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**PROGRAM FOR  
DISPOSITION OF DEPLETED UF<sub>6</sub>**

**PRESENTATION TO  
DOE-EM423**

**1 APRIL 1993**



**SEQUOYAH FUELS**  
A GENERAL ATOMICS COMPANY

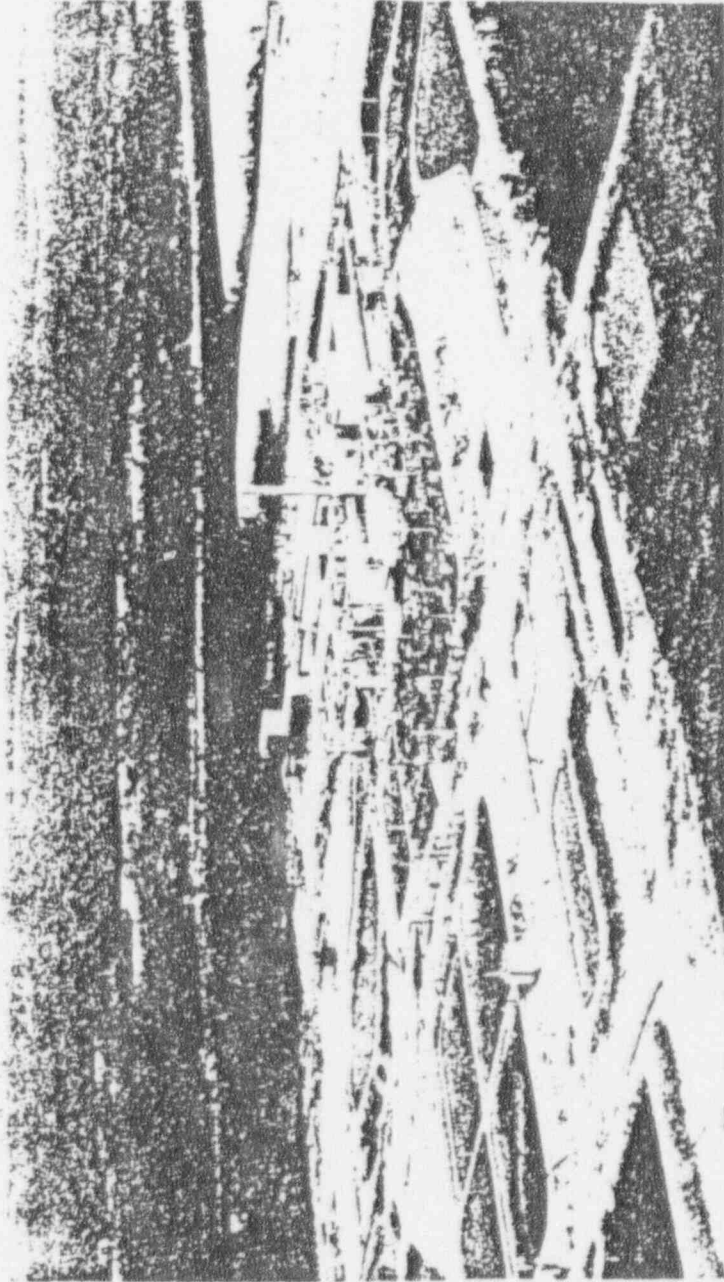
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## AGENDA ITEMS PREPARED FOR PRESENTATION AND DISCUSSION

- INTRODUCTION TO SEQUOYAH FUELS CORPORATION
- MEETING PURPOSE
- DISCUSSION OF DEPLETED  $UF_6$  DISPOSITION
- A SOLUTION
- SEQUOYAH FUELS PROGRAM PLAN
- CLARIFICATION OF ISSUES
- ACTION PLAN

# SEQUOYAH FUELS PLANT SITE



K-836(2)  
3-29-93 Mc



## SEQUOYAH FUELS CORPORATION PERFORMS URANIUM CONVERSION WORK

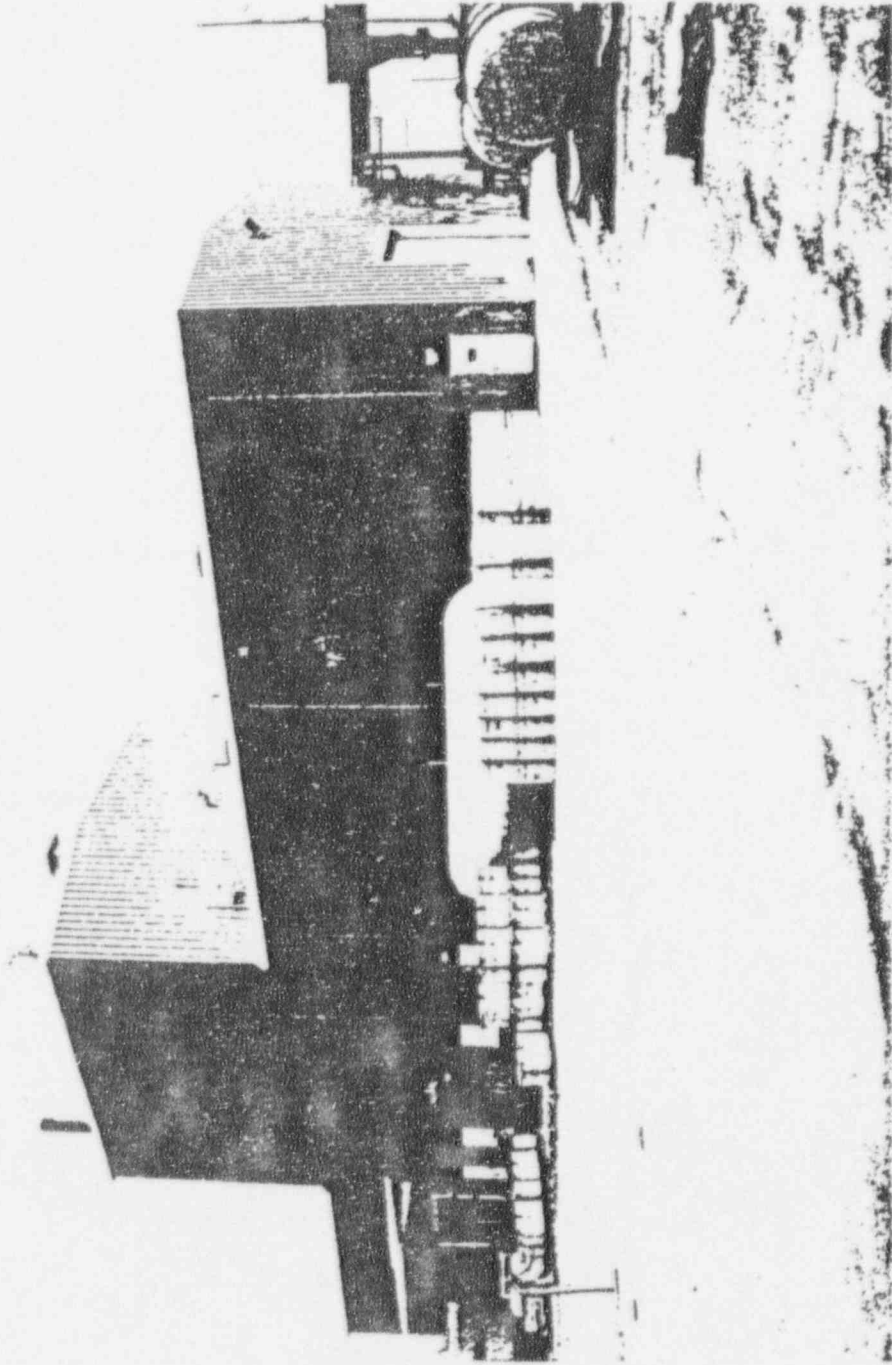
- SEQUOYAH FUELS IS OWNED BY GENERAL ATOMICS TECHNOLOGY
- GENERAL ATOMICS (GA) IS ALSO OWNED BY GENERAL ATOMICS TECHNOLOGY
- SEQUOYAH FUELS HAS TWO DIFFERENT URANIUM CONVERSION PLANTS:
  - A  $UF_6$  PRODUCTION PLANT, AND
  - A  $DUF_4$  PLANT



## SEQUOYAH FUELS CORPORATION PERFORMS URANIUM CONVERSION WORK (CONT'D)

- $UF_6$  PLANT CONVERTS NATURAL  $U_3O_8$  (YELLOW CAKE) TO  $UF_6$
- $DUF_4$  PLANT CONVERTS DEPLETED  $UF_6$  TO  $UF_4$  (1ST STEP TO U METAL)
- SEQUOYAH FUELS HAS SHUTDOWN  $UF_6$  PLANT
- $DUF_4$  PLANT IN OPERATION BUT SCHEDULED FOR SHUTDOWN IN JUNE

# MODERN, STATE-OF-THE-ART DUF<sub>4</sub> PLANT



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**CONTINUED MAINTENANCE IS COSTLY**



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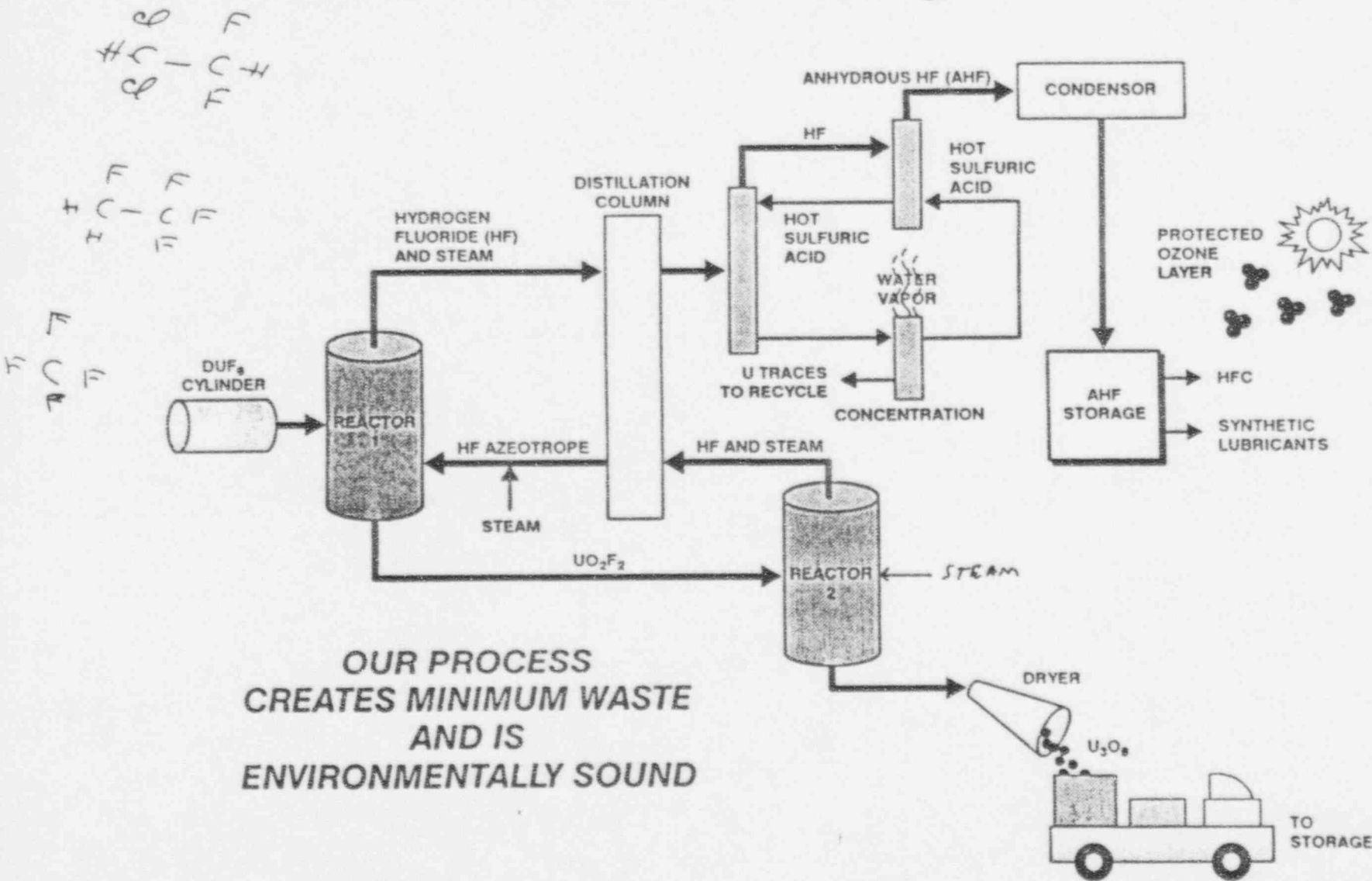
**SOLUTION RECOMMENDED FOR  
DISPOSITION OF DEPLETED UF<sub>6</sub>**

- **CONVERT DUF<sub>6</sub> TO U<sub>3</sub>O<sub>8</sub> (SEQUOYAH FUELS INITIAL RECOMMENDATION)**
- **RECOVER FLUORINE AS ANHYDROUS HF:**
  - **ANHYDROUS HF HAS HIGH COMMERCIAL VALUE**
  - **SEQUOYAH FUELS HAS DEVELOPED A PROCESS AND APPLIED FOR A PATENT**
  - **RECOVERY OF FLUORINE FOR REUSE MINIMIZES WASTE**
  - **COMMERCIAL SALE OF HF OFFSETS COST OF CONVERSION**

**SOLUTION RECOMMENDED FOR  
DISPOSITION OF DEPLETED UF<sub>6</sub> (CONT'D)**

- **MODIFY SEQUOYAH FUELS DUF<sub>4</sub> PLANT TO SERVE AS PILOT PLANT**
- **OPERATE PILOT PLANT TO PROVE OUT PROCESS AND COMMERCIAL ECONOMICS**
- **PROVIDES BASIS FOR COMPETITIVE COMMERCIAL CONVERSION SERVICES**

# SOLUTION RECOMMENDED FOR DISPOSITION OF DEPLETED $UF_6$

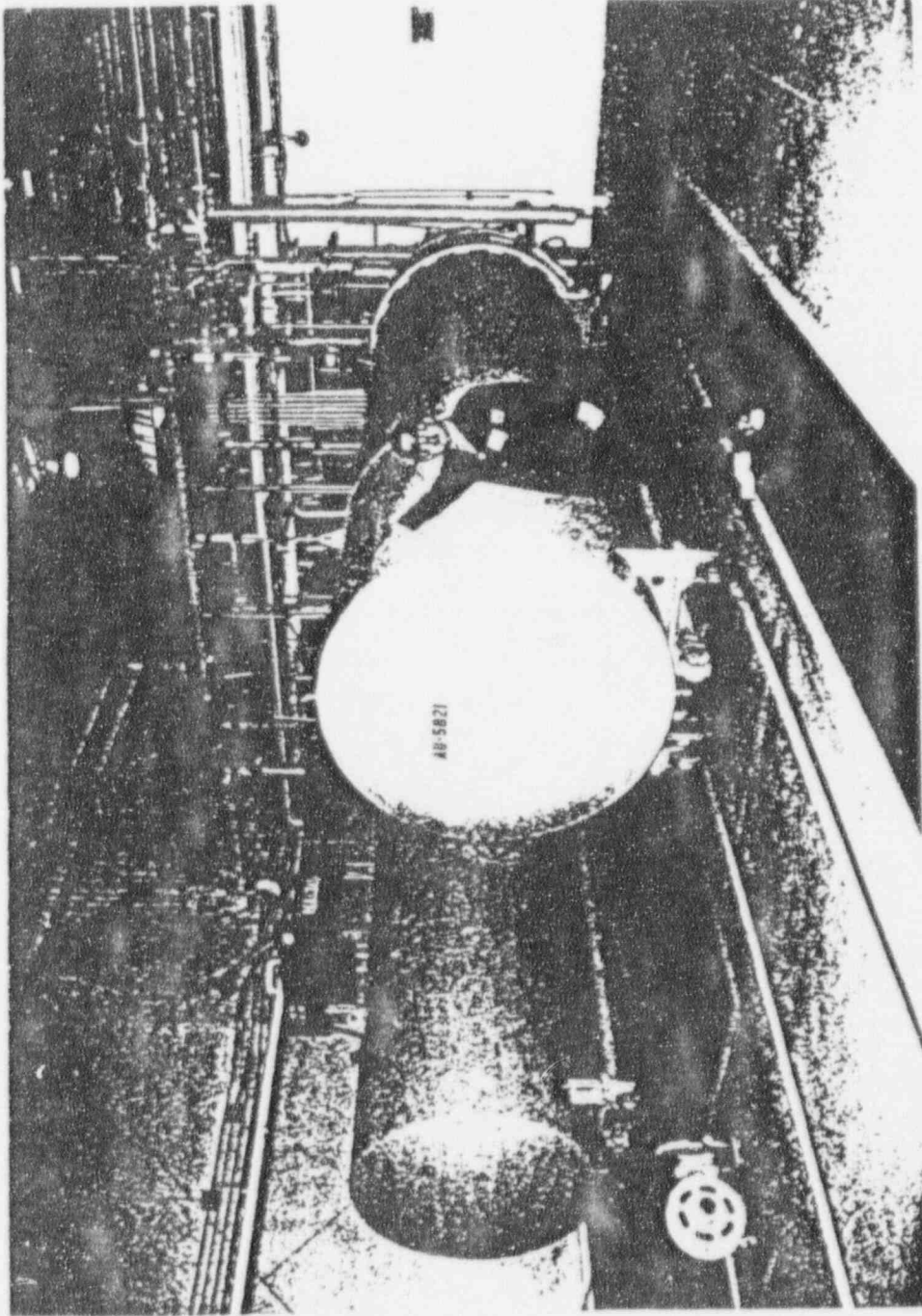


## SEQUOYAH FUELS DUF<sub>4</sub> PLANT IDEAL FOR DEVELOPMENT OF DEPLETED UF<sub>6</sub> DISPOSITION

- DUF<sub>4</sub> PLANT, BUILT IN 1988, IS A STATE-OF-THE-ART PLANT
- DUF<sub>4</sub> PLANT AVAILABILITY OFFERS A UNIQUE OPPORTUNITY
  - CAN BE USED AS IS FOR DISPOSITION DEVELOPMENT IF DISPOSITION FORM IS UF<sub>4</sub>
  - CAN BE MODIFIED AT LOW COST FOR OTHER DISPOSITION FORMS SUCH AS U<sub>3</sub>O<sub>8</sub>
- SEQUOYAH FUELS HAS FORMULATED A LOW COST PLAN FOR DEVELOPING UF<sub>6</sub> DISPOSITION WHICH TAKES ADVANTAGE OF THE DUF<sub>4</sub> PLANT
- MEETING PURPOSE IS TO DISCUSS PLAN AND TO OBTAIN CLARIFICATION OF ISSUES FROM DOE



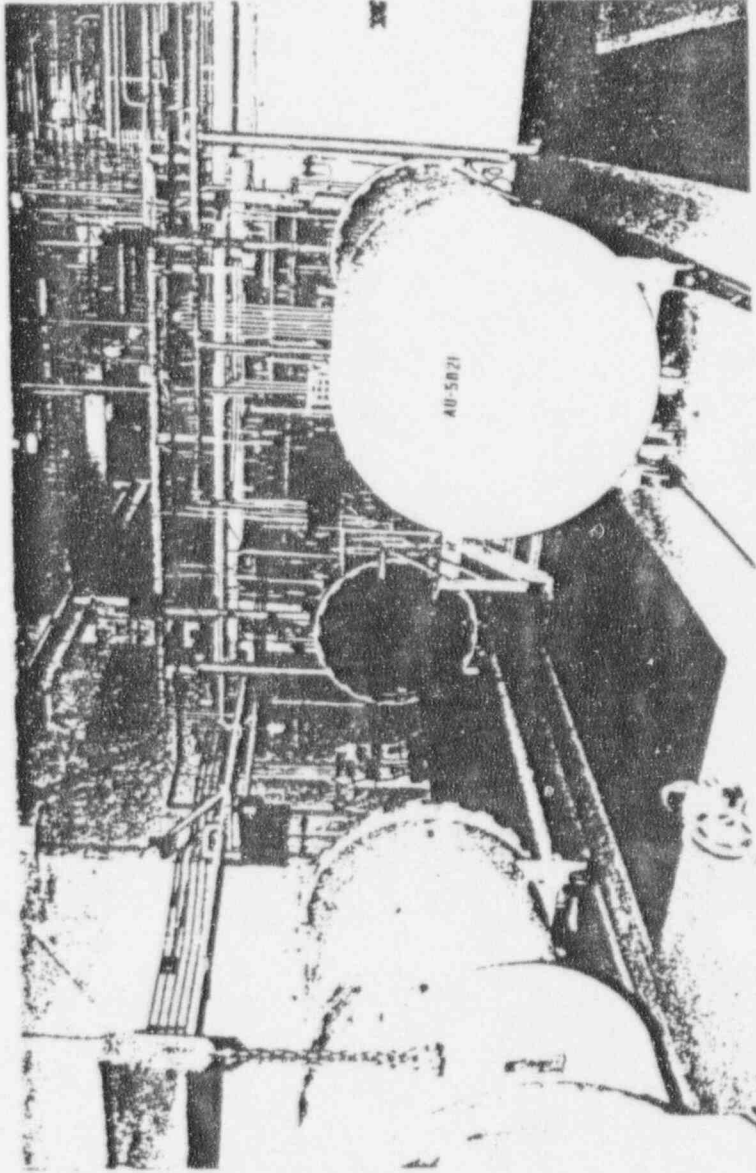
# AUTOCLAVE SIZED TO HOLD 14-TON CYLINDERS



NOTE: 3RD BAY

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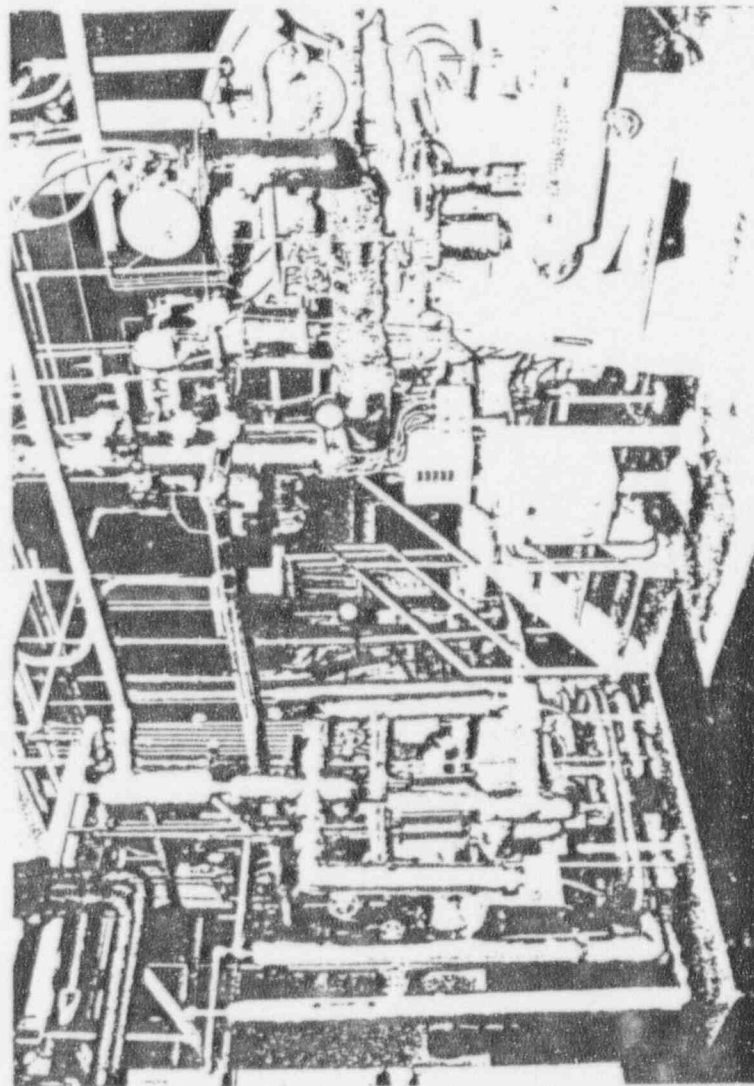
# AUTOCLAVE SYSTEM HANDLES DUF<sub>6</sub> CYLINDERS SAFELY



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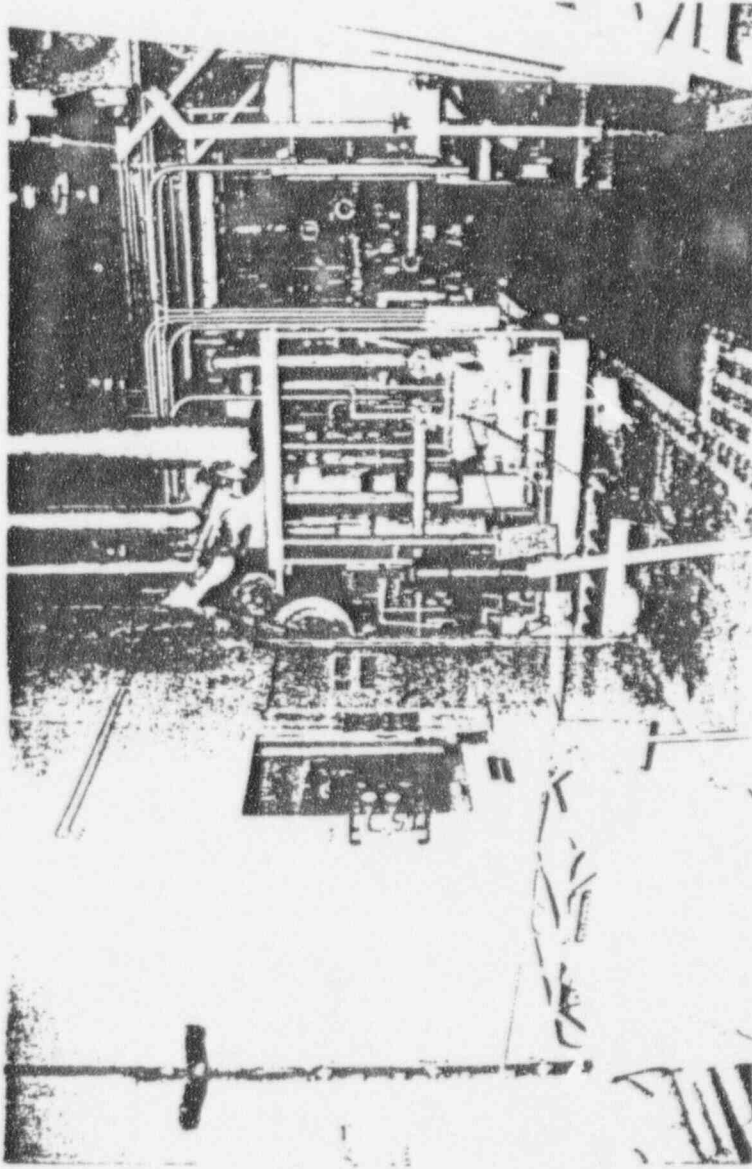
**AUTOCLAVE SYSTEM IS AUTOMATED**



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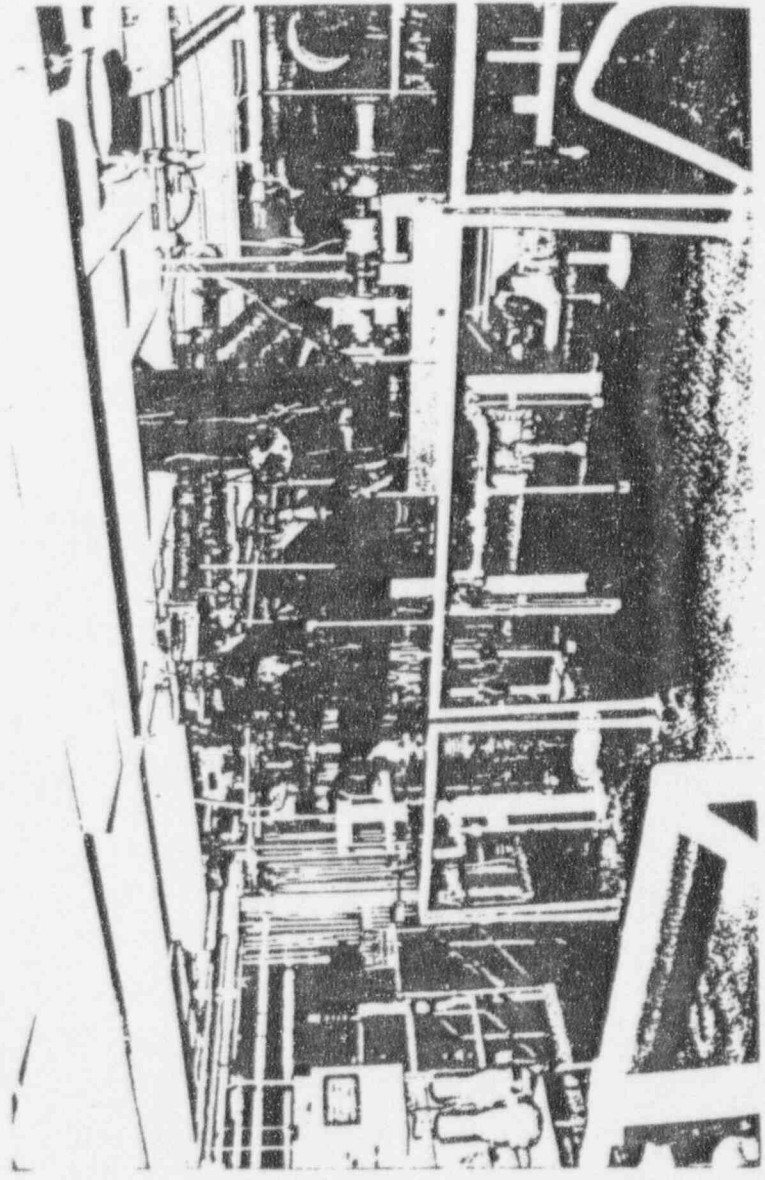
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**NEEDED REFRIGERATION SYSTEMS ARE IN PLACE**



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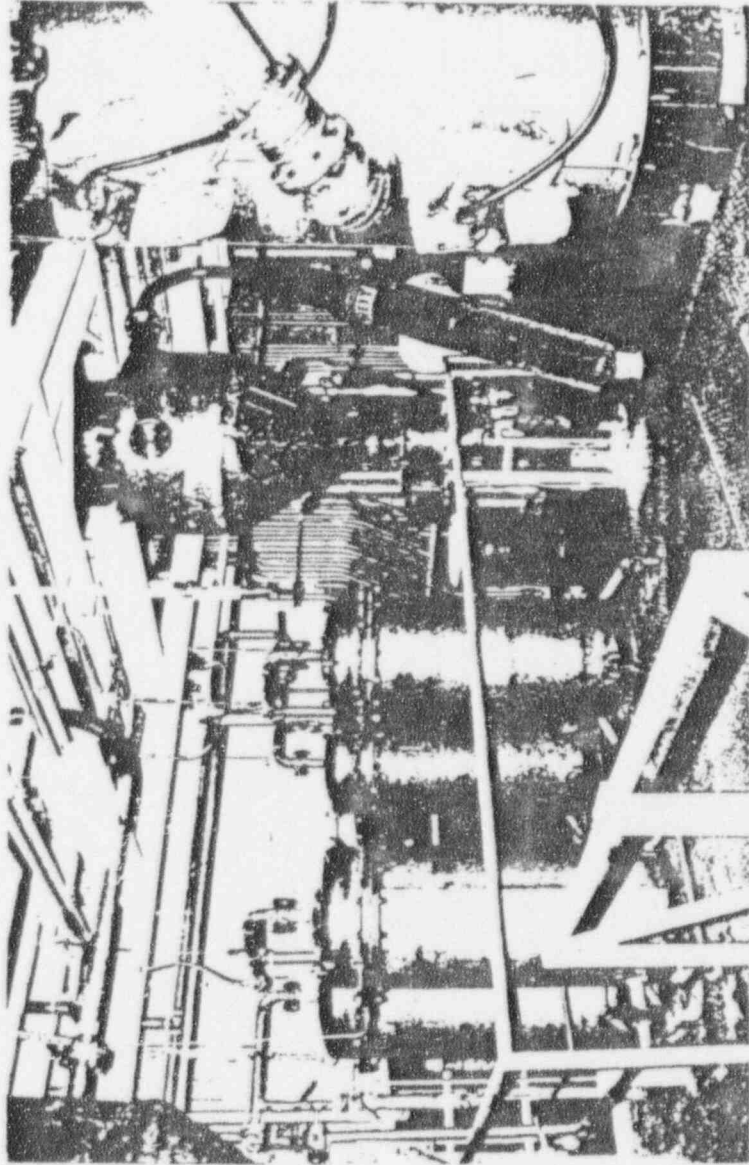
**DUF<sub>4</sub> REACTOR DISCHARGE WITH HF VENT  
CURRENTLY OPERATING**



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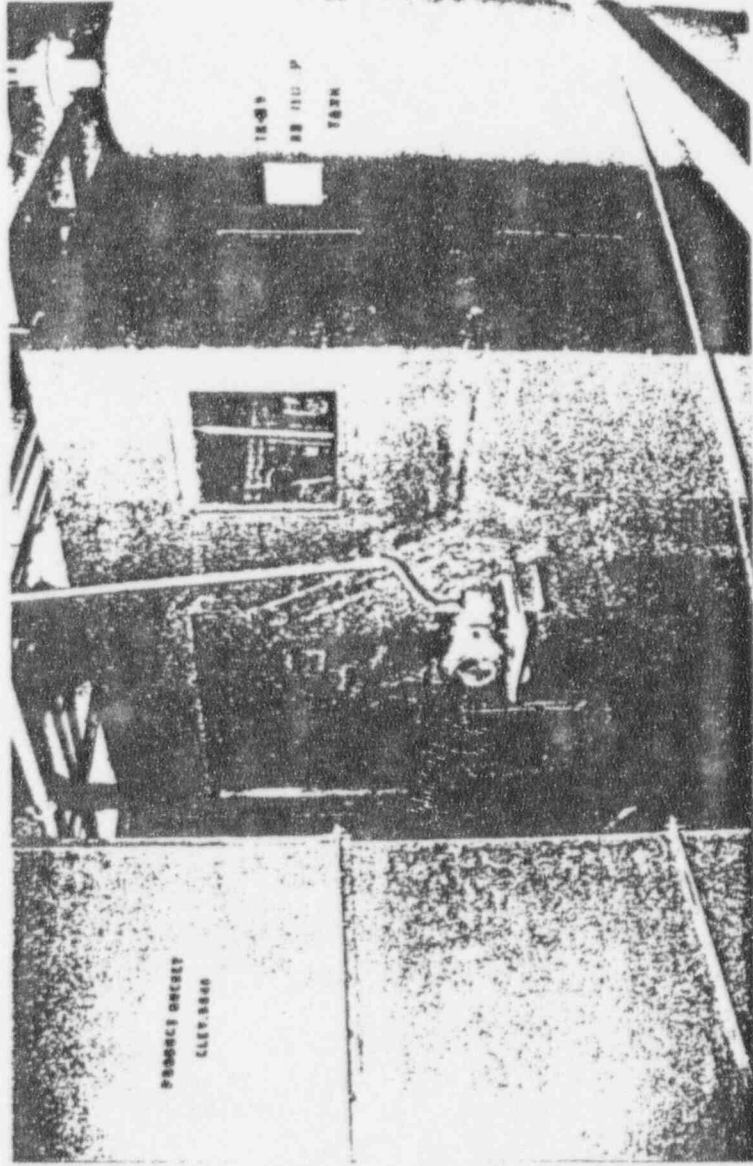


# HF FILTRATION SYSTEM



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# VIBRATING SCREEN SIZES PARTICLES

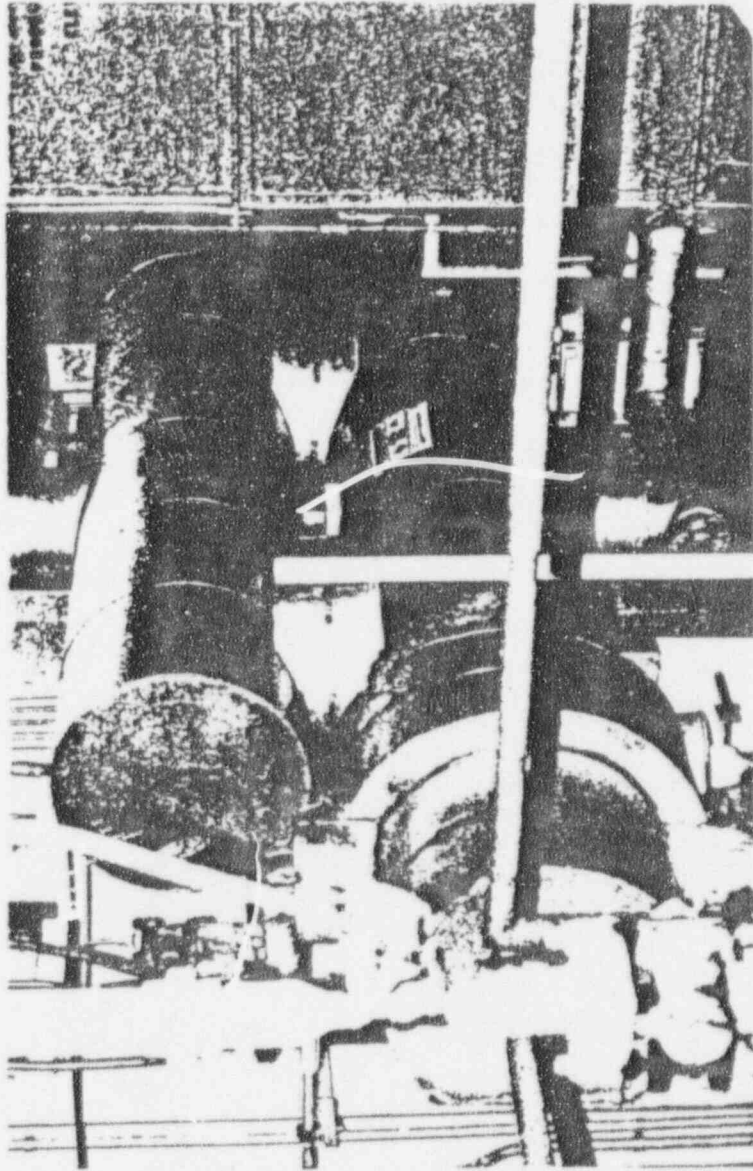


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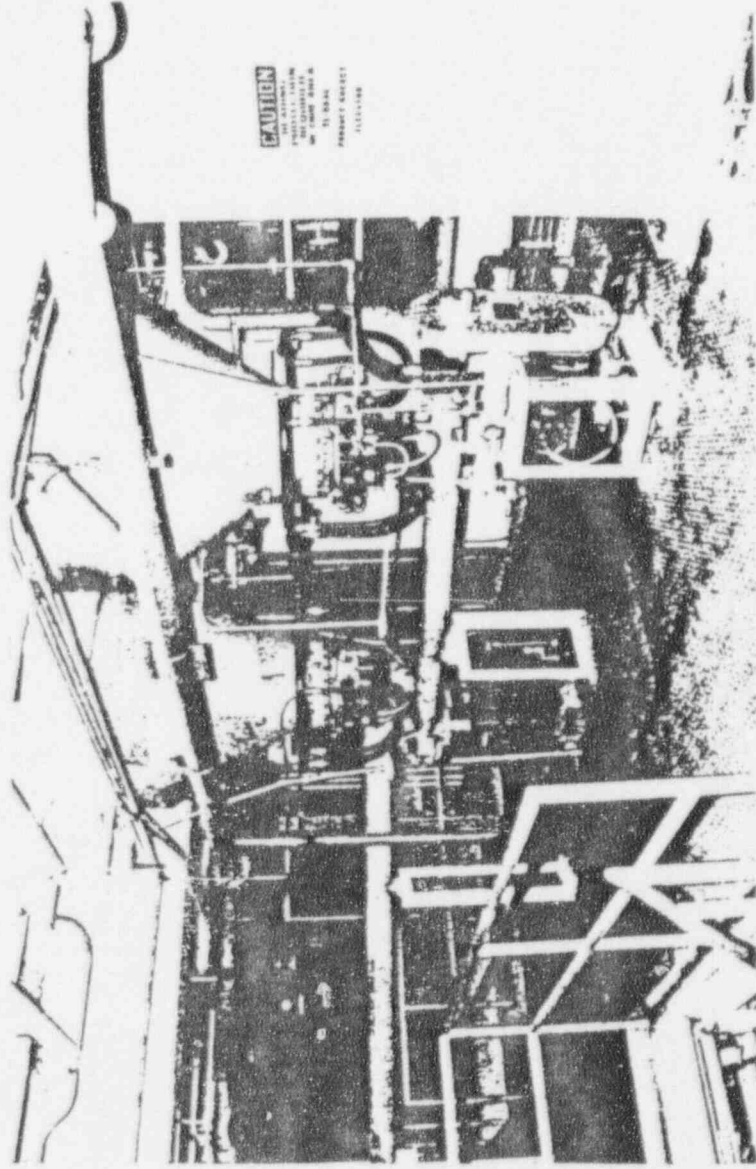


# HYDROFLUORIC ACID CONDENSORS



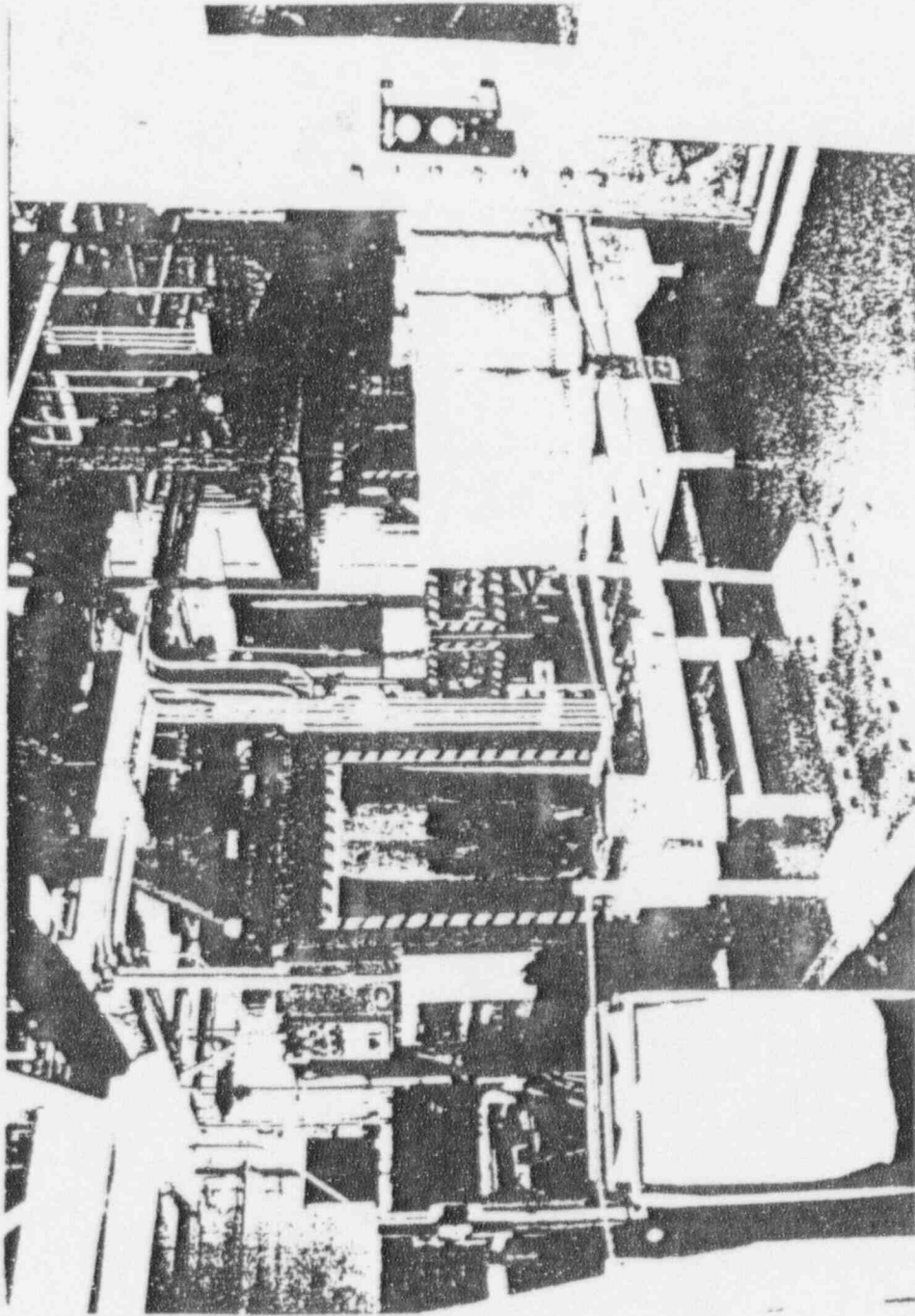
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**BIN UNLOADING SYSTEM  
MAINTAINS U<sub>3</sub>O<sub>8</sub> ACCOUNTABILITY**



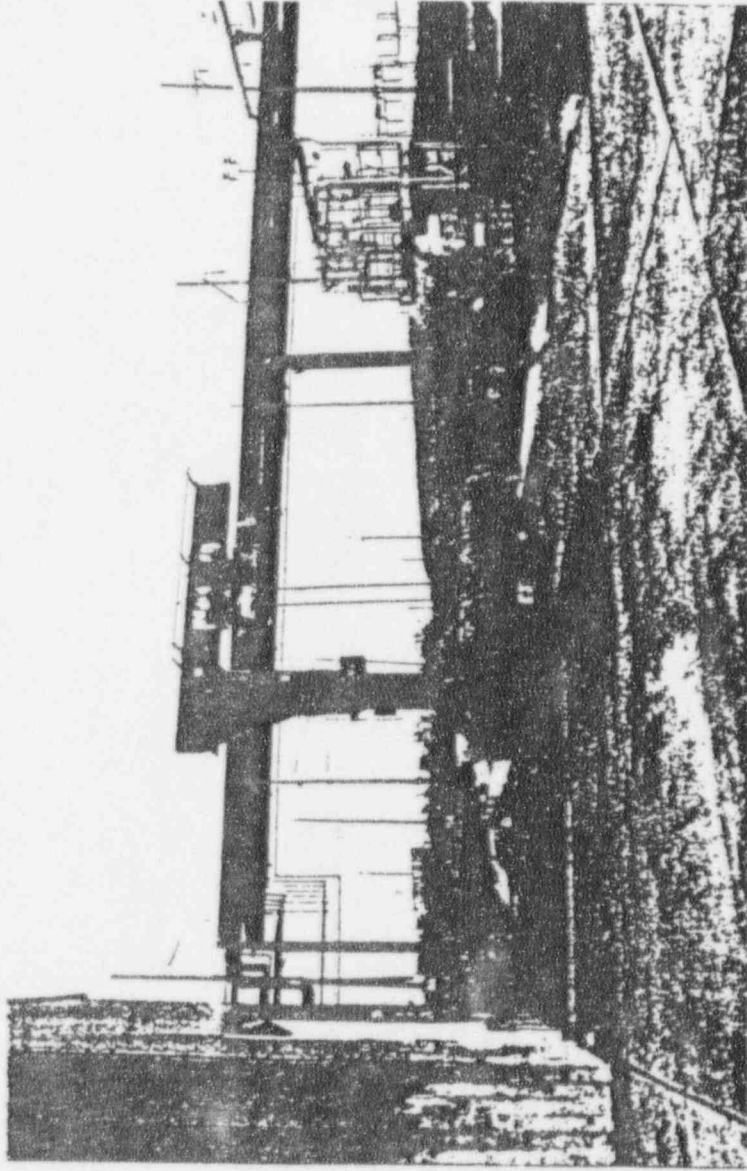
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**DRUM LOADING SYSTEM FOR SAFE  
AND EFFICIENT U<sub>3</sub>O<sub>8</sub> HANDLING**



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ANHYDROUS HF INTERMEDIATE STORAGE  
SYSTEM HAS DEMONSTRATED SAFE HANDLING



K-838(19)  
3-29-93 Mc

**DEPLETED UF<sub>6</sub> DISPOSITION UNRESOLVED  
(CONT'D)**

- **CYLINDERS SUBJECT TO LOSS OF CONTAINMENT: (CORROSION, INADVERTENT DAMAGE)**
- **LARGE MANAGEMENT COST: \$6 - 9 MILLION PER YEAR**
- **VERY LITTLE NEAR TERM NEED FOR DEPLETED UF<sub>6</sub>**

## DEPLETED UF<sub>6</sub> DISPOSITION UNRESOLVED

- LARGE NUMBER OF CYLINDERS OF DEPLETED UF<sub>6</sub> HAVE ACCUMULATED
- AS OF END OF FY 90,
  - 34,400 STD 14-TON CYLINDERS
  - ~7,000 OF OTHER TYPES (10-TON CYLINDERS + MISC)
- TOTAL INVENTORY OF 322,100 TONNES OF U (>1 BILLION LB OF UF<sub>6</sub>)
- INVENTORY CONTINUES TO INCREASE

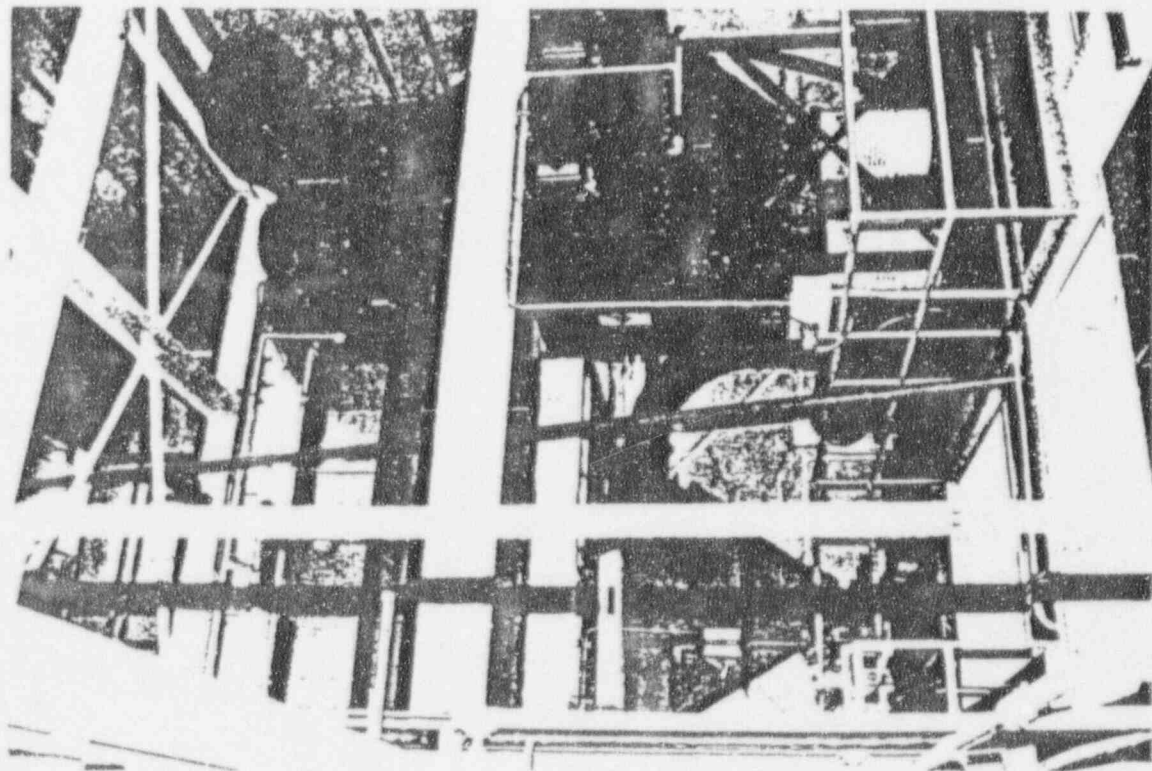


## FOUR PHASE PROGRAM PLANNED FOR DEVELOPING DEPLETED UF<sub>6</sub> DISPOSITION

- PHASE 1 ( 3 MOS) - PROCESS AND PRODUCT EVALUATION
- PHASE 2 ( 9 MOS) - DUF<sub>4</sub> PLANT DESIGN MODIFICATIONS
- PHASE 3 ( 6 MOS) - DUF<sub>4</sub> PLANT CONVERSION TO DEPLETED UF<sub>6</sub> PILOT PLANT
- PHASE 4 (18 MOS) - DEPLETED UF<sub>6</sub> PILOT PLANT OPERATION



**ENVIRONMENTAL PROTECTION SYSTEMS  
COLLECT PARTICULATES FROM FACILITY ATMOSPHERE**



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## PHASE 1 CONFIRMS DISPOSITION FORM AND CONVERSION PROCESS

- DISPOSITION REQUIREMENTS DEFINITION
- ASSESSMENT OF ALTERNATE DISPOSITION FORMS
- DISPOSITION FORM SELECTION
- EVALUATION OF ALTERNATE CONVERSION PROCESSES
- SELECTION OF CONVERSION PROCESS (RISK EVALUATION, COST BENEFIT, ENVIRONMENTAL IMPACT, STATUS OF TECHNOLