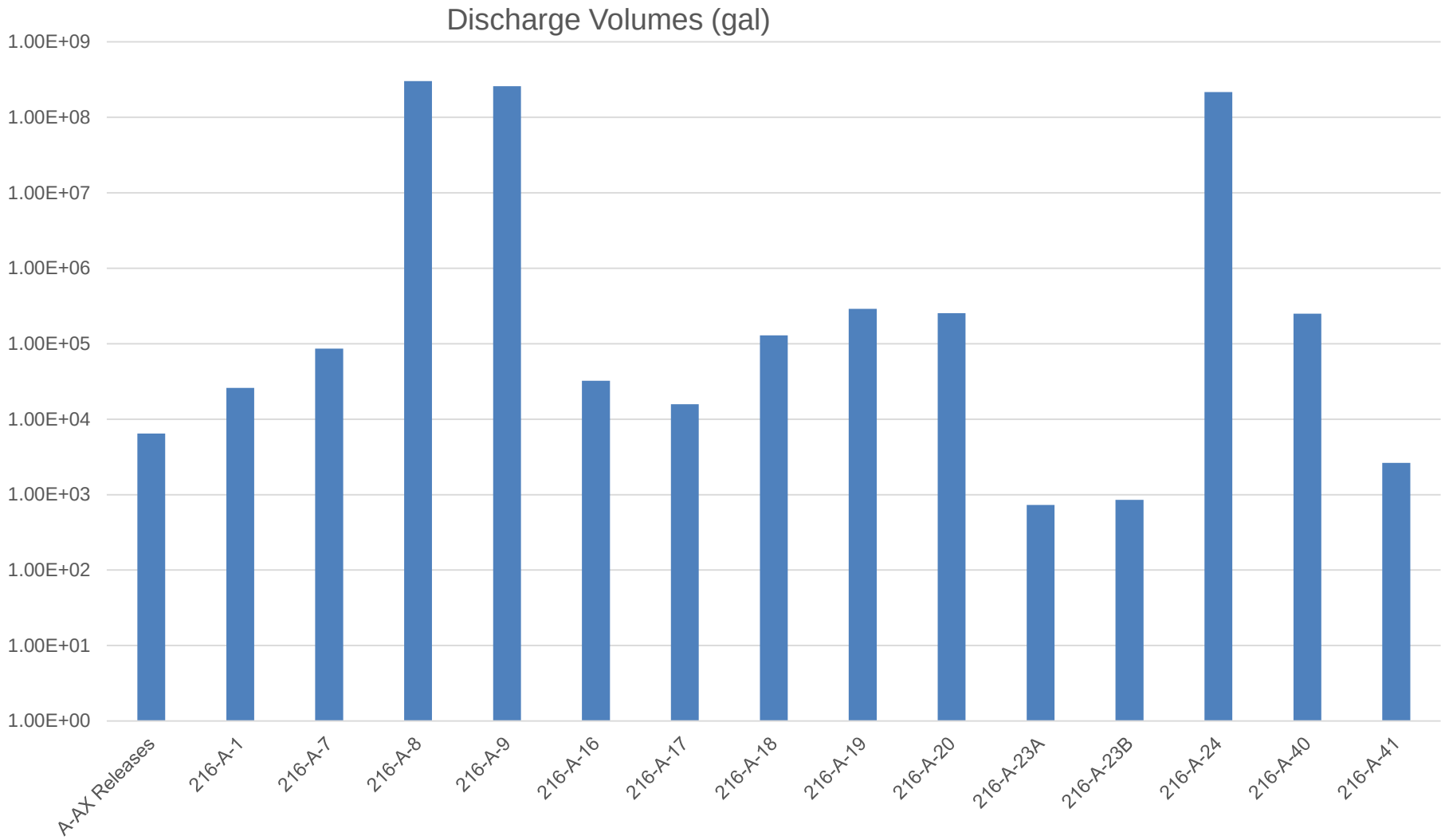
12 ft bgs

~20 Ci of ^{137}Cs Contamination from spills and releases in top 10 ft of soil.
Assume A1 Slt-Ck

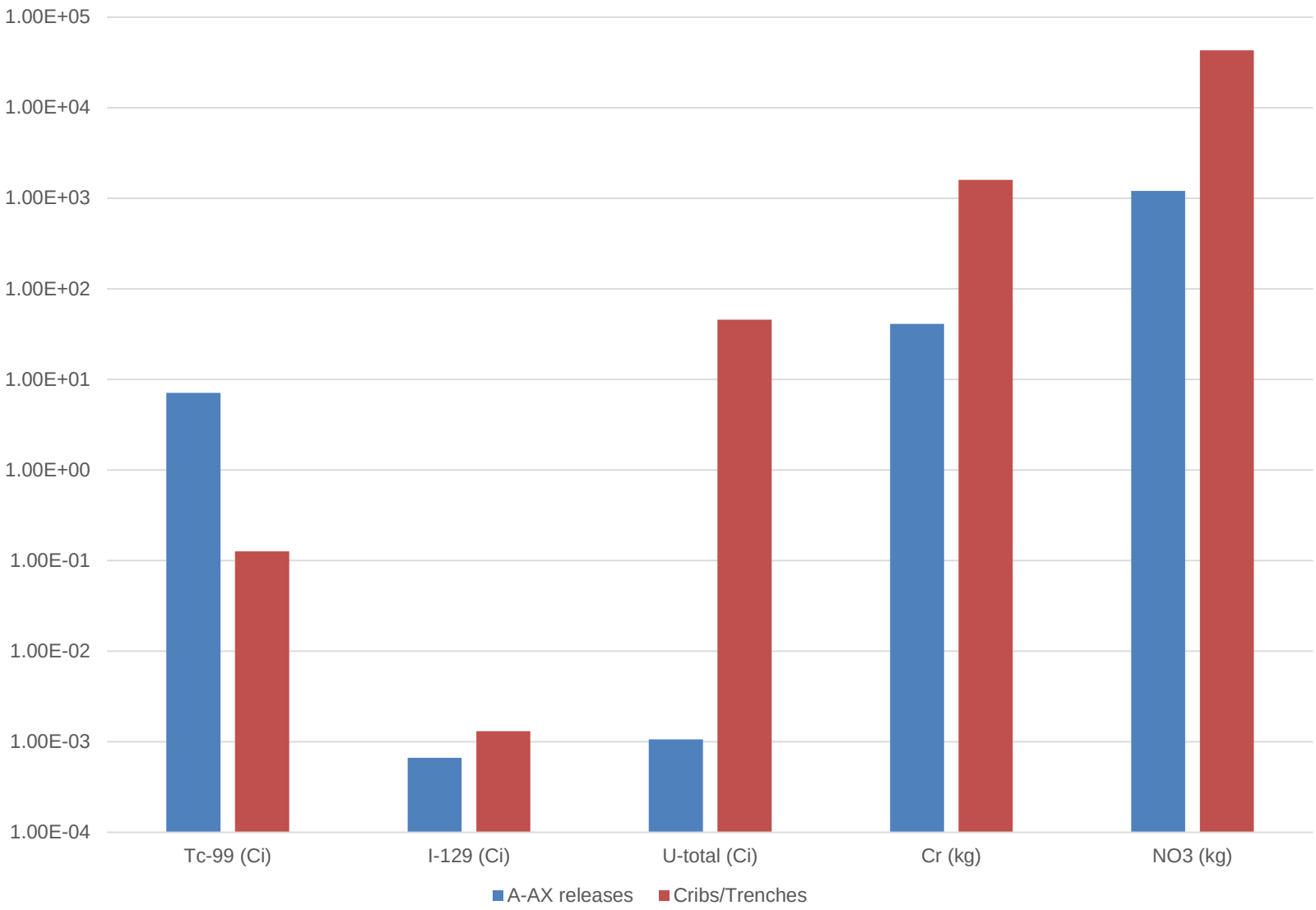
Discharges to Surrounding Facilities (SIM 2005)



Discharges to Surrounding Facilities (SIM 2005)



Chemicals and Radionuclides Discharged (SIM 2005)



Other Releases and Potential Releases

- **Unquantified Releases:**
  - Other Unplanned Releases (UPRs) in Waste Information Data System (WIDS)
  - Failed Pipelines
  - Undocumented surface spills

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A/AX Farm Soil Release Inventory Estimates

Source	Estimated Earliest Release	Volume (gal)	Chemicals (kg)	Radionuclides (Ci)[1]	Tc-99 (Ci)
241-A-104	3/1/1975	2,000	240	2,700	0.4
241-A-105[2]	11/1/1963	2,000	4,300	49,000	6.5
241-A-01B sluice pit	7/1/1980	~640	480	310	0.1
241-A Surface	1/1/1960	~400	20	13	0.005
241-AX-101 Surface	11/1/1975	~110	390	260	0.1
241-AX Surface	6/1/1966	~1,300	64	42	0.02
Discharge to Cribs/trenches[3]	1/1/1955	~780,000,000	800,000	47,000	0.1
Other Releases	Unknown Quantities				

[1]Radionuclides decayed to 1/1/2001.
[2]Initial estimate; assumes:

- **P1 waste released,**
- **Initial release at Cs-137 saturation capacity.**
- **Cs-137 above laterals.**

[3] Soil inventory Model, RPP-26744.

Sources of Uncertainty

- Gaps in tank process reporting
- Understanding in-tank liquid level measurements
- Gaps in waste transfer records
- Logging data
  - Shows gamma activity only
    - Cs-137, Co-60
  - Limited well spacing and frequency of logging
  - Most data from 1970 to present
- Location and depth of vadose zone logs and samples

Uncertainty Estimates

- A-105 uncertainty in waste type and depth of Cs-137 released.
- Other leak volumes considered reasonable upper bound estimates.
  - Insufficient data for average or lower bound estimates.
- Leak composition estimates considered averages. SIM uncertainty distributions based on ORIGEN2 ranges for similar waste types.
- Data Quality Objective for A-AX farm soil characterization in progress.
- Modeling evaluation to be conducted to determine a range of volumes and inventories to evaluate in the Performance Assessment.