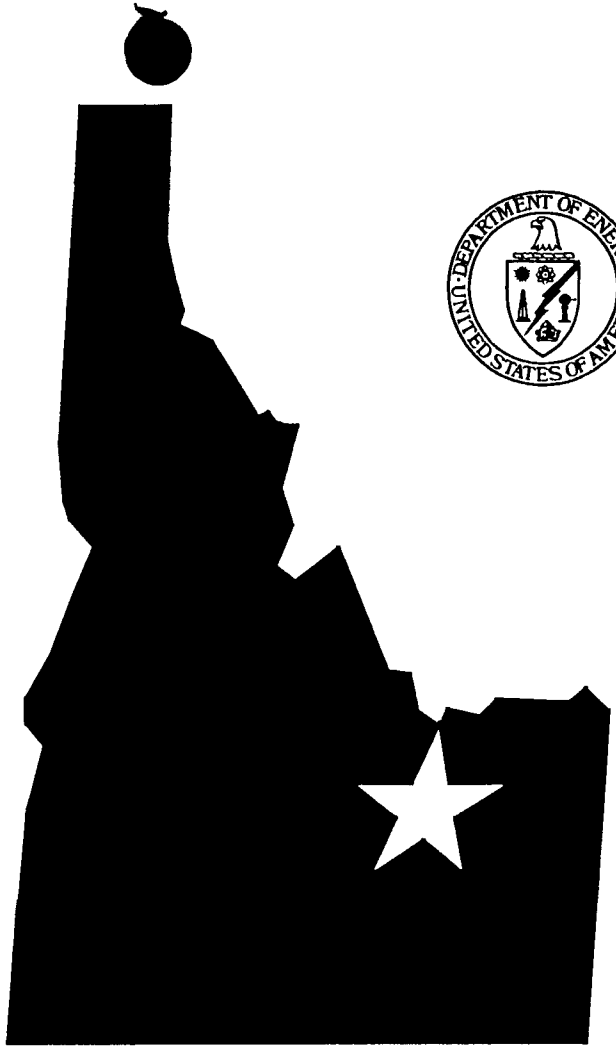
Idaho
National
Engineering
Laboratory

Spent Fuel and High Level Waste Management Operations at INEL

May 13, 1992

Michael J. Bonkoski



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Presentation Outline

I. Spent Fuel & Waste Management Mission

A. Idaho Chemical Processing Plan (ICPP)

1. Process Flow
2. Regulatory Issues
3. Ft. St. Vrain

B. Three Mile Island Program

C. Office of Civilian Radioactive Waste (RW) Program

II. Spent Fuel types & sources

III. Transition planning

Mission Change

On April 29, 1992 the Secretary of Energy announced that reprocessing at the Idaho Chemical Processing Plant would be phased out.

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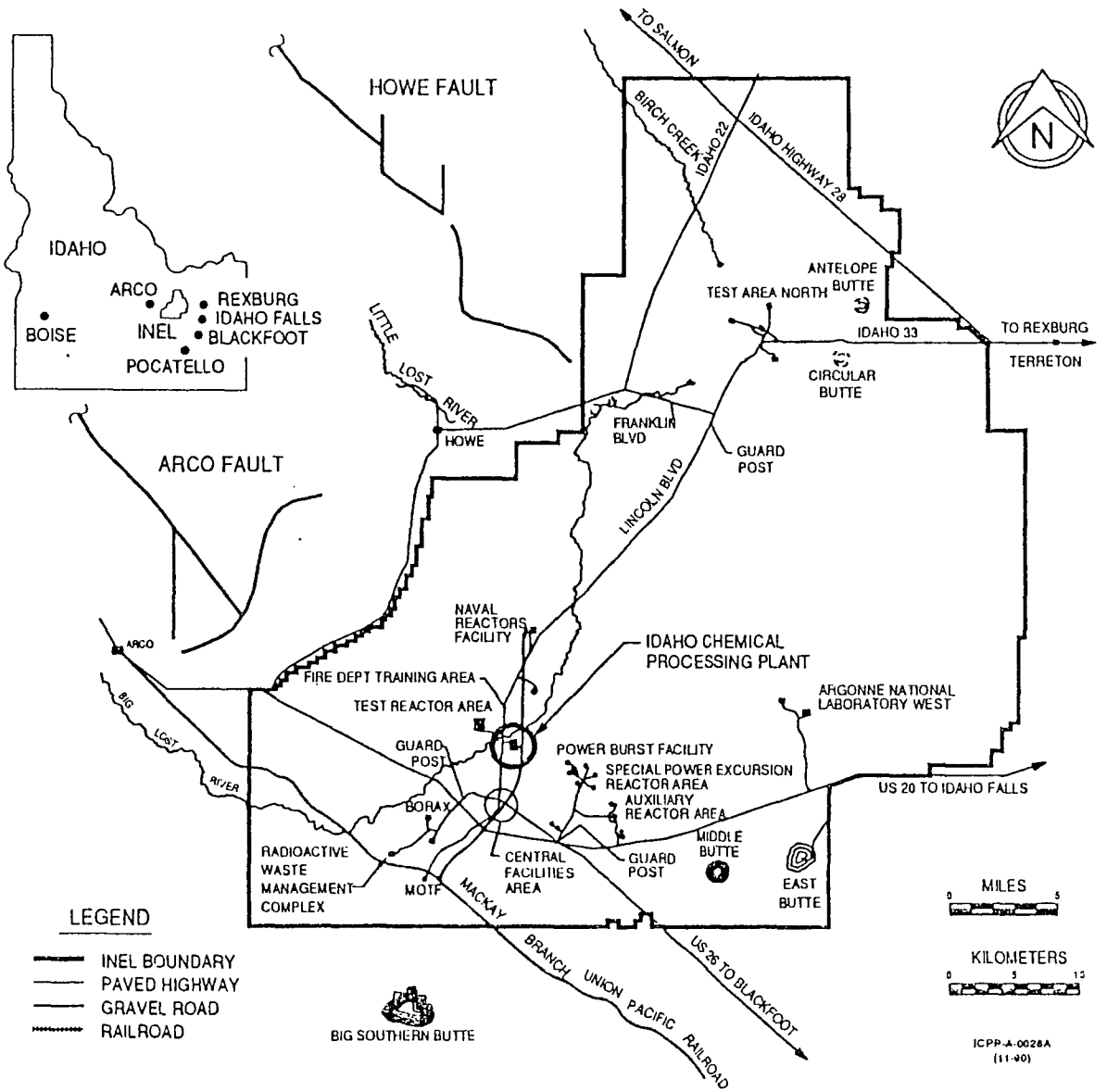
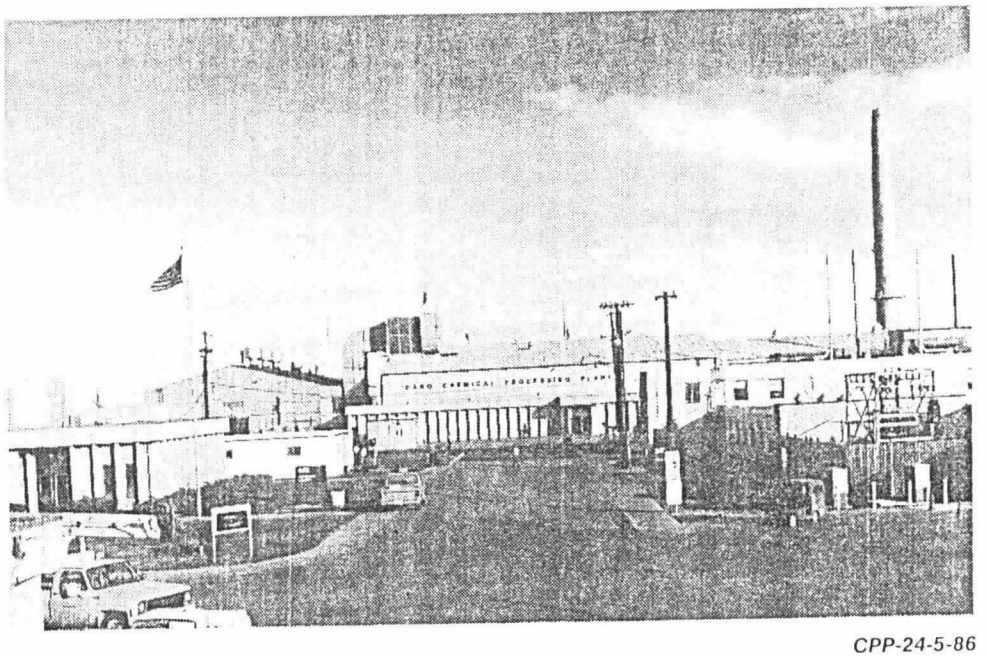


Idaho Chemical Processing Plant

- Construction began 1949
- Spent fuel reprocessing 1953
- Solidify liquid high level radioactive waste by calcining 1963
- Facility upgrade 1980's



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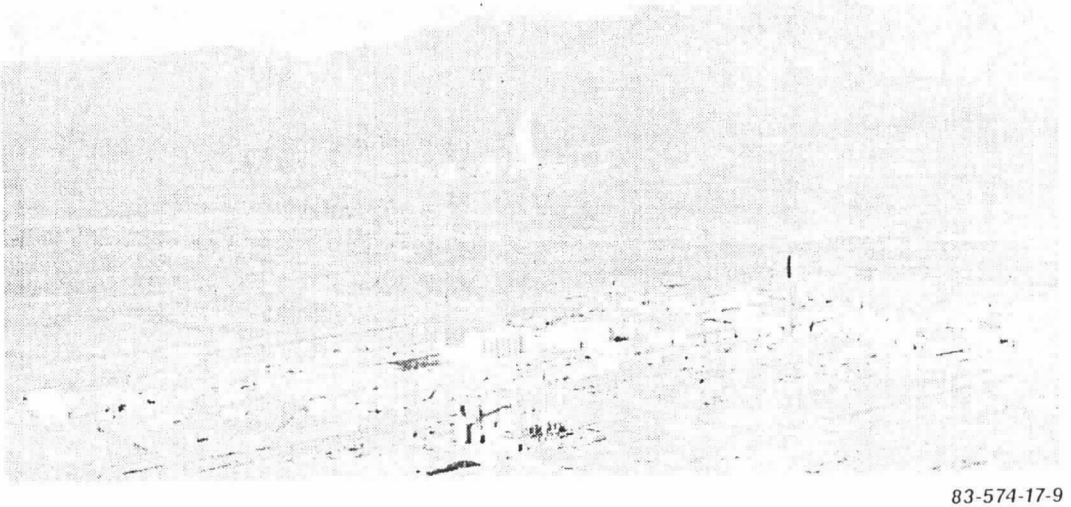
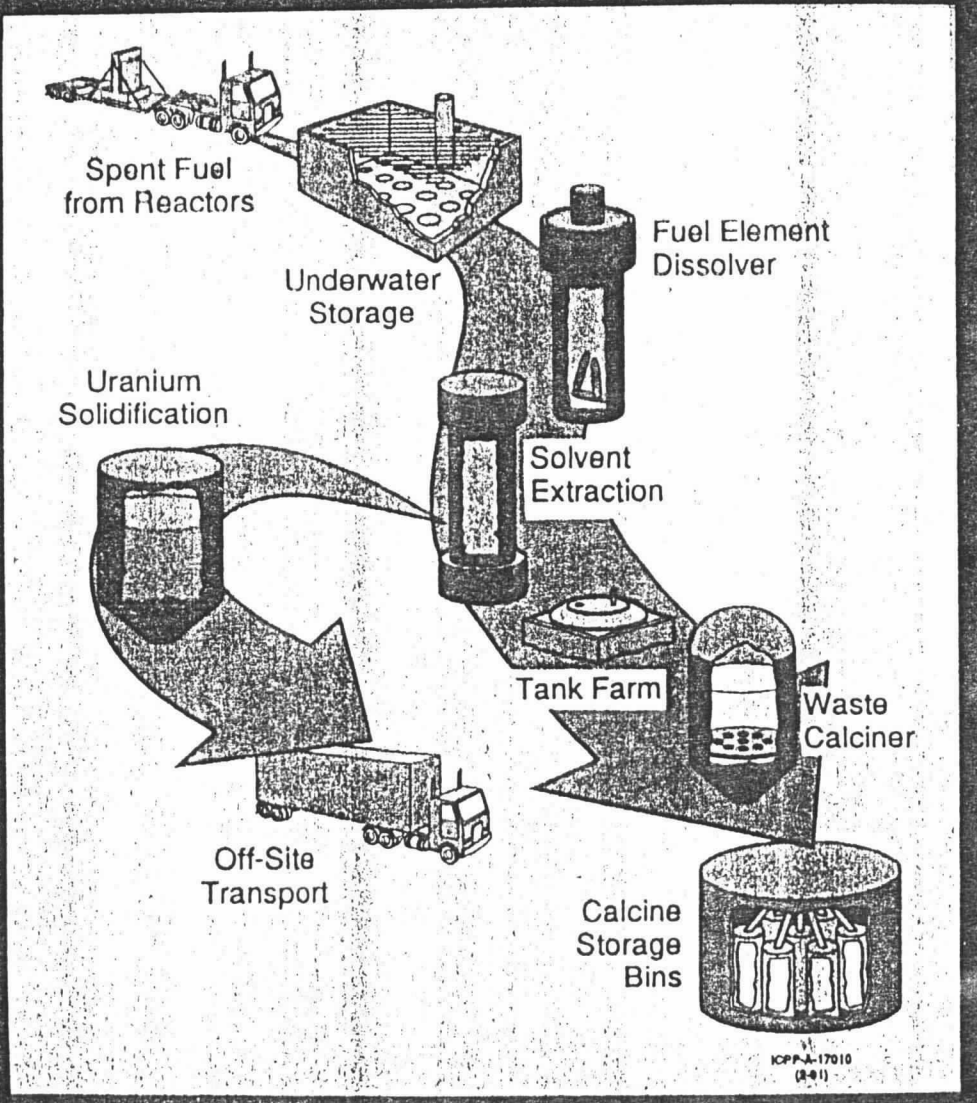


83-574-17-9

ICPP-S-13029
(2-87)

ICPP Mission

- Operate in a manner that protects the safety of our employees, the public and the environment
- Reprocess Naval fuel in a safe and cost effective manner
- Receive, store, and reprocess other DOE-assigned fuels
- Recover highly enriched uranium (U-235) and special isotopes (Kr-85)
- Manage radioactive and hazardous wastes



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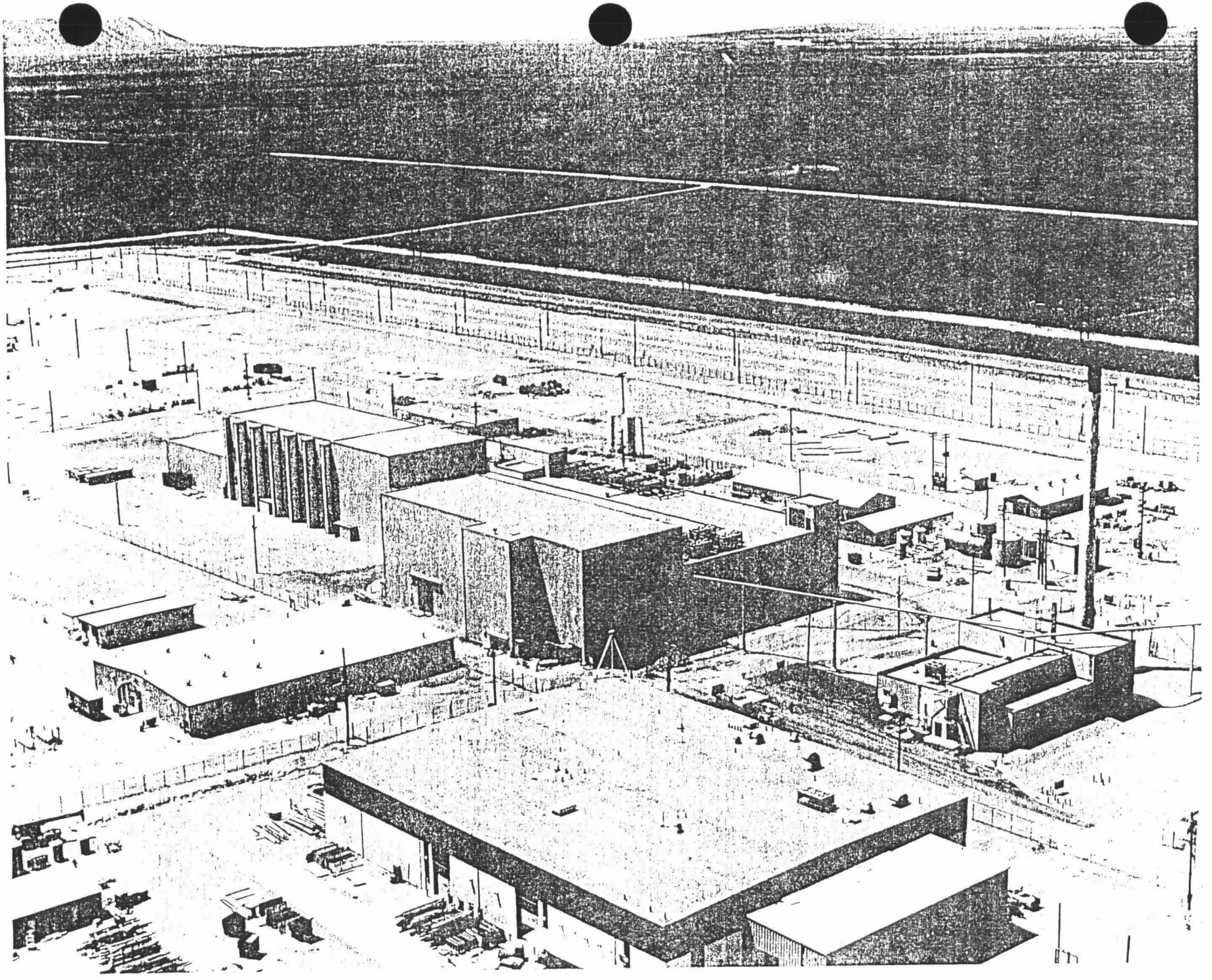
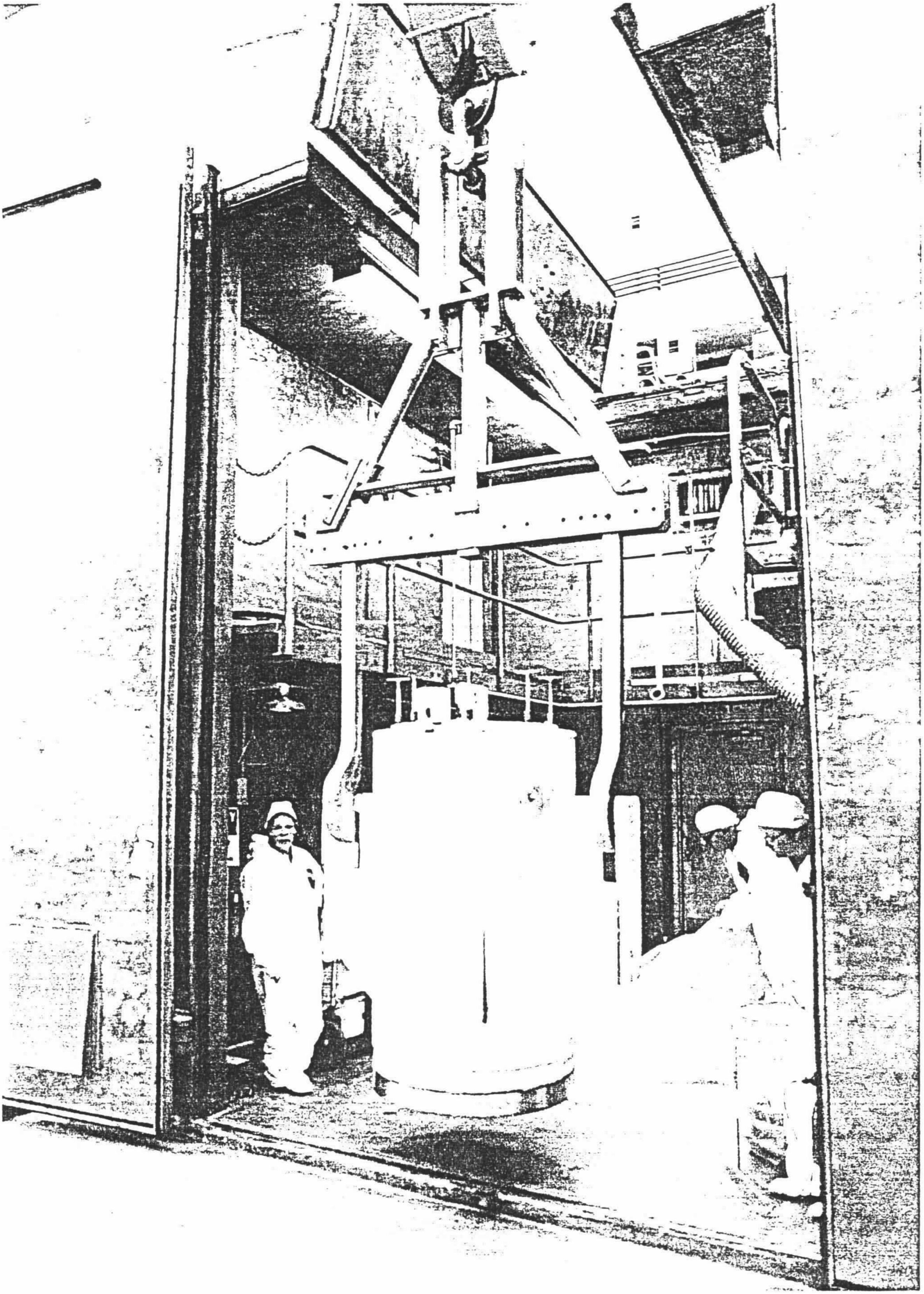
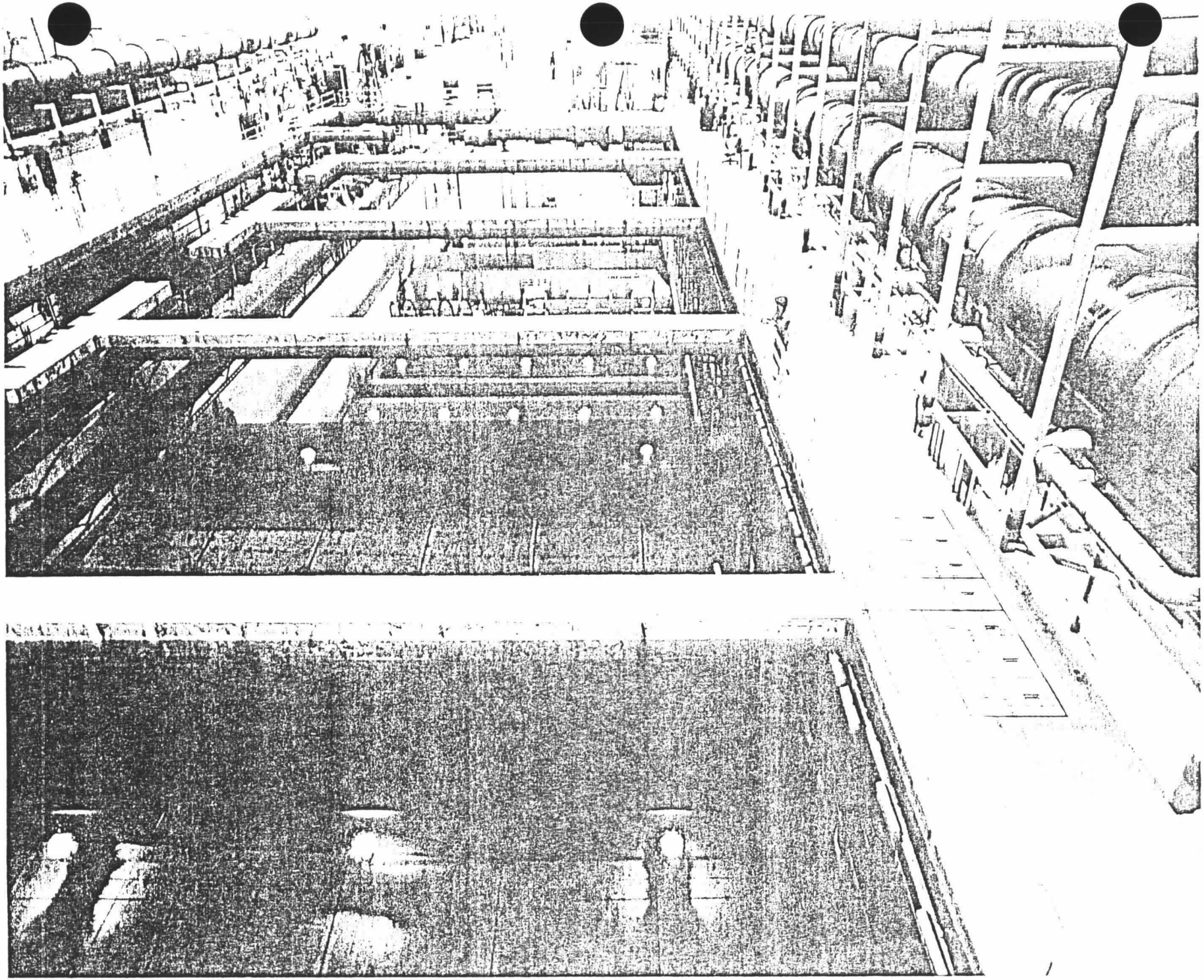
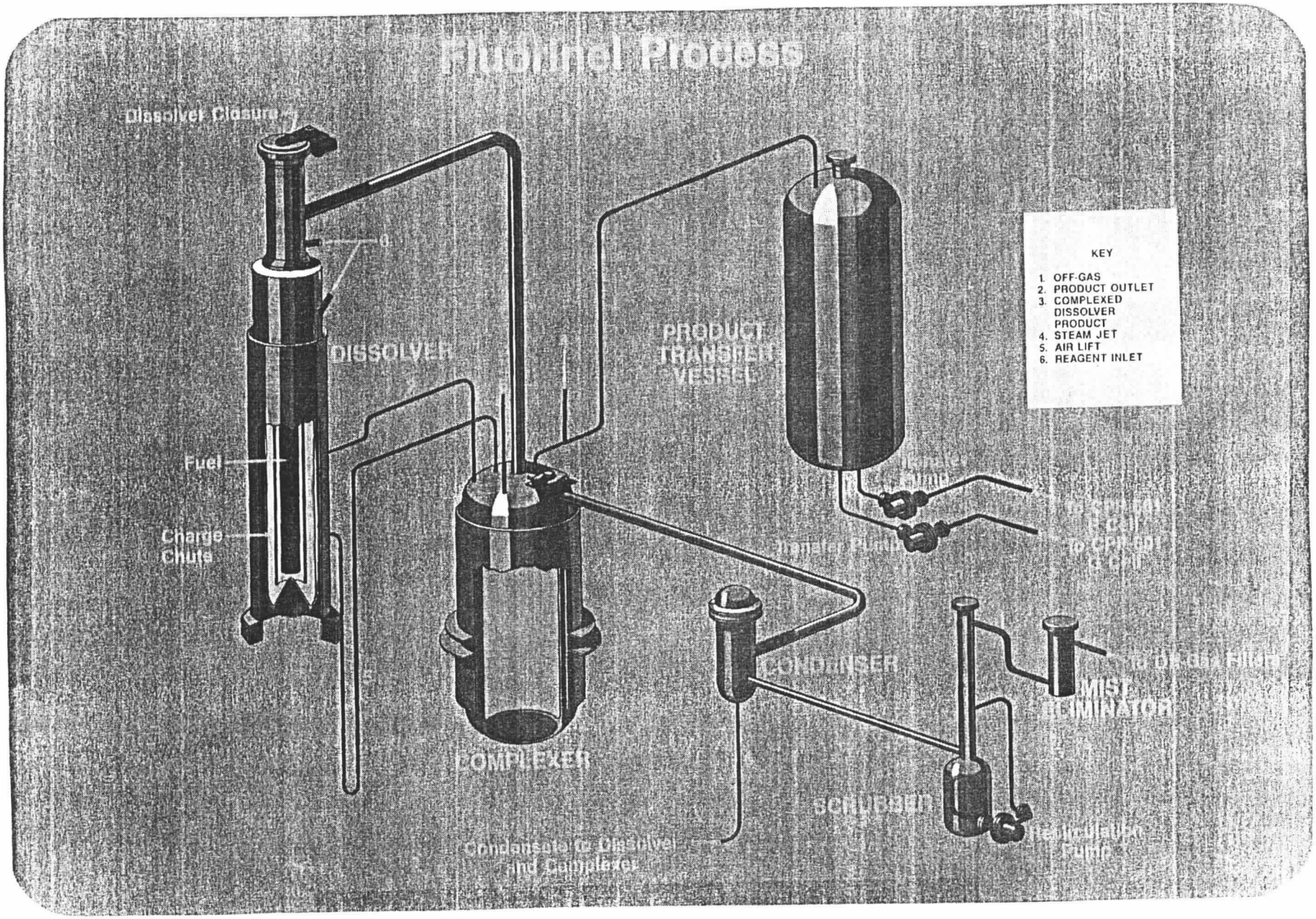
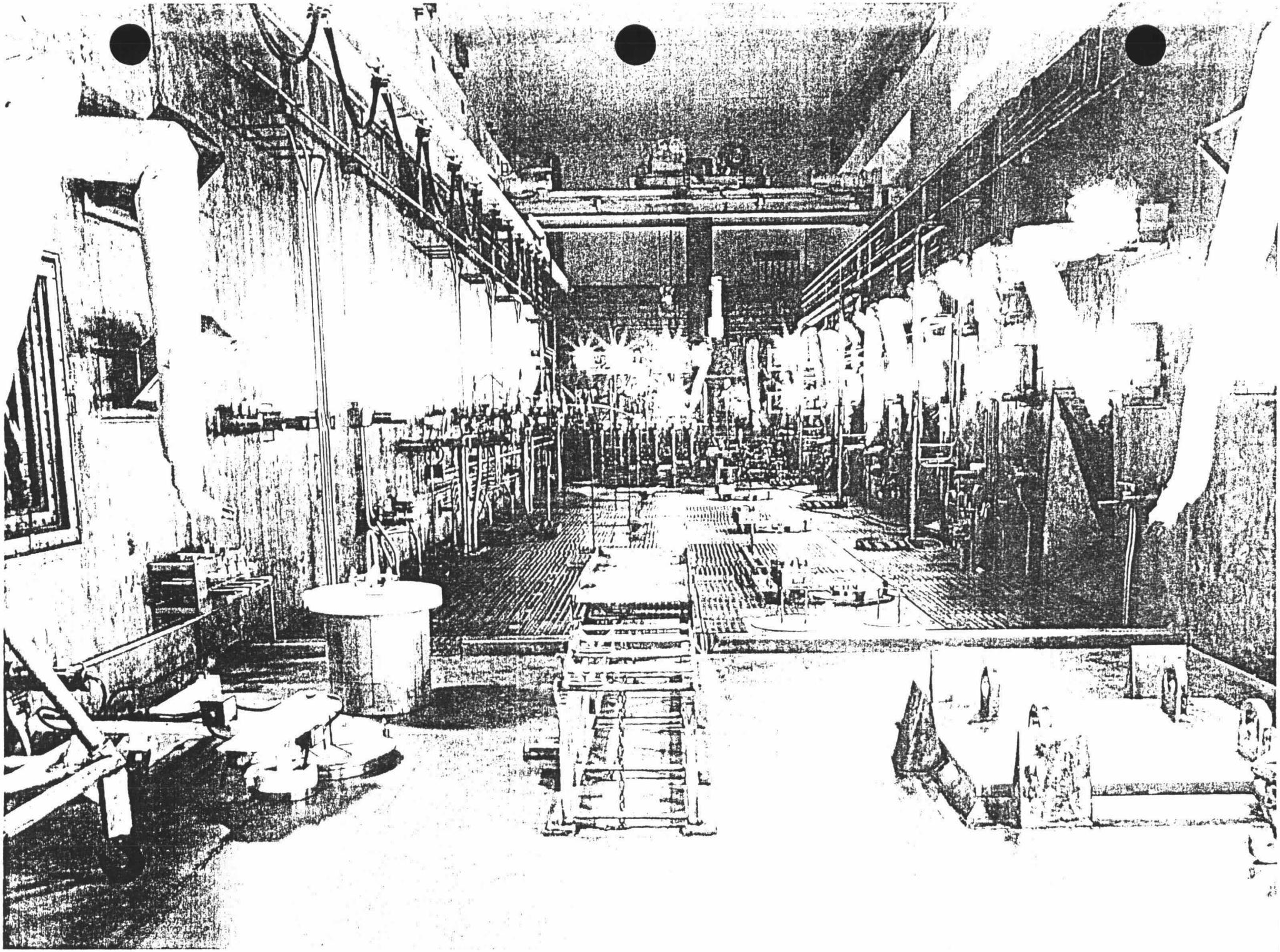


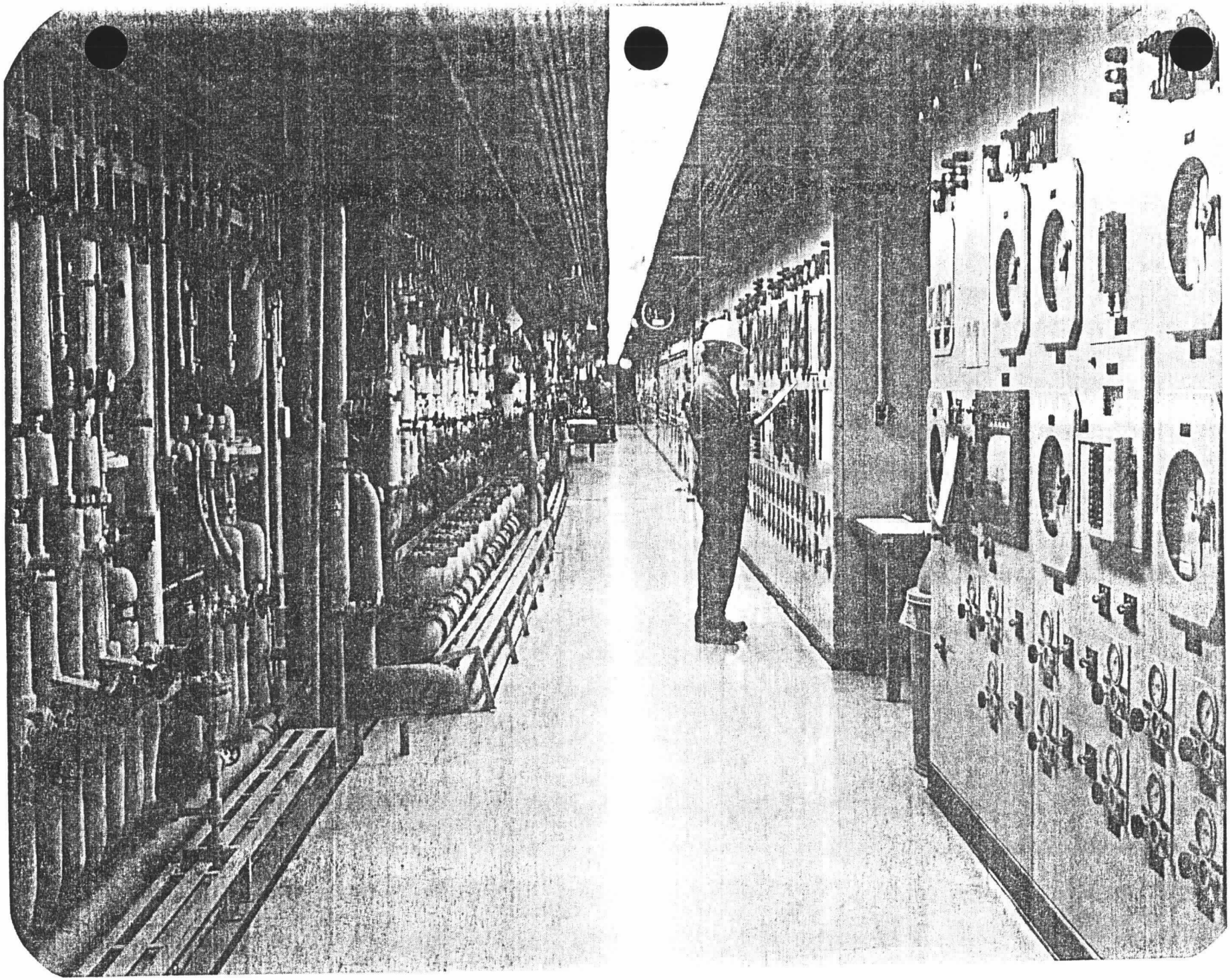





Fluorinel Process
Dissolver Closure
DISSOLVER
Fuel
Charge Chute
PRODUCT TRANSFER VESSEL
KEY
1. OFF-GAS
2. PRODUCT OUTLET
3. COMPLEXED DISSOLVER PRODUCT
4. STEAM JET
5. AIR LIFT
6. REAGENT INLET
CONDENSER
MIST ELIMINATOR
COMPLEXER
SCRUBBER
Condensate to Dissolver and Complexer



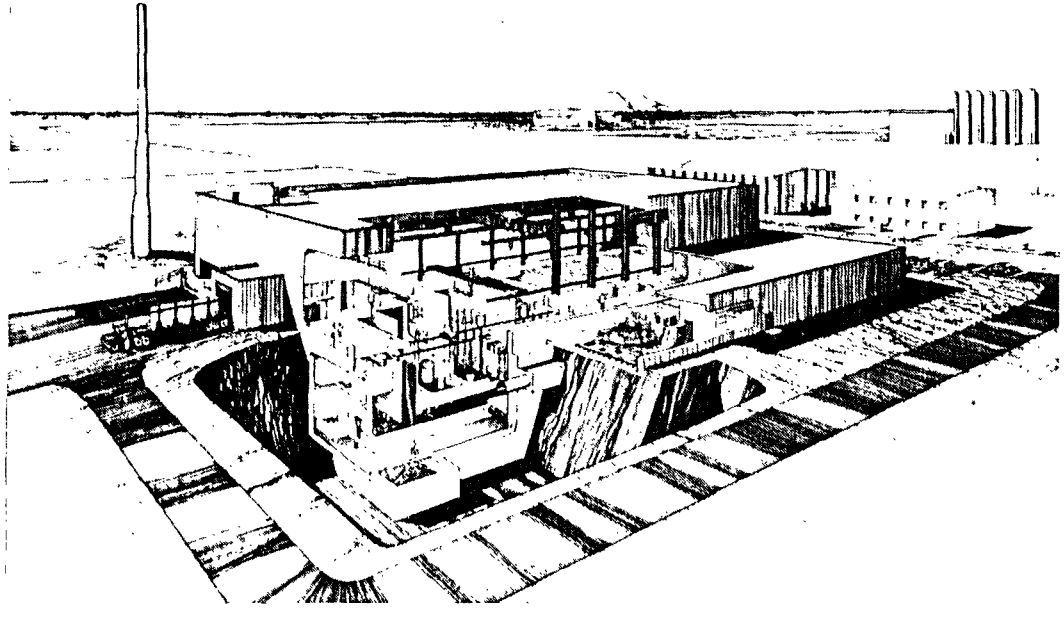
FAST Main Control Room



CPP-601 FUEL PROCESSING FACILITY

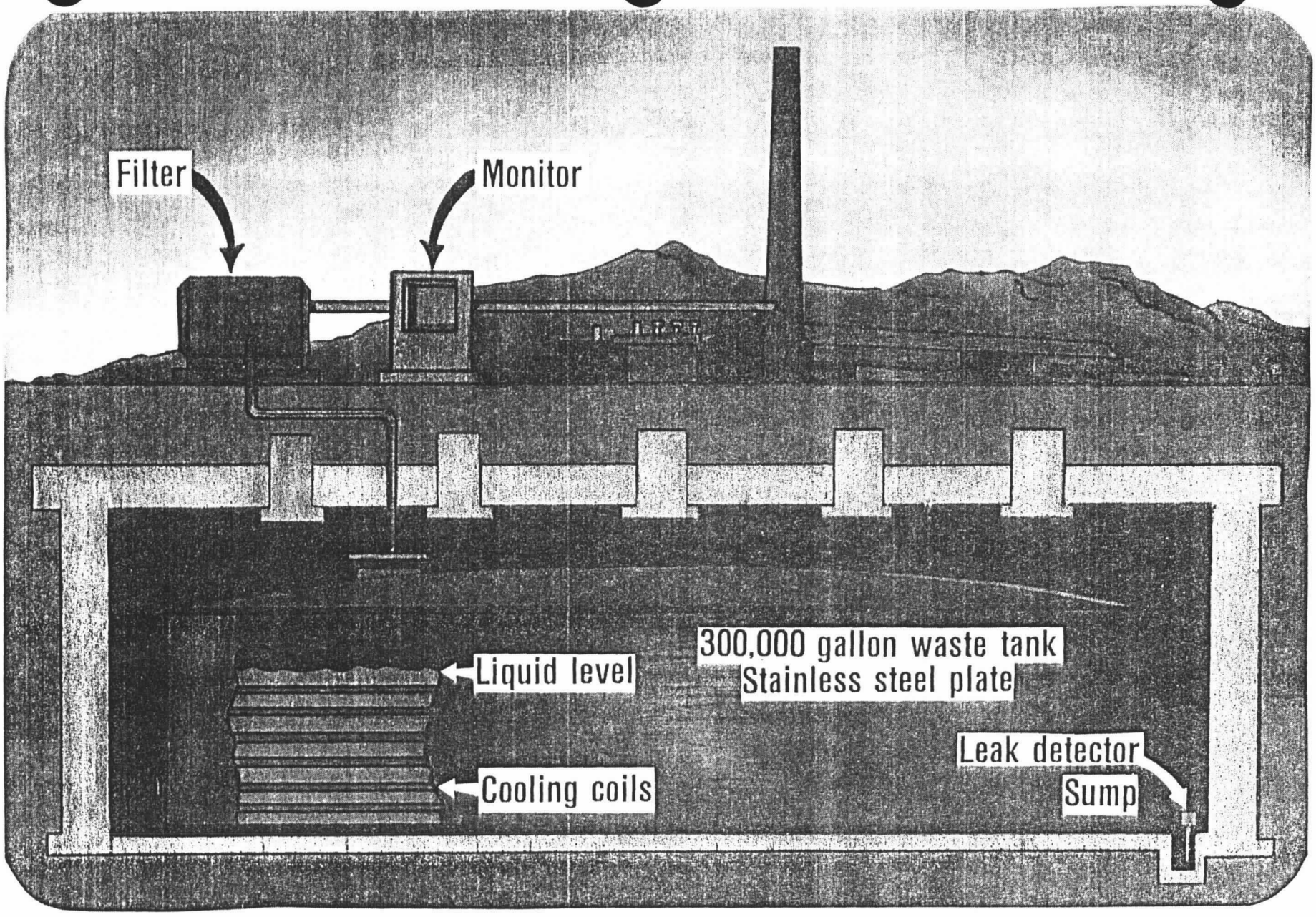
Fuel Process Restoration Facility (FPR)

- Groundbreaking initiated April 1986
- 70% on-line availability
- 16 Kg of uranium per day design capacity
- Remote maintenance and operation
- Safety and environmental control



84-238-1-1

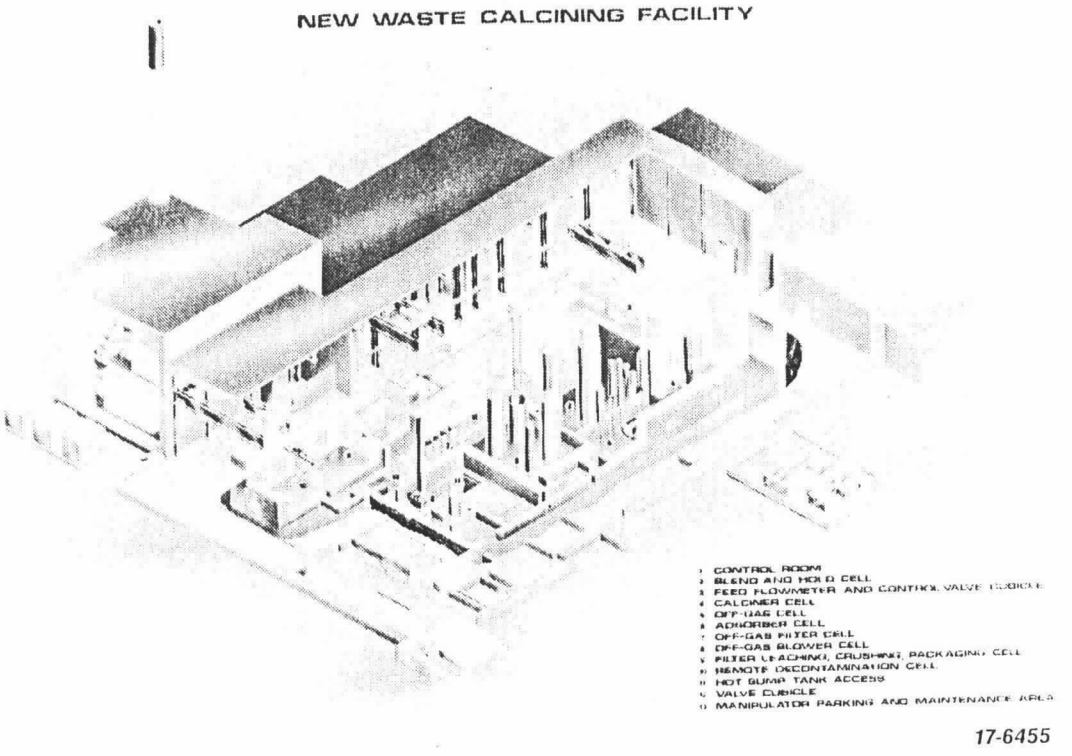
ICPP-S-13036
(5-88)



HIGH LEVEL WASTE STORAGE TANK

New Waste Calcining Facility (NWCF)

- Began hot operations September 1982
- 3000 gallon per day design capacity
- Remote operations and maintenance
- Automated data collection
- 90% of facility devoted to effluent treatment



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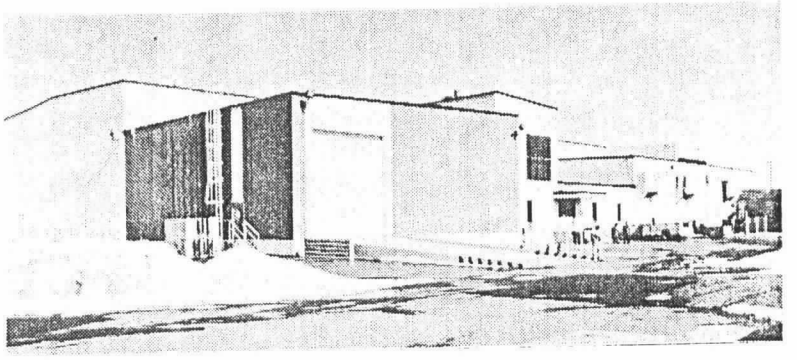

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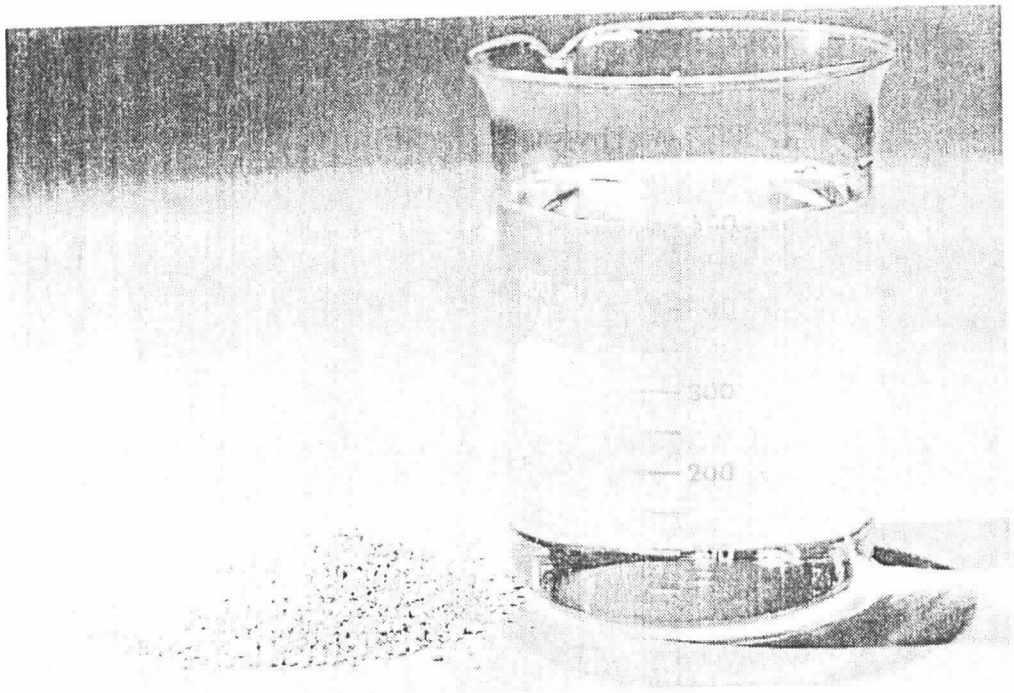
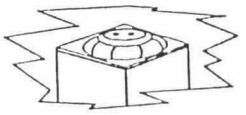
ICPP-S-13028
(6-87)

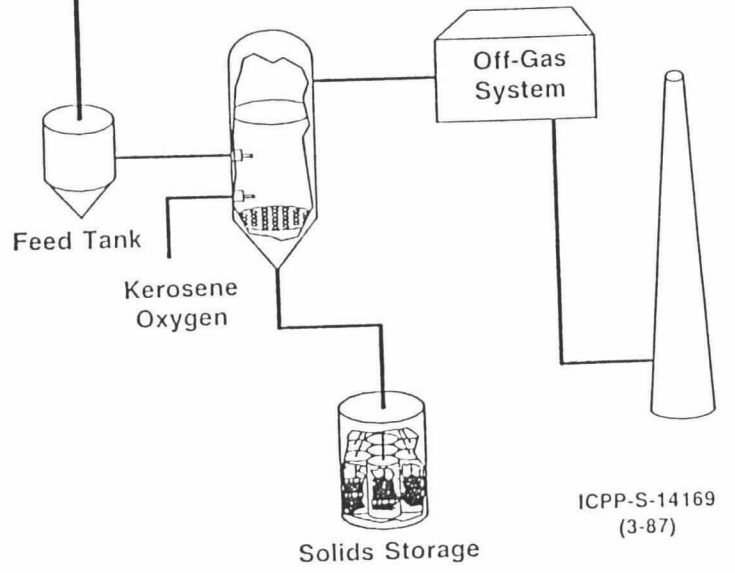
Calcining Process

- Conversion of liquid, high-level radioactive waste to solid by calcination (high temperature drying) process.
- Fluidized bed produces solidified granular high-level radioactive waste.
- Pneumatic transfer of solid waste to bin set storage.
- Sophisticated effluent cleanup system.





THE CALCINING PROCESS . . .



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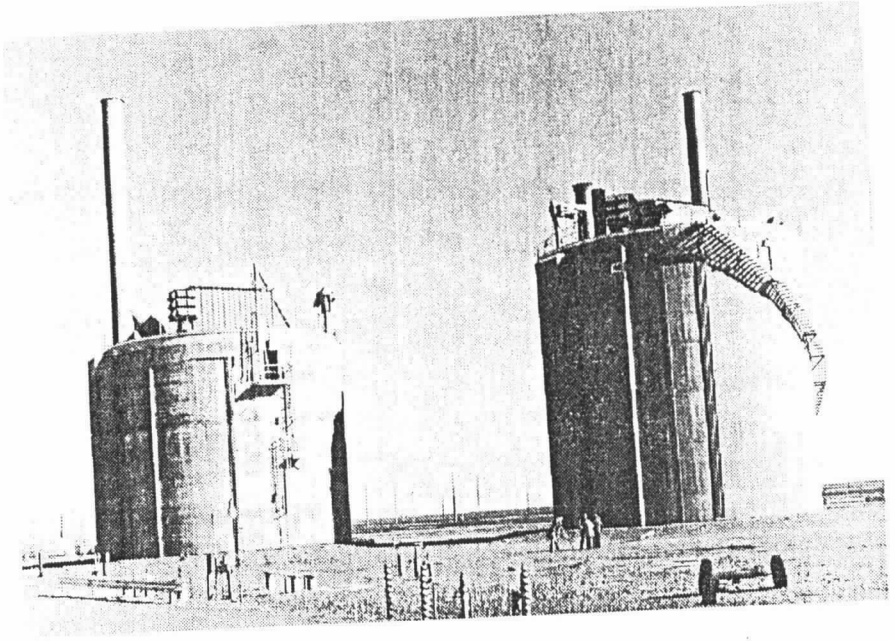
(6-87)

Calcined Waste Management

- Safer waste form
- Volume reduction
- 500 year retrievable storage
- Construction emphasis on safety
- Continuous monitoring



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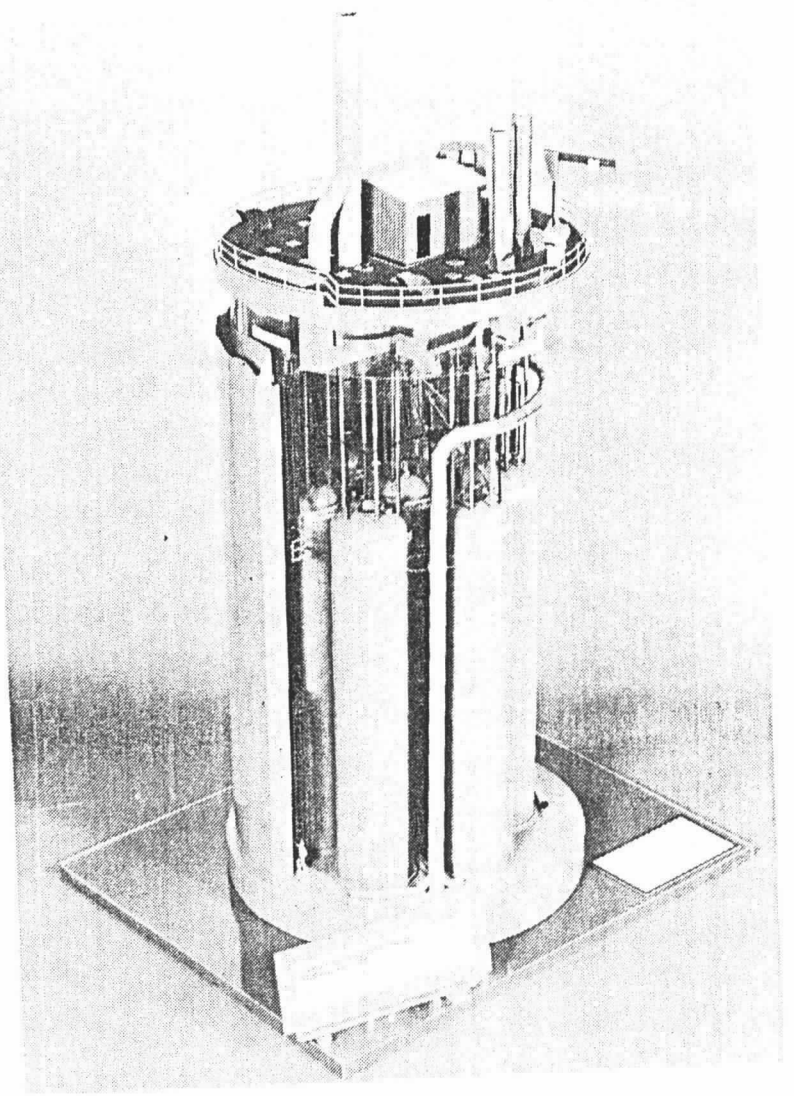

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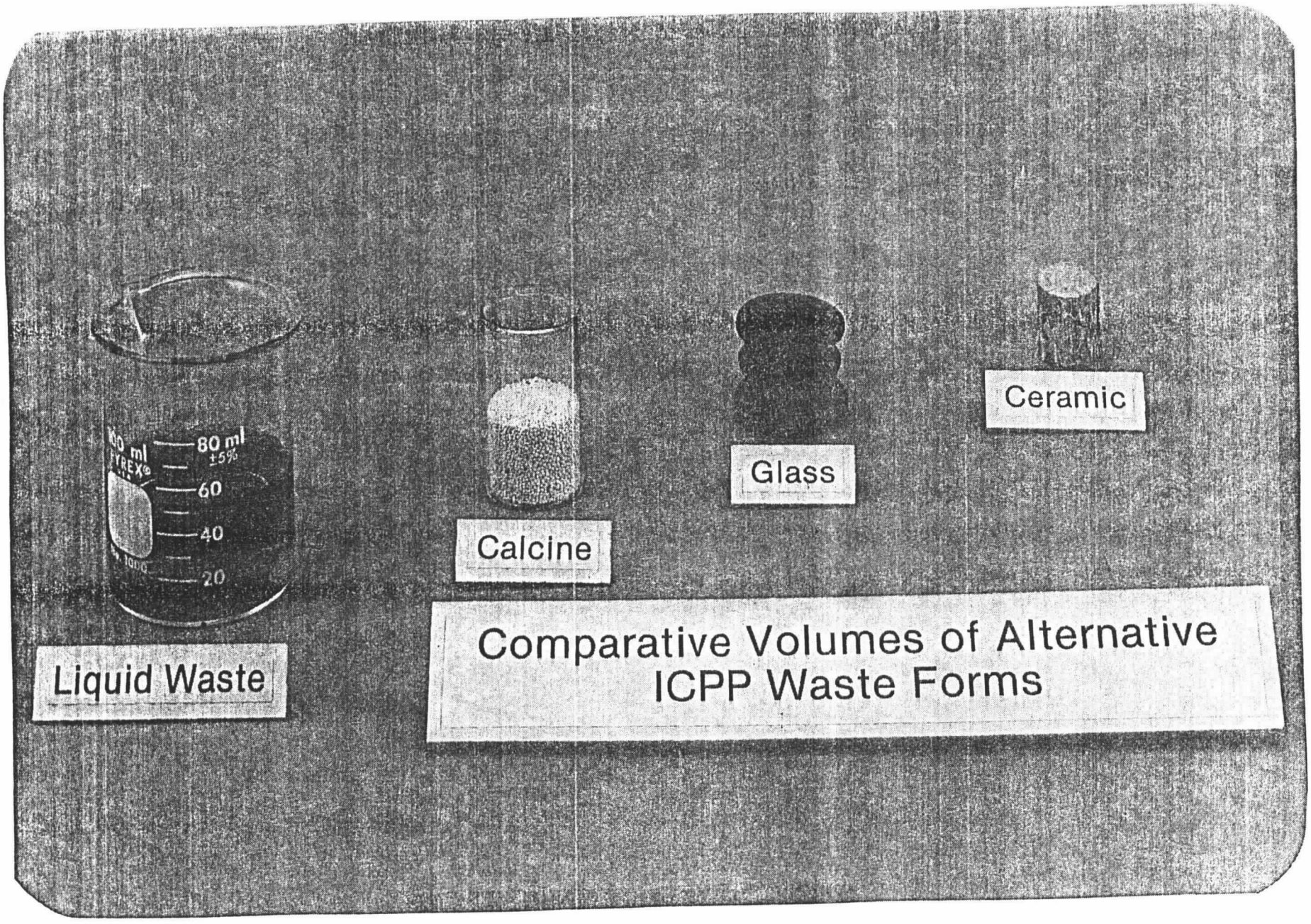

Liquid Waste
Calcine
Glass
Ceramic
Comparative Volumes of Alternative
ICPP Waste Forms

Consent Order Requirements:

- Cease Use Of Or Come Into Compliance (Pillar And Panel Tanks) -- 2009

- Cease Use Of Or Come Into Compliance (Non-Pillar And Panel Tanks) -- 2015

- Cease Use Of Or Come Into Compliance (Ancillary Equipment) -- 1993,1995, 2009, 2015

Project Objectives

- Replace Five Seismically Deficient Tanks/Vaults
- Upgrade Waste Transfer Lines, Valve Boxes And Piping
- Install Equipment To Place Old Tanks In Less-Threatening Condition
- Resolve Project Portion Of NON Violation No. 20
- Meet All Applicable DOE, State And Federal Requirements

Background

- 11 Existing (1 Spare) Tanks/Vaults: 1950 - 1964

- 5 Tanks/Vaults Being Replaced (Highest Risk)
  - Vaults Do Not Meet INEL Seismic Criteria
  - Vaults Do Not Meet RCRA Requirements

- Seismic Upgrade Alternatives Reviewed
  - WINCO/DOE-ID Concluded Not Feasible
  - Concurred With By HLW Tanks Safety Task Force

- Additionally: Waste Transfer Lines, Valve Boxes, And Piping Do Not Satisfy RCRA Requirements

High Temperature Gas-Cooled Reactor
Significant Events

1950-60s	AEC's "Power Demonstration Program" constructs experimental and technology demonstration reactors
1965	Three Party Agreement (AEC, PSC, and GD) signed to demonstrate HTGR Technology
1966	FSV design begins
1968	FSV reactor construction begins
1972	FSV Final EIS and FSAR issued
1973	FSV reactor construction ends
1976	FSV initial power generation
1979	FSV begins commercial operation

AG1 0282

High Temperature Gas-Cooled Reactor
Significant Events

1980 - Contract DE-SC07-79ID01370 signed to implement in part the original agreement

- DOE agrees to take eight segments of FSV fuel

- Shipment of FSV fuel to INEL begins

1981 FSV achieves 100% power

1989 Reactor shuts down

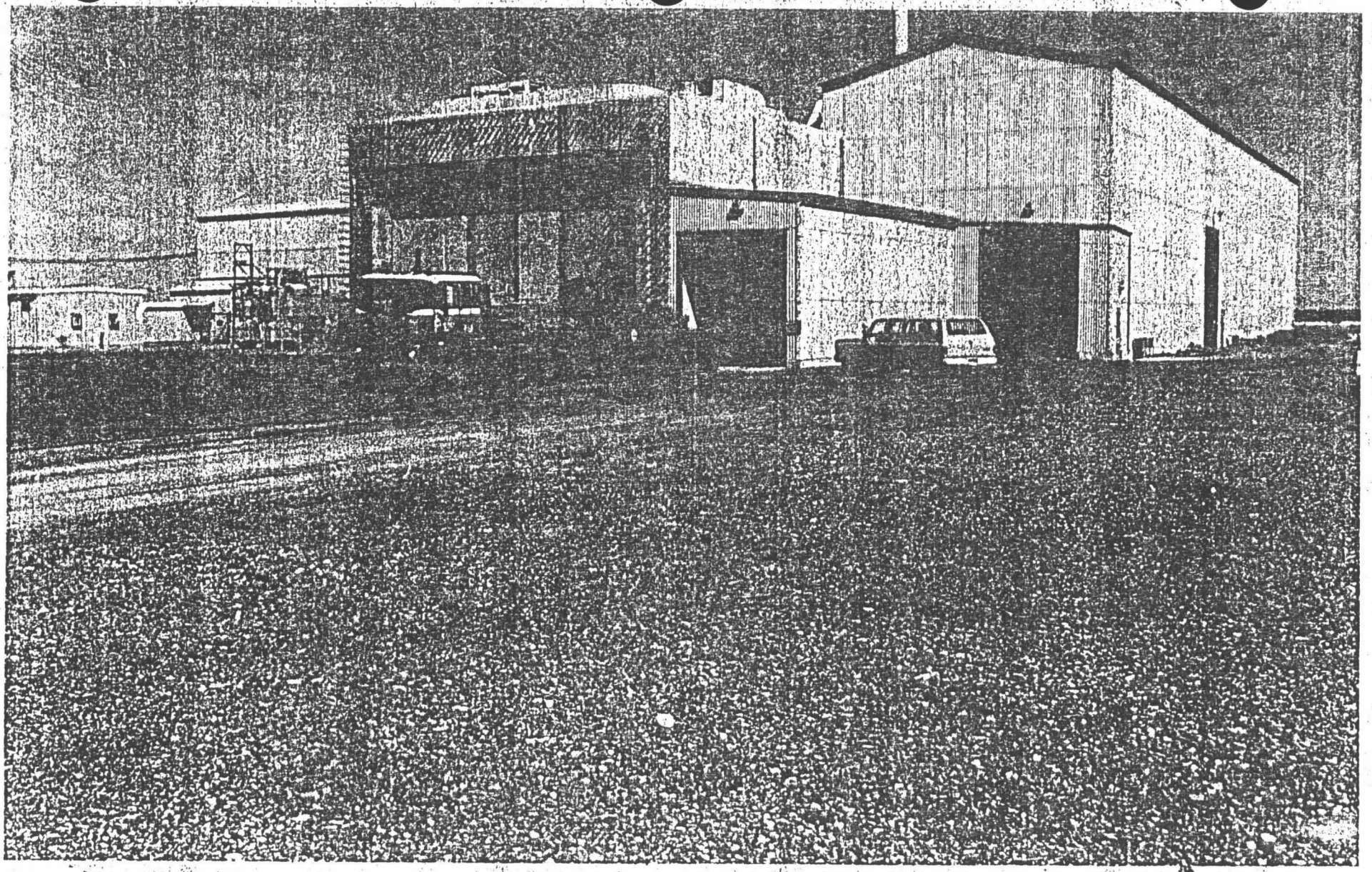
A91 0283

The Irradiated Fuel Storage Was Built to Store FSV Fuel

Provides safe storage for fuel from:

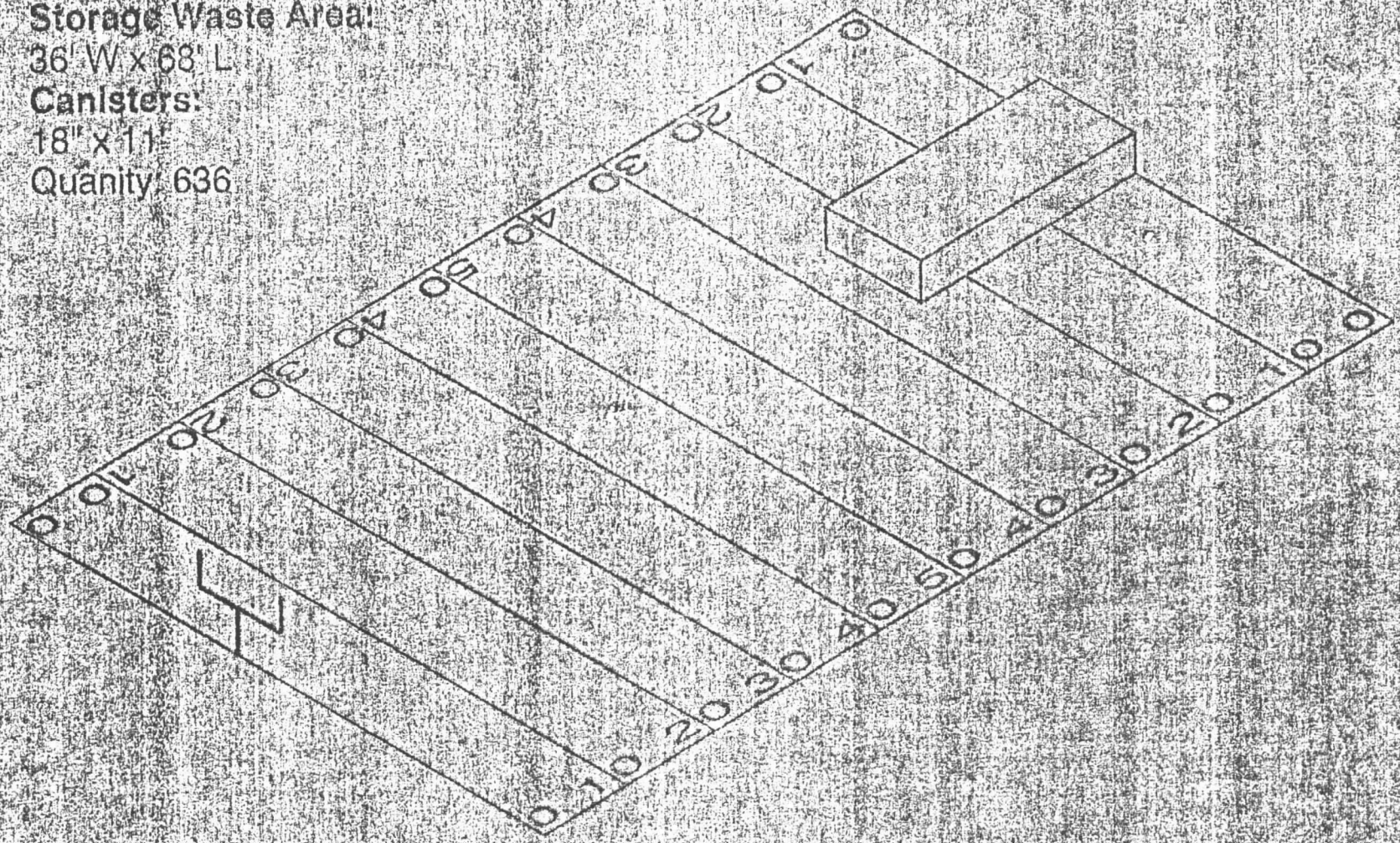
- Two high-temperature gas-cooled reactors
  - Peach Bottom (1 core)
  - Fort St. Vrain (1-1/2 cores)
- Twenty Rover Nuclear Rocket Program reactors

AB1 0289



Fort St. Vrain
Requires Small Storage Area

Storage Waste Area:
36' W x 68' L
Canisters:
18" x 11"
Quanity: 636



W91 0105

TMI Program

- Accident on March 28, 1979 represented several integral test of nuclear plant safety philosophy and safety systems
- Opportunity for nuclear industry to advance its understanding of plant behavior during and after a severe core damage accident (47% of core melted)
- DOE charged with implementing a research and development program
  - Establishing the causes and consequences of the accident
    - -- Support Early access to the core to assess the extent of damage
    - -- Core removal, packaging, and shipment to DOE site for storage and examination
    - -- Ultimate disposal at DOE's discretion

TAN Dry Cask Storage Project

- **Technical Scope**
  - The Dry Cask Storage Project (DCSP) will provide interim long-term, dry, in-cask storage of all fuel-bearing materials currently in the TAN Hot Shop pool. TMI Core Debris stored in 54 low-cost custom-designed, 9 ft. diameter by 16 ft. high concrete and steel casks. LOFT and Commercial Fuel stored in a licensed commercial cask.
- **Budget** Total Projects Cost $24M

TMI Program (cont.)

- R&D efforts resulted in:
  - Numerous changes to operation of nuclear facilities
  - Greatly enhanced safety
  - Better understanding of melting sequence and attack on the vessel
- Research still on-going on integrity of vessel lower-head

TAN Dry Cask Storage Project (cont.)

	FY92	FY93	FY94	FY95	FY96	FY97
Funding	589	2,870	8,050	5,370	5,400	1,900

FY92 - Environmental assessment, safety analysis documentation, canister dryer design verification

FY93 - Canister drying system fabrication, storage pad construction, purchase cask transporter tractor

FY94 - Production of 11 storage casks, purchase cask weather bonnets, canister drying system testing

FY95 thru FY97 - Purchase commercially built fuel storage casks, first TMI fuel canisters place in storage, seasonal fabrication of remaining 43 casks

TAN Dry Cask Storage Project (cont.)

- **Schedule**
  - 5/92 ADS and draft EA submitted to HQ (delayed 8 months)
  - 8/92 EM/EA review
  - 9/92 Idaho State review
  - 10/92 FONSI received and SAR/OSR completed
  - 11/92 First cask completed for testing

TAN Dry Cask Storage Project (cont.)

- **Spent Fuel Inventory**
  - TMI reactor core debris, 342 canisters, estimated 6,026,100 Ci
  - NRC fuel, 7 storage coffins, 241 fuel rods, estimated 194,000 Ci
  - LOFT, 14 fuel assemblies, estimated 20,000 Ci
  - NRC and LOFT, 10x10 storage rack, 35 fuel rods, 16,000 Ci

Research and Development Programs for Storage Cask Performance Testing at the Idaho National Engineering Laboratory Objectives

- Participate in cooperative demonstrations with utilities and conduct related federal site R&D
- Establish data base for dry storage and rod consolidation technologies for NRC to use in licensing by generic rule
- Provide information to utilities to facilitate licensing at-reactor dry storage

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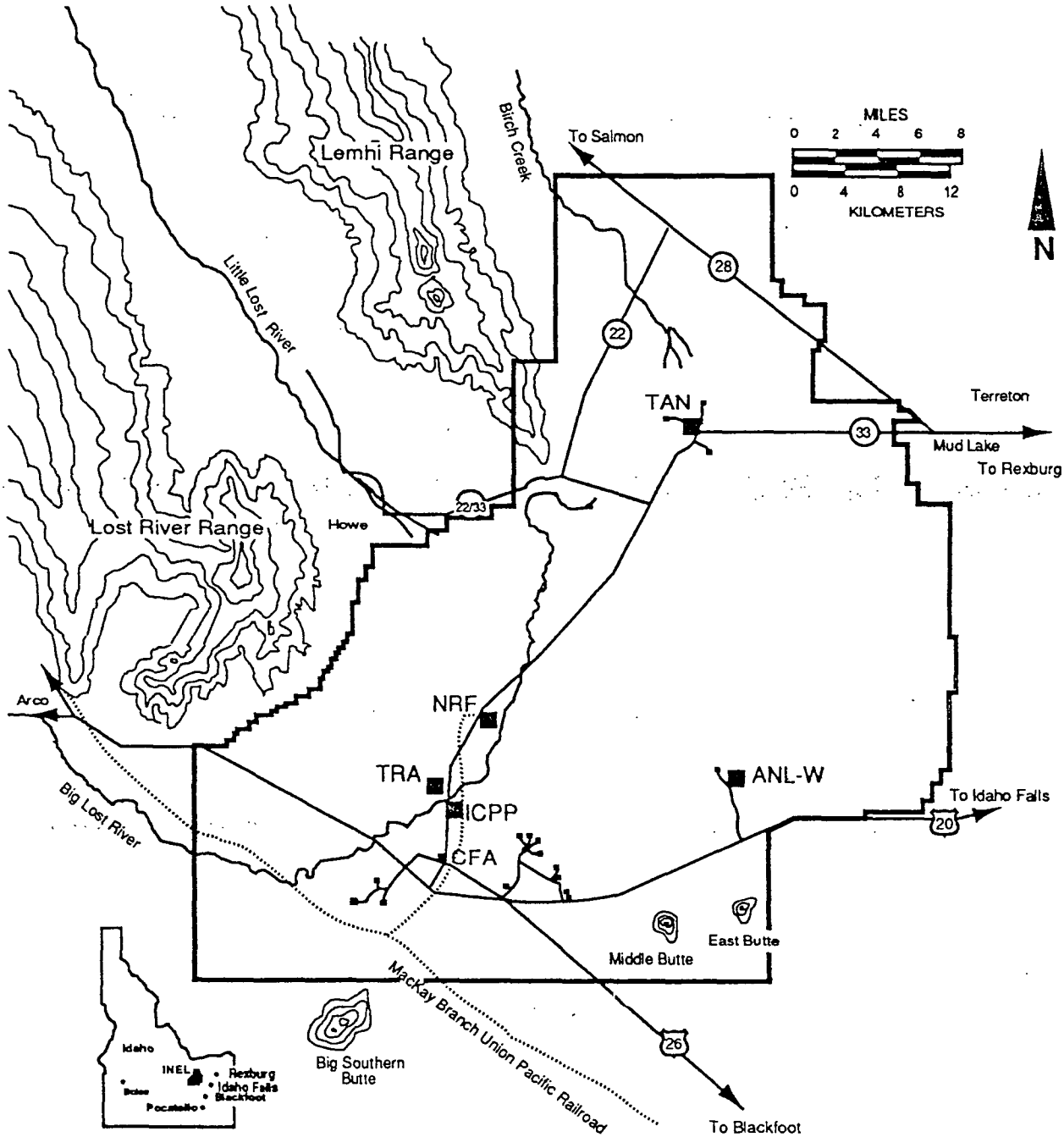


Current Fuel Storage Locations

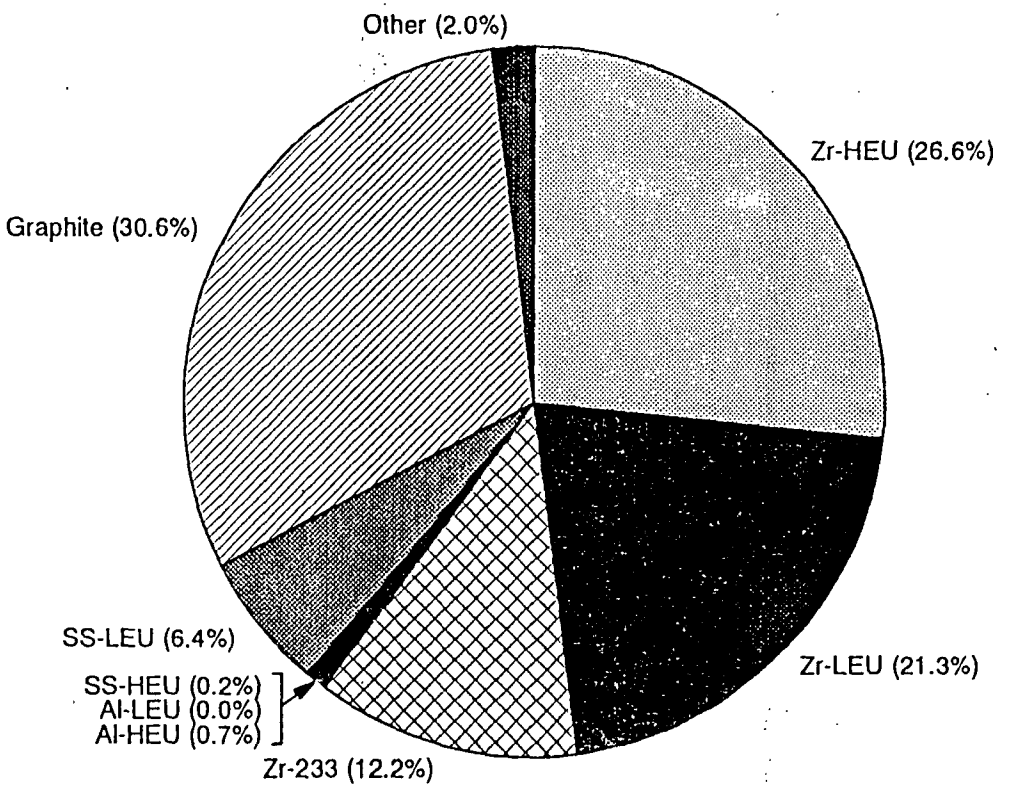
Idaho National Engineering Laboratory

Sources Of Spent Fuel At The INEL

Type/Source	Cladding	Location
• DOE		
Naval Reactors	Zr	ICPP, NRF
Test Reactors	Al, Zr, SS	ICPP, TRA, TAN
EBR-II	SS	ICPP, EBR-II
University	Al, Zr, SS	ICPP
Research Reactors	Al, Zr, SS	ICPP
Rover Parka	Graphite Matrix	ICPP
• Commercial		
Light Water	Zr, SS, Rubble	ICPP, TAN
Gas Cooled Ft. St. Vrain	Graphite Matrix	ICPP
Sodium Cooled Fermi	Zr, SS	ICPP

* Al - Aluminum, SS - Stainles Steel, Zr - Zirconium

Distribution of Current INEL Spent Fuel Inventory Mass



Total Mass = 1,000 MT

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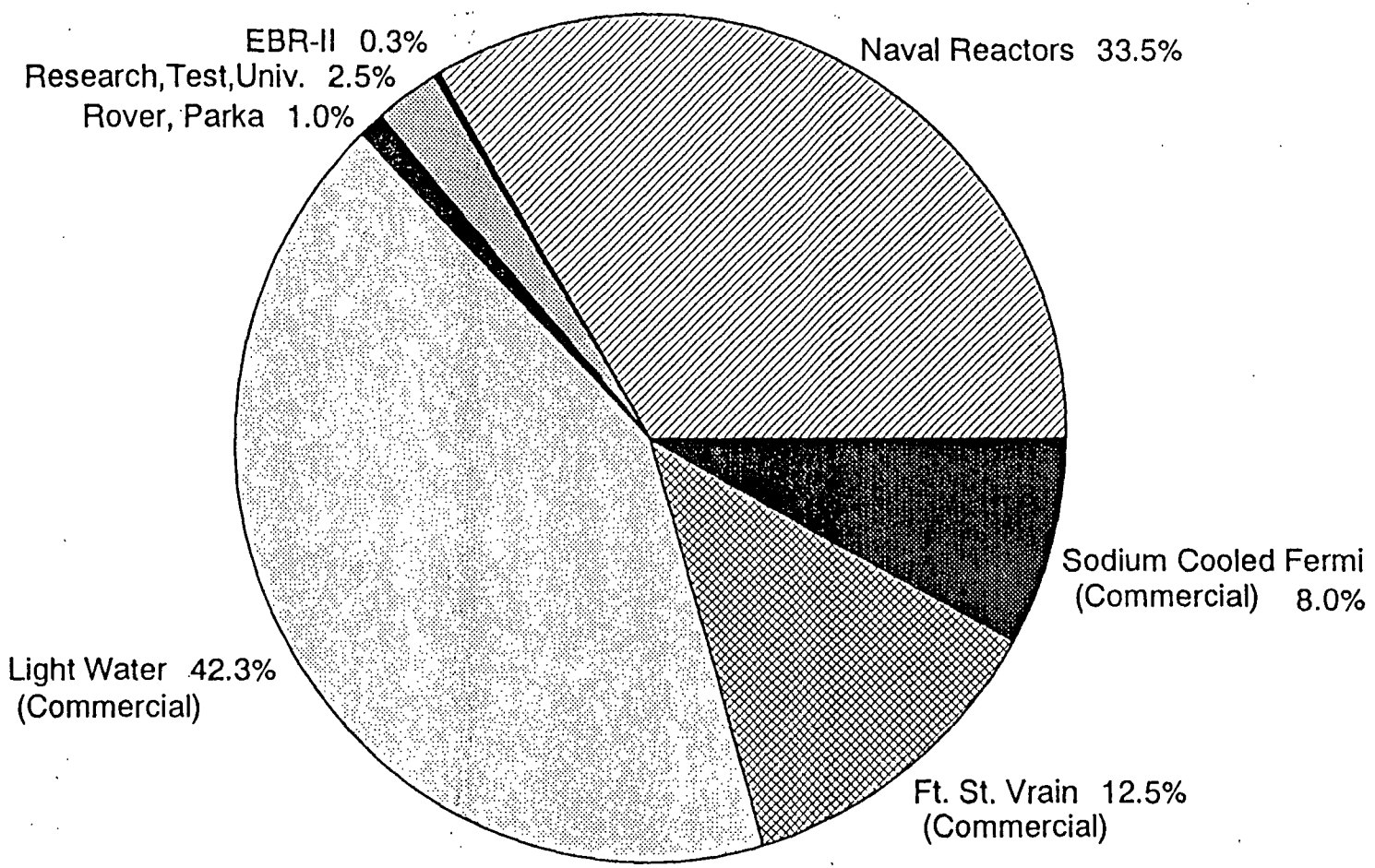
Sources Of Spent Fuel At The INEL

Based on Total Mass



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Transition Planning

- Phase out planning
- Transition reprocess facilities to decontamination & decommissioning
- Transition from reprocessing to dispositioning