Integration Disposal Facility and its Performance Assessment

Presented by:
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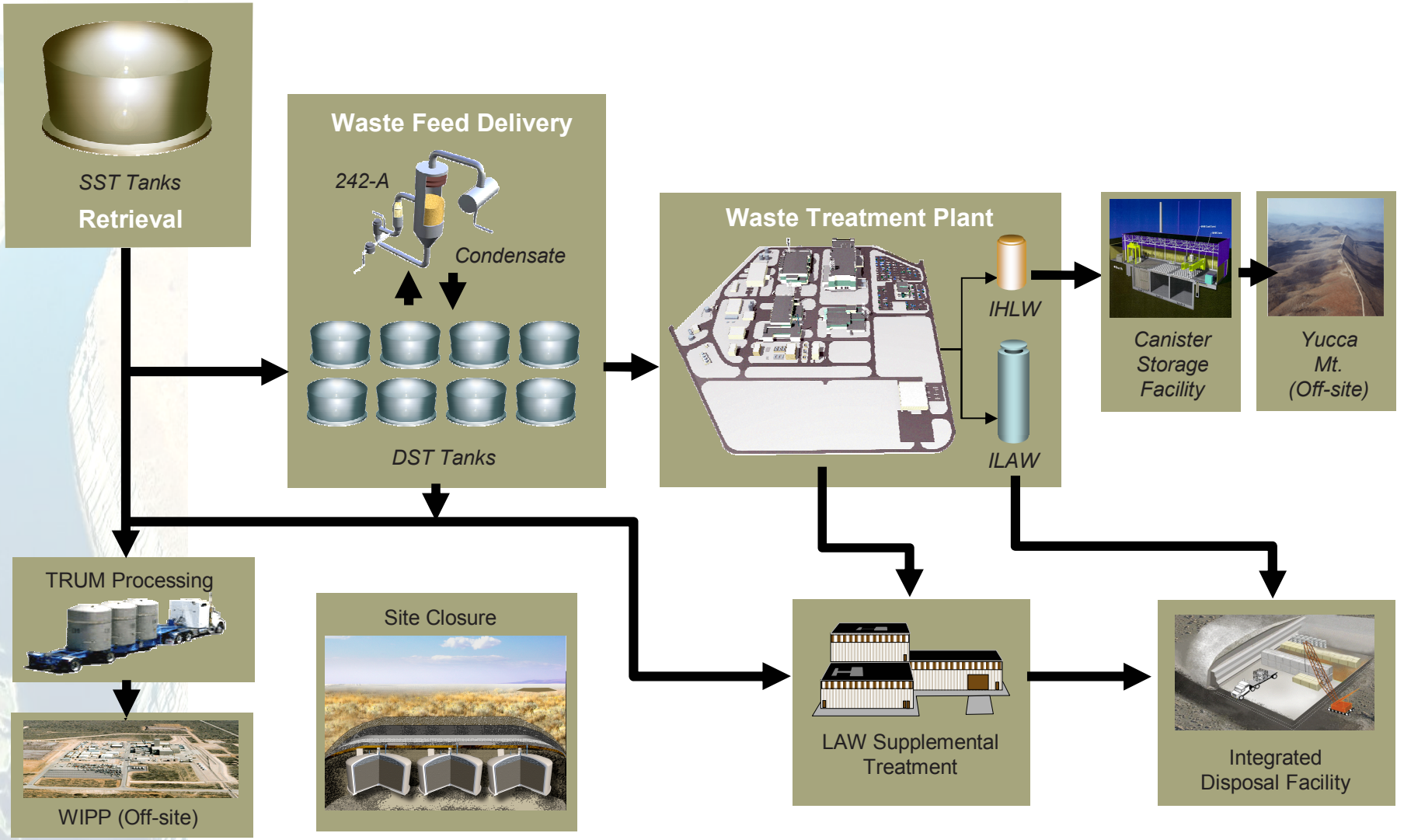
RPP Vision


SST Tanks
Retrieval
Waste Feed Delivery
242-A
Condensate
DST Tanks
Waste Treatment Plant
IHLW
ILAW
Canister Storage Facility
Yucca Mt. (Off-site)
TRUM Processing
WIPP (Off-site)
Site Closure
LAW Supplemental Treatment
Integrated Disposal Facility

Purpose of IDF

- Dispose of ILAW produced by WTP
- Dispose of ILAW produced by DBVS and potentially by Supplemental Treatment Plant
- Dispose of treated WTP secondary waste
- Dispose of other Hanford and DOE complex LLW and MLLW

History of ILAW/IDF

- ILAW has evolved from grout to glass and its disposal from concrete vaults to engineered landfills
- 1996/1997 NRC consultation on DOE's proposed ILAW waste management plan
- ILAW waste management plan being implemented
- IDF started as disposal facility for WTP ILAW only
- IDF mission was expanded in 2002 to include:
  - ILAW from DBVS and Supplemental Treatment Plant
  - Treated WTP secondary waste
  - Other Hanford and DOE complex LLW and MLLW

ILAW Criteria

- Radionuclides have been removed to the maximum extent technically and economically practical
- Wastes are incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C [low-level waste] as set out in 10 CFR Part 61
- Wastes are to be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR 61, Subpart C are satisfied

All ILAW waste form concentrations are well below class C limits

Comparison of ILAW Glass Radionuclide Concentrations with US NRC Class C Limits						
Radionuclide	**Units**	**10 CFR §61.55 Class C[1]**	**WTP Contract[2]**	**Projected Average Concentrations[3]**		
				WTP ILAW Glass	**Demonstration Bulk Vitrification ILAW Glass**	**Bulk Vitrification ILAW Glass**
Alpha emitting transuranic nuclides with half-life greater than five years	ηCi/gram	100	Less than Class C limits in 10CFR61.55	16.8	0.60	17.9
^{241}Pu	ηCi/gram	3,500		4.6	0.23	6.83
^{242}Cm	ηCi/gram	20,000		4.29E-02	2.22E-03	3.99E-02
^{99}Tc	Ci/m^3	3		1.41E-04	1.47E-04	1.92E-04
^{129}I	Ci/m^3	0.08		9.31E-08	1.54E-08	3.46E-07
^{90}Sr	Ci/m^3	7,000	< 20	4.28E-03	1.98E-03	3.89E-03
^{137}Cs	Ci/m^3	4,600	< 3	2.78E-04	7.90E-03	8.06E-03

[1] Title 10 Code of Federal Regulations Part 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, §61.55 *Waste Classification*
[2] U.S. Department of Energy Office of River Protection WTP Contract, Contract No. DE-AC27-01RV14136, Specification 2: *Immobilized Low Activity Waste Product*, requirement 2.2.2.8, *Radionuclide Concentration Limits*
[3] RPP-RPT-23412, 2005, *Hanford Tank Waste Operations Simulator Model Data Package for the Development Run for the Refined Target Case*, Appendix C, CH2M Hill Hanford Group Inc., Richland Washington

Types of ILAW

- Glass Produced in Waste Treatment Plant (WTP)
  - Baseline in Hanford Federal Facility Agreement and Consent Order

- Bulk Vitrified (BV) Waste Product
  - Demonstration Bulk Vitrification System (DBVS) (<= 50 packages)
  - Supplemental LAW Treatment System (potentially ~1/2 of total ILAW)

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ILAW Testing

- **Performance Assessment**
  - PCT, VHT, SPFT, and PUF
  - Supports long-term modeling
  - Three compositions studied in 2005 IDF Performance Assessment (PA): LAWA44, LAWB45, LAWC22
- **Waste Treatment Plant**
  - Supports contract requirements as well as processing and optimization studies
- **Bulk Vitrification**
  - Supports development and demonstration

Acronyms:

PCT: product consistency test

VHT: vapor hydration test

SPFT: single pass-flow thru test

PUF: pressurized unsaturated flow test

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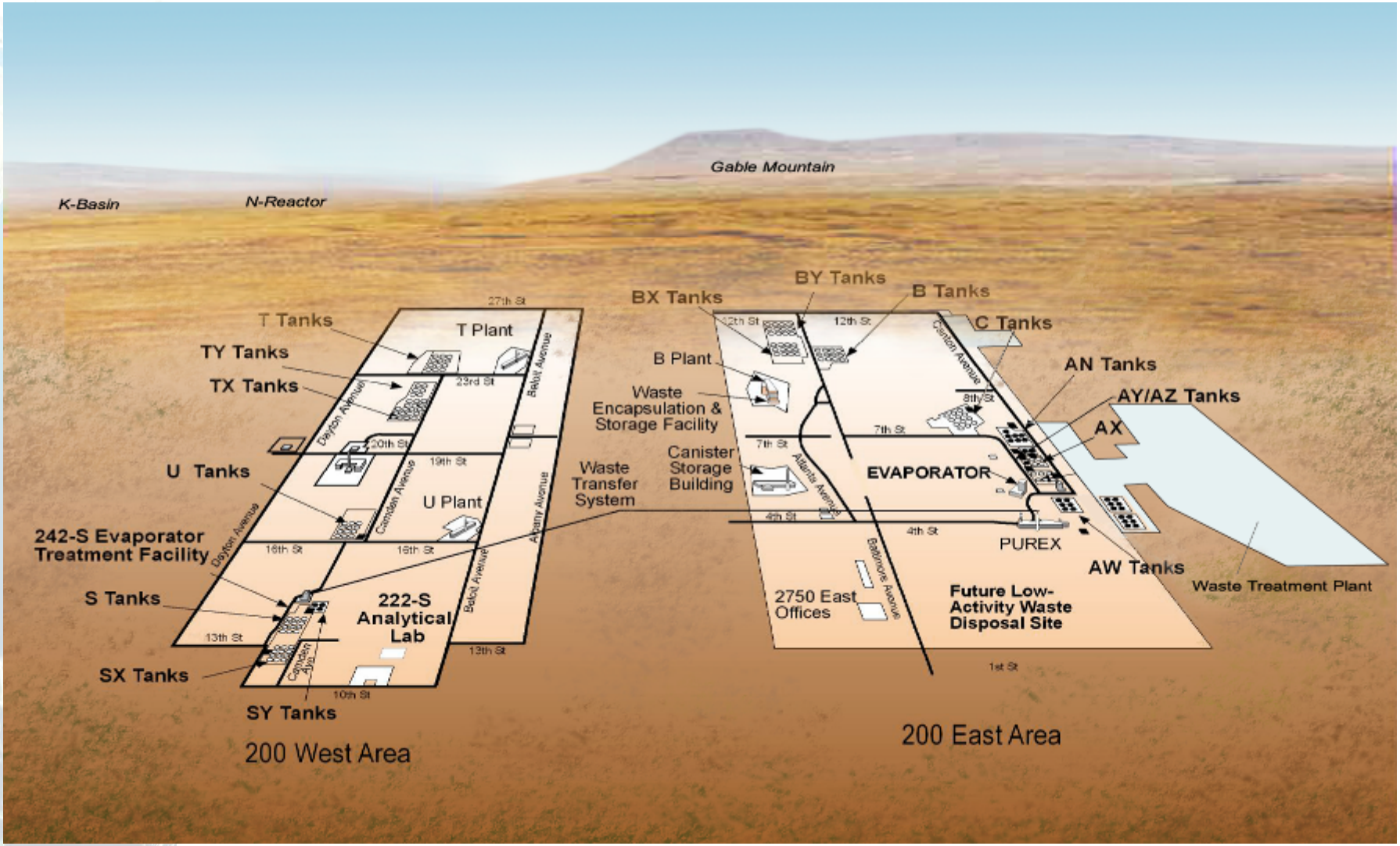
Hanford's Central Plateau



Facility Concept

- Double-lined landfill including leachate collection and removal, with secondary containment and leak detection system
- Phase 1 size will be approximately 442 meters wide, 158 meters long, up to 15 meters deep, with length increasing up to 555 meters at full build out
- Phase 1 will provide capacity for approximately 165,000 cubic meters, with capacity increasing up to 900,000 cubic meters at full build out
- Cell 1 will be for disposal of mixed low-level waste containing Resource Conservation and Recovery Act (RCRA) regulated components including Immobilized Low Activity Waste
- Cell 2 will be for disposal of low-level waste with no RCRA regulated components

Facility Concept (continued)

- In addition to the regulatory required barriers to protect the environment, the following enhancements are included in the IDF design
  - A Geosynthetic Clay Liner (GCL) layer has been added to the required primary liner to provide a composite barrier [High Density Poly Ethylene (HDPE) and bentonite clay] throughout the landfill cell floor
  - A second GCL layer has been added to the required secondary liner to enhance the effectiveness of the composite barrier under leak detection sump
  - A third HDPE geomembrane liner has been added beneath the liquid collection area to provide a secondary leak detection system.

Proposed Operations

- Proposed operations will be similar to disposal activities currently performed on-site
- Waste to be disposed will be:
  - Certified by generator and verified by operator
  - Segregated and staged until wastes are accepted for disposal
- Leachate will be:
  - Monitored, pumped as required, sampled, characterized, and transported to other treatment storage and disposal facilities for final disposition
- Waste placement location will be recorded in order to facilitate retrieval in the unlikely event retrieval is required
- Closure will include RCRA compliant cover

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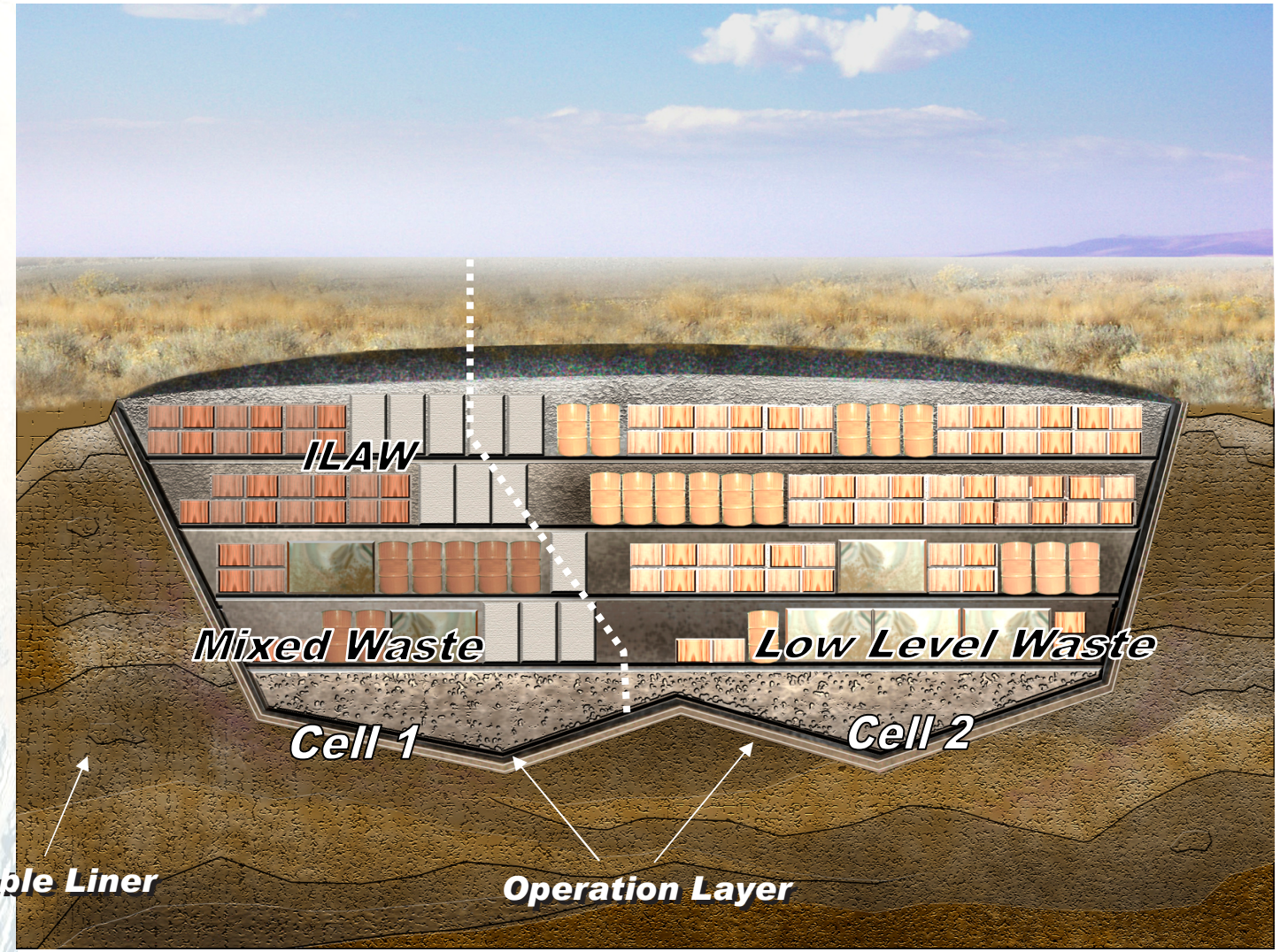
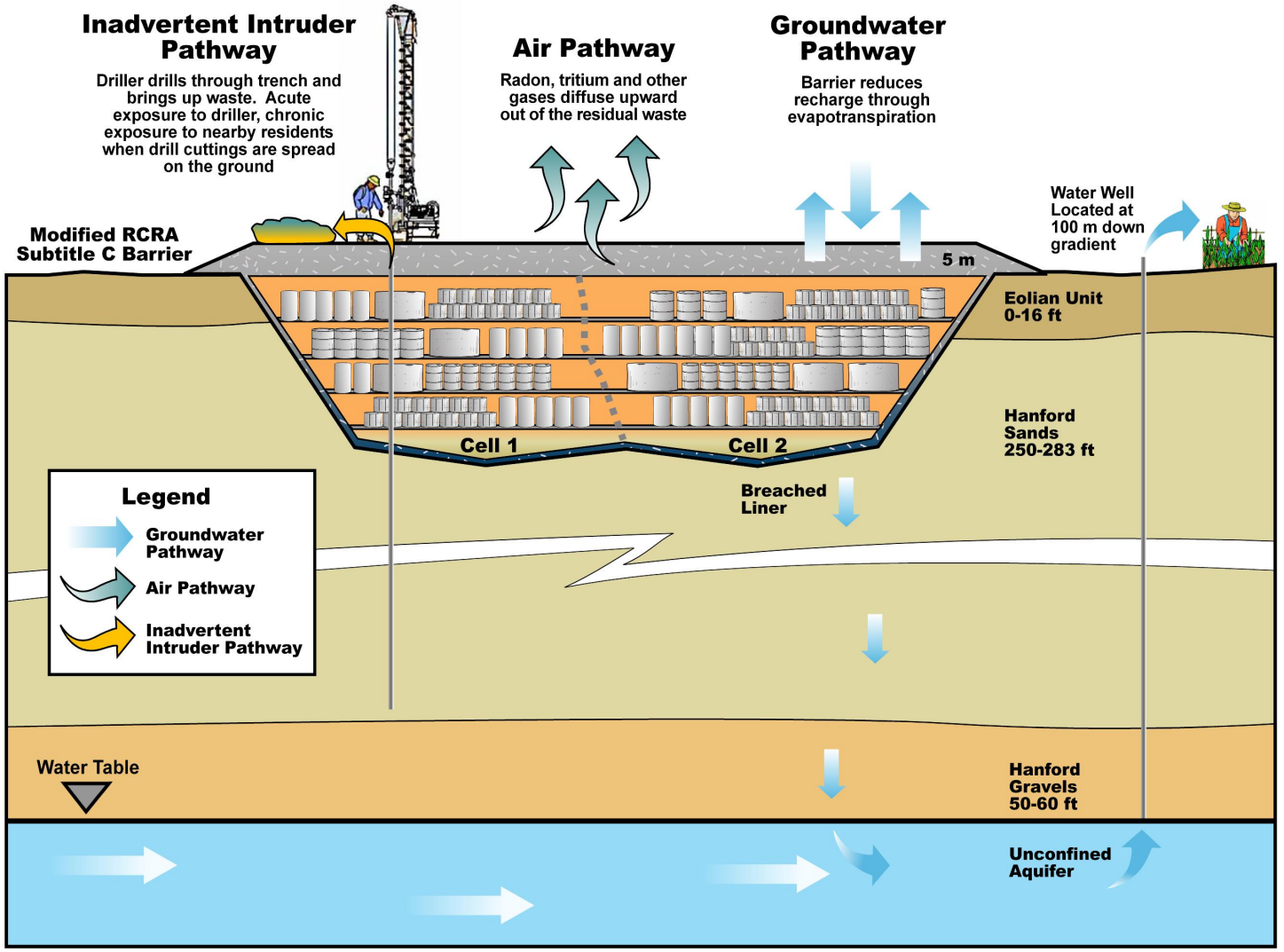
IDF Landfill Concept



Key Performance Objectives

- General public protection (rural farming with a cow) – 25 mrem EDE/yr
- Inadvertent Intruder (driller and farming scenarios) – 500/100 mrem EDE/yr
- Groundwater protection (beta/gamma drinking water dose for 2 liters/day) – 4 mrem/yr
- Air and surface water protection
- Chemical performance objectives
- Performance Objectives for the Hanford ILAW PA HNF-EP-0826

Conceptual Models for Various Pathways Analyzed in PA



IDF Inventory for Key Contaminants [a]

	Tank Waste (HTWOS)					Approved Generators (SWIFT)			Potential Generators (HSW EIS/TID)	
Contaminant	WTP ILAW glass	Spent LAW Melters	Spent HLW Melters	BV Product	ILAW Secondary Waste	Cat 1	Cat 3	MLLW	LLW	MLLW
^{99}Tc	1.1E+04	2.2E+01	1.2E+01	1.2E+04	2.3E+02	5.3E-01	3.0E+00	6.1E+00	1.0E+00	5.1E+01
^{129}I	7.1E+00	1.6E-02	7.7E-03	2.1E+01	1.3E+01	1.1E-02	6.9E-03	1.0E-01	2.5E-02	2.7E-04
$^{237}Np+D$ [b]	2.0E+01	2.8E-02	1.4E-01	2.3E+01	9.3E-02	7.6E-02	1.2E-02	1.1E-02	2.2E-01	7.9E+00
$^{238}U+D$ [b]	3.9E+00	7.7E-03	1.0E+00	2.7E+00	2.3E-02	2.7E-01	2.7E+00	6.1E-01	3.5E+01	9.9E+01
Cr	2.9E+05	5.1E+02	3.0E+02	1.9E+05	1.7E+02	NA	NA	7.7E+03	NA	1.0E+04
NO_3^-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+06	NA	NA	2.6E+05	NA	3.3E+05

[a] Units for inventories provided in this Table. Radionuclide contaminant inventories are in units of Ci decayed to January 1, 2005; chemical contaminant inventories are in units of kg include the mass associated with radionuclides

[b] Short-lived progeny in equilibrium with parent

Major Uncertainties/Sensitivities

- Inventory (particularly uncertainties in treatment flow sheets)
- Waste form release rate (particularly from grout)
- Recharge
- Sediment retardation
- The largest uncertainties are associated with decisions (e.g. such as waste form, surface barrier design) which are not yet made, rather than from knowledge of the natural system