LIQUID WASTE OPERATIONS OVERVIEW

Peter Hill
Beginning

- Request from President Truman to DuPont 1950
- SRP Site acquired 1951
- DuPont begins operations 1952
- WSRC assumes operations 1989
- SRR contract begins July 2009

THE WHITE HOUSE
WASHINGTON

July 25, 1950

Dear Mr. Greenewalt:

The Atomic Energy Commission has informed me that it has requested the DuPont Company to undertake the design, construction and operation of certain new facilities for the atomic energy program.

The Commission advises me that the Company has within its organisation technical, scientific, engineering, construction and operating staffs capable of handling a task of this magnitude. The great resources of your Company in these fields, together with the experience which it has acquired through the successful handling of the design, construction and operation of the Hanford Project during the War make it uniquely qualified to undertake this most essential task.

I want you to know that I consider this project as one of highest urgency and vitally important to our national security and defense.

Very sincerely yours,

Harry S. Truman

Mr. Crawford H. Greenewalt
President, DuPont Company
10Harvet Street
Wilmington, Delaware

RECEIVED
JUL 26 1950
C. H. Greenewalt
We do the right thing.
Facilities

- Site Construction begins Feb 1951
- D-Area — Heavy Water, operations begin Aug 1952
- M-Area — Fuel & Target Fab, slugs produced Dec 1952
- 100 Areas — R Reactor goes critical Dec 1953
- 200 Areas — Separations
  - 221-F operations begin Nov 1954
  - 221-H operations begin Jul 1955
- Tank Farms —
  - F-Area Tanks 1-8 built 1951-1953, received first waste 1954
  - H-Area Tanks 9-12 built 1951-1953, received first waste 1955
Tank Waste Sources—Pu-239 Recovery
F-Canyon - PUREX Process

- Pu-239 recovery
  - Depleted uranium targets dissolved in nitric acid and processed through solvent extraction
  - Acidic waste stream evaporated and neutralized with sodium hydroxide
  - High amounts of radioactivity (fission products)
H-Canyon and Tank Farm

We do the right thing.
- **U-235 / Np-237 recovery**
  - Uranium fuel dissolved in nitric acid and processed through solvent extraction
  - Acidic waste stream evaporated and neutralized with sodium hydroxide
  - High amounts of radioactivity (fission products)

- **Pu-238 recovery**
  - Neptunium targets dissolved in nitric acid and processed through solvent extraction
  - Acidic waste stream evaporated and neutralized with sodium hydroxide
  - High amounts of radioactivity (fission products)
Type III Tank Under Construction

Tanks are built at grade and then backfilled with dirt to provide shielding.
LWO Mission

- Safely receive and store liquid radioactive waste
- Process that waste into stable, inert solids
- Operationally close the tanks
High-Level Waste Facilities

170 acres
3 miles in length

Saltstone Processing/Disposal Facilities

H-Tank Farm
- 29 tanks
- 2 evaporators (2H & 3H)
- Volume reduction and pre-treatment occurs in H Area

Inter-Area Line
- 2.2 miles
- Pump pits at each end
- Diversion boxes at each end and at high point in the middle

F-Tank Farm
- 22 tanks

Effluent Treatment Facility
We do the right thing.

H-Canyon

Sludge

Waste Receipt Tank

SRS Tank Farm Operations
We do the right thing.

SRS Composite Inventory

Volume

- Salt Supernate: 17.5 Mgal (49%)
- Saltcake: 15.9 Mgal (44%)
- Sludge: 2.6 Mgal (7%)

36.0 Million Gallons (Mgal)

Curies

- Salt Supernate: 110 MCi (44%)
- Saltcake: 122 MCi (49%)
- Sludge: 128 MCi (51%)

250 Million Curies (MCi)

Inventory values as of 2015-12-31
We do the right thing.

Sludge
Sludge Stored in a Waste Tank

- Insoluble solids contained in the waste
- Settles to the bottom of a tank
- Consistency of thin peanut butter
- 7% of volume (2.6 million gallons)
- 51% of radioactivity (128 million curies [Ci])

Hydrogen (generated from radiolysis) bubbles up through the sludge
Salt Stored in a Waste Tank

- Liquid portion of the waste
- Contains dissolved salts
- Stored in three forms
  - Decanted liquid ...
    - Supernate
  - After evaporation ...
    - Concentrated Supernate
    - Salt Cake (crystallized out of solution)
- 93% of volume (33.4 million gallons)
- 49% of radioactivity (122 million curies)
- Primarily Cesium-137
SRS Tank Farm Operations

We do the right thing.

