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E-Area Performance Assessment

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P&RA Community of Practice Technical Exchange

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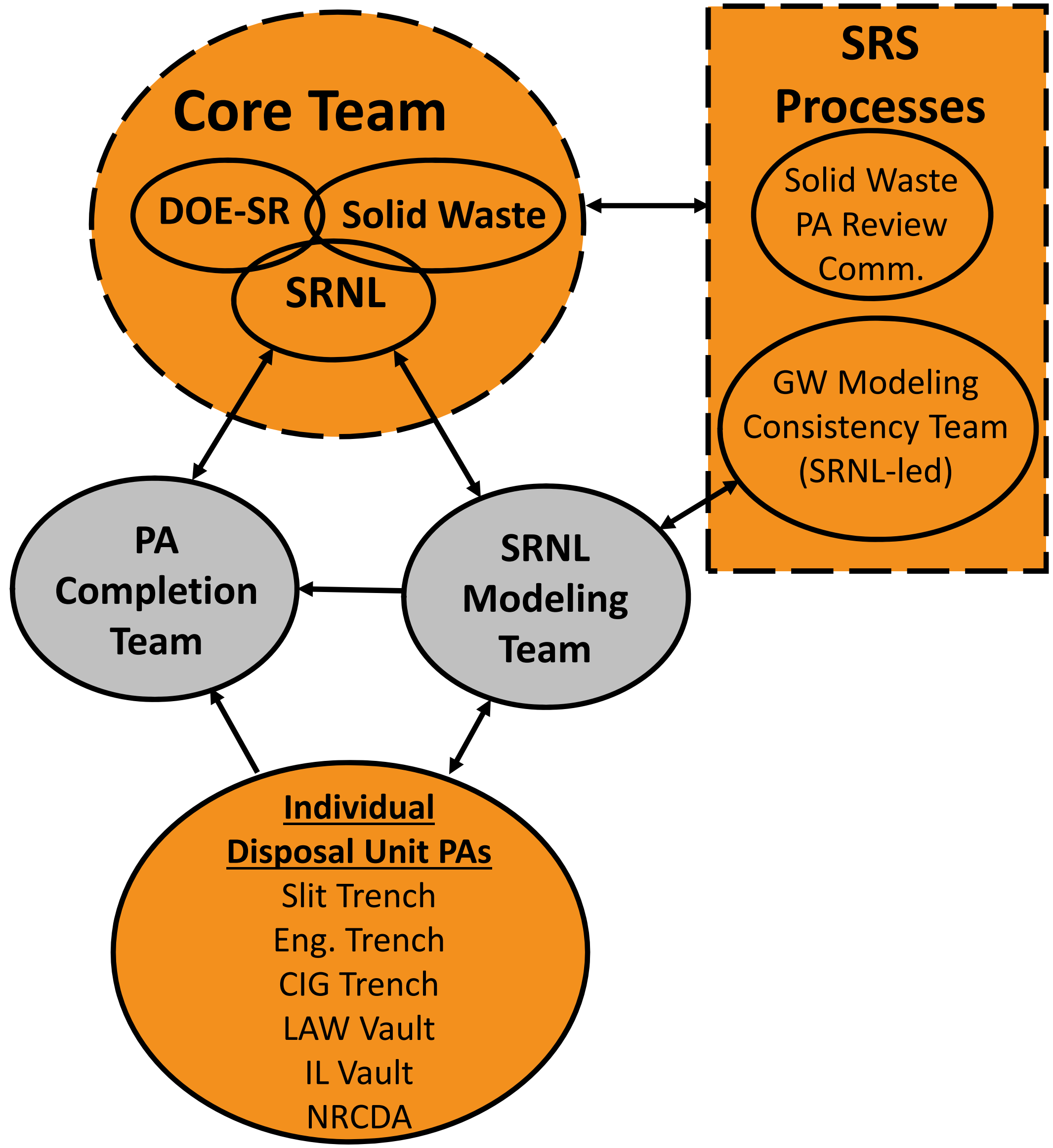
Introduction

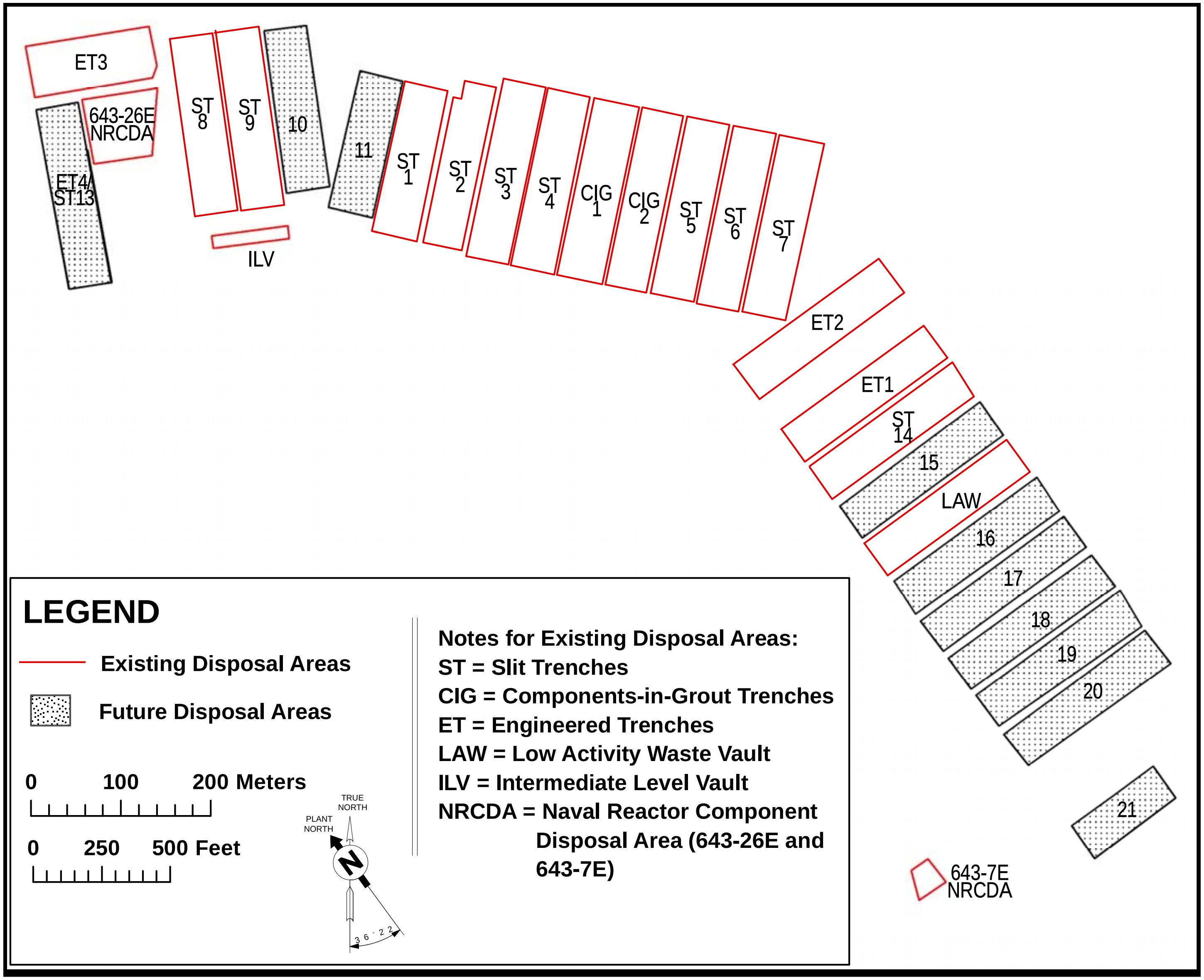
- E-Area low-level radioactive waste disposal facility operated since 1994 using 6 disposal types
- Performance-based, graded approach for safe and cost-effective disposal at a humid site
- PAs conducted from October 2005 – September 2007, finalized in 2008
- Operational changes and unique wastes addressed with unreviewed disposal question process and special analyses
- PA Strategic Planning Team is considering approaches for more efficient implementation of the PA update

Integrated Team Approach for 2008 Performance Assessment

- Graded approach for disposal rather than use of vaults for all waste (~$120 million cost savings)
- Each disposal concept had a separate PA (integrated using plume interaction analysis)
- Deterministic approach for compliance determination (PORFLOW™)
- Limited implementation of hybrid modeling with probabilistic approach for sensitivity and uncertainty analysis (GoldSim™)



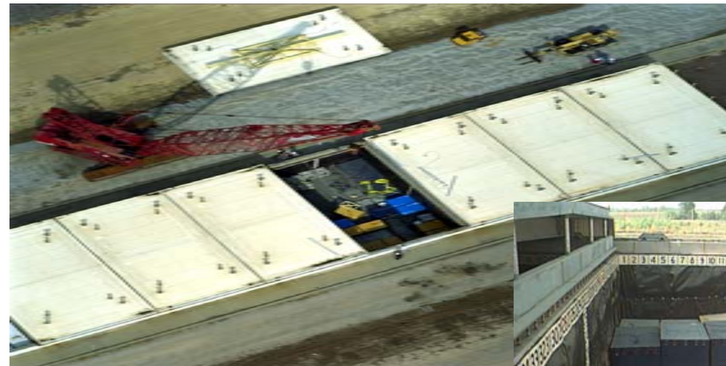
Current E-Area Disposal Layout



Low and Intermediate Level Vaults (Reinforced Concrete with 2 foot thick walls)

Low Activity Vaults

- 12 cells, each approx. 50’ x 145‘ x 20’ high
- 12” floor slab, 16” roof slab on bridge beams
- Leachate sumps for each pair of cells
- Interim closure - fill doors, vents closed
- Final closure - soil / membrane cover



Intermediate Level Vaults

- Silo cell - 142 silos (~20”D x 25’ deep)
- Eight bulk cells (~25’ x 45’ x 25’ deep)
- Each waste layer is grouted in place (isolation and dose reduction)
- Independent leachate collection sumps
- Interim closure - reinforced concrete slab
- Final closure - soil / membrane cover

- PA demonstrates long-term structural stability to support cover, but infiltration begins to increase following maintenance period and cracking of vault assumed at closure
- K_ds changed in a stepwise manner as vault chemistry evolves from interaction with groundwater

Components in Grout (CIG) Trenches

- Utilized for large bulky equipment
- Minimum 1 foot of grout is poured below, above and around the component
- After base grout hardens, boxes and components are placed by crane
- Multiple pours are then made to reduce grout stress on components
- A cover grout layer, reinforced concrete slab and moisture barrier cover installed as required by the PA
- Trench layout same as Slit Trench but using segmented footprints
- PA credits container for 40 years, grout for 300 years (structural and chemical), flow through grout assumed to increase after 300 years, K_ds changed in a stepwise manner as grout chemistry evolves

Slit and Engineered Trenches

Slit Trenches

Engineered Trenches

- Utilized primarily for low curie content debris (Slit Trench (ST)) and containerized waste (Engineered Trench (ET)) - ~95% of Volume, ~5% of Activity for PA
- Disposal footprint is 650 feet long by 160 feet wide and excavated to 20 feet deep, accommodates five parallel 20 foot wide slit trenches (modified footprint for ET 3)
- No personnel access into Slit Trench, Engineered Trench is “clean facility”
- Clean soil fills top four feet of trenches
- Generally no credit for waste form or containers (except for special case waste), cover subject to subsidence

Naval Reactor Component Disposal Area (NRCDA)

- Utilized for receipt and disposal of Naval Reactor components from Eastern Labs and Shipyards (KAPL, Bettis, Portsmouth, Norfolk, Newport News, etc.)
- Components placed ‘at grade’
- Typically very robust containers (e.g., multiple inches of stainless steel)
- Interim closure - soil cover
- Final closure - soil / membrane cover
- PA assumes stainless steel containers provide long-term barrier to releases