H-Canyon

Waste Receipt Tank

Evaporator System

Feed Tank

Overheads (to Effluent Treatment Facility)

Evaporator

Saltcake

Concentrate Salt Solution Storage Tank

Concentrate Supernate

Canisters to Federal Repository

Sludge Processing Tank

Sludge Slurry

Sludge

DWPF

Concetrated Supernate

SAVANNAH RIVER SITE • AIKEN, SC • www.SRRemediation.com
Existing 13.8 kV Service

Portable 2500 kVA Substation

Mobile Waste Removal Control Center

Waste Tank
Tank Closure Plan

- Bulk Waste Removal
  - Mechanical Heel Removal
    - Chemical Cleaning
      - Annulus Cleaning / Cooling Coil Flushing
        - Sampling
Tank 5 - Chemical Cleaning Results

Coil now exposed

2006 2008
Tank 5 - Chemical Cleaning Results
Tank Cracks...

Resulted in Waste Leaking into Annuli of 12 Tanks

- Primary Tank Wall
- Crystallized Salt Supernate
- 5 foot Annulus Pan
• Wall Crawler used to clean and inspect Tks 5 & 6 annulus wall (Tank 5 ~ 10 gallons of salt - Tank 6 ~ 90 gallons of salt)
We can get some tanks nearly clean

12” x 12” x ⅜” construction plates

July 16, 1996
Tank Closure

Tank 12 Bulk Fill – 34.8 % Complete

Type I Tank Profile View

Type I Tank Plan View

GROUT DELIVERY NUMBERS
Total Volume ≈ 4,529 yd³
8 yd³ per Truck
8 Trucks per Hour (max)
Pour 7 Hrs each 10 Hr Day
≈ 336 yd³ per Day (max)
4 Days per Week

NOTES
This Week
No safety events this week.
94,118 gallons of grout – 867.5 cubic yards of grout – 99 trucks

Tank 12 Total To Date
No safety events
318,408 gallons of grout
1,578.5 cubic yards of grout
199 trucks

GROUT LIFTS

Grouting Risk Tracking

- Weather Delays – 2 hr delay, each of 3 days total to date, due to cold weather. 2 days lost to rain. Total weather delays to date 26 hours (2 work days, and 6 hours).
- Grout Delivery Issues – Only 6 trucks in the rotation days 2 and 4 of grouting delayed progress. 3 trucks rejected due to out of spec flow/spread on 2/10.
- Readiness Rework – none to date
- Annulus / Coil Fill Issues – none to date
- Equipment Issues – none to date
- Resource Limitations – none to date
- In-process Inspections Delays – none to date
- Grout Flowability Issues – none to date
Grouting
We do the right thing.

Evaporator System

- Feed Tank
- Evaporator
- Concentrate Receipt Tank
- Overheads (to Effluent Treatment Facility)
- Saltcake
- Concentrated Supernate
- Concentrate Salt Solution Storage Tank
- Canisters to Federal Repository
- Sludge Processing Tank
- Sludge Slurry
- Sludge
- Waste Receipt Tank
- H-Canyon
- SDU
- Lower Curie Salt Sol'n
- Salt Processing Tank
Evaporator System

H-Canyon

Waste Receipt Tank

Feed Tank

Overheads (to Effluent Treatment Facility)

Evaporator

Saltcake

Concentrate Receipt Tank

Concentrate Salt Solution Storage Tank

Canisters to Federal Repository

Salt Processing Tank

Sludge Processing Tank

Sludge Slurry

Sludge

SDU

MCU

ARP

Lower Curie Salt Sol'n

Concentrated Supernate

SRS Tank Farm Operations

We do the right thing.
ARP - Actinide Removal Process
DWPF - Defense Waste Processing Facility
MCU - Modular CSSX Unit
SPF - Saltstone Processing Facility
SDF - Saltstone Disposal Facility
This is the Main Menu, click on any of the ITEMS below. To Exit the CD press the “Esc” key on you keyboard at any time.

- **How it Works**
  - Separation
  - Mix and Separate
  - Multi-Stage Process
  - Clean In Place

- **See the Models**
  - V02 - (0.5 GPM)
  - V05 - V20 (6.0 - 200 GPM)

- **Information (PDF Docs)**
  - Articles
  - Brochure
  - Manuals
  - Tech Bulletins
  - Model Specifications

- **General Information**
  - CINC Presentation
  - About CINC
  - Contact CINC

- **Maintenance**
  - V02 - (0.5 GPM)
  - V05 - V20 (6.0 - 200 GPM)
  - V05 - TA (Take-Apart Rotor)
  - V10 - TA (Take-Apart Rotor)

- **Application Animations**
  - V02 - Examples
  - V05 - Examples
Utilities (by SRR)
(i.e., electricity, water)

Tank Closure
Cesium Removal (TCCR) Unit

Spent treatment media

Interim Safe Storage

containment

Dissolved salt

Tank 10H

Tank 11H

Tank 50H

TCCR
SRS Tank Farm Operations

We do the right thing.

Evaporator System

- Feed Tank
- Concentrate Receipt Tank
- Concentrated Supernate
- Saltcake
- Overheads (to Effluent Treatment Facility)
- Salt Solution
- SDU
- Canisters to Federal Repository
- Concentrate Salt Solution Storage Tank
- Swell Ammonium Perchlorate Filtration (SWPF)
- Sludge Processing Tank
- Sludge Slurry
- Waste Receipt Tank
- H-Canyon
- Evaporator
Saltstone Facility

- **Saltstone Disposal Facility**
  - Engineered disposal facility
  - Low water permeability
  - Excellent non-leaching qualities
  - Non-hazardous product

- **Saltstone Production Facility**
  - Aqueous waste mixed with flyash, slag and cement

We do the right thing.
We do the right thing.
Saltstone Flow Diagram

SFT: Salt Feed Tank
SSRT: Salt Solution Receipt Tank
SDU: Saltstone Disposal Unit

We do the right thing.
DWPF receives waste for processing from H Tank Farm. The waste is “vitrified” and poured into stainless steel canisters that are sealed and decontaminated.
We do the right thing.

H-Tank Farm (Tank 40)

DWPF Chemical Processing

Chemical Addition

MFT

SME

SRAT

Glass Waste Storage Building

Glass Melting

Canister Cleaning

Welding

Largest Vitrification Plant in the World
Melter
DWP F Canister

Filled Canister

Materials: 304L Stainless Steel
Empty Weight: 1,150 lbs.
Glass Weight: 4,000 lbs.
Shielded Canister Transporter

- Canisters
  - Filled
  - Cleaned
  - Sealed . . .

Ready for Transport
Glass Waste Storage Building #1 provides earthquake-resistant, safe interim storage for radioactive waste canisters

Glass Waste Storage Building #2 provides interim storage for an additional 2500 canisters
Interim Canister Storage - Double Stack (ICS-DS) Concept for GWSB1

- Two canisters per location (vs. one can per location)
- Lower canister on support plate on vault floor (vs. cross bar support 3’ off floor)
- Upper canister placed directly on top of lower canister
- Upper canister extends into operating deck floor, but remains below grade
- Shield plug redesigned for equivalent radiological protection
Inside vault looking across rows of canister supports

Inside canister storage location

- Minimum Opening in floor is 27 inch ID
- Cross Bar Assembly is 1 ½ inch x 3 inch galvanized carbon steel bars
- Cross Bar Assembly~ 18 ft down with 30 inch OD
- 2 sets of guides (3 tabs each) to guide canisters
- Bottom guides sit 5 inches above cross bar assembly
Proposed Modifications

Single Stack (Current)

Double Stack (Modified)
Operational Highlights

- 51 Tanks
  - 7 grouted & closed
  - 1 being grouted
  - 4 bulk waste removed
  - 64% empty (old style)
  - 22% empty (new style)

- Poured 4,030 cans of projected 8,582
- 18.3 Mgal grout dispositioned containing 413 kCi
- 8.5 Mgal salt waste treated

Legend:
- ARP: Actinide Removal Process
- DWPF: Defense Waste Processing Facility
- MCU: Modular Caustic Side Solvent Extraction Unit
- SWPF: Salt Waste Processing Facility