Sum of Fractions (2008 Performance Assessment)

Graded approach used to manage sum of fractions (SOF) and disposal in an efficient manner

Disposal Unit	Maximum SOF	Limiting Pathway	Major Radionuclides
Slit Trenches			
East	0.93	4 mrem/yr beta-gamma 12-100 years	^{129}I, ^{3}H, ^{14}C
Central	0.93	4 mrem/yr beta-gamma 12-100 years	^{99}Tc, ^{129}I, ^{3}H
West	0.95	4 mrem/yr beta-gamma 0-12 years	^{129}I, ^{3}H
Engineered Trenches	0.96	4 mrem/yr beta-gamma 12-100 years	^{99}Tc, ^{14}C, ^{129}I, ^{3}H
CIG Trenches	0.96	4 mrem/yr beta-gamma 122-1125 years	^{14}C, ^{3}H, ^{129}I
LAWV	0.92	4 mrem/yr beta-gamma	^{129}I, ^{14}C
ILV	0.82	4 mrem/yr beta-gamma 200-1100 years	^{129}I
NRCDA			
643-7E	0.26	10 mrem/yr Air	^{14}C
643-26E	0.13	10 mrem/yr Air	^{14}C

Unreviewed Disposal Question Evaluations and Special Analyses

22 UDQEs and Special Analyses since 2008 PA, for example:

- New operational stormwater runoff covers over Slit Trenches (WAC updated to reflect change in performance)
- Disposal of unique waste streams (e.g., HWCTR (next slide))
- Addressing new information (assumptions and parameter values)
- Engineered Trench 3
- Waste inventories

HWCTR Special Analysis: D&D Waste Management

- Heavy Water Component Test Reactor (HWCTR) vessel (1962 – 1964 operations)
  - *30 feet long by 8 feet diameter*
  - *Inventory – Ni-63 (3,300 Ci), Co-60 (170 Ci), Ni-59 (37 Ci)*
- Off-site disposal planned & shipping container being designed
- Performed scoping analysis - concluded on-site disposal worth considering
- Special Analysis for disposal in Slit Trench
  - *Source release from the activated metals estimated based upon their corrosion lifetimes*
  - *6 disposal options evaluated - 2 trench widths × 3 trench locations*
- Special Analysis Results
  - *Demonstrated defensible on-site trench disposal*
  - *Avoided packaging, transportation, and off-site disposal costs*

Path Forward for PA Update Scheduled for 2019

- Challenges: multiple disposal concepts, humid site, tight margins (SOF)
- Strategic Planning Team identifying and evaluating efficient approaches for implementation (DOE, Solid Waste, Environmental Compliance, SRNL)
  - 159 potential considerations for streamlining PA process
  - 38 specific work tasks identified for implementation (e.g., reusing unchanged documentation from 2008 PA, consolidation of data, improved screening, simplification of WAC, …)
  - PA Conceptual Model report being prepared in FY16 to implement recommendations
- General philosophy
  - Graded approach, adding detail only as needed
  - Utilizing best estimate and pessimistic values (concept of "most probable and defensible")
  - Hybrid approach using combination of deterministic and probabilistic modeling

Summary

- Integrated Team Approach for planning and implementation of PAs
- Graded approach to disposal results in added complexity (i.e., multiple disposal units)
- E-Area Slit Trench and Engineered Trench units optimized to tight performance margins not typical of other DOE LLW disposal facilities
- PA Strategic Planning team developed options for streamlining 2019 PAs, implementation being documented in PA Conceptual Model report in FY16
- Graded approach has proven beneficial for humid conditions at SRS
  - Four LAWV's would have been needed based on ET volumes received to date and waste forecasts through 2025 resulting in an estimated lifecycle capital cost savings of ~$120M
  - Special waste form modeling has enabled the SRNS to cost-effectively dispose of legacy wastes and to evaluate onsite disposal options for challenging waste streams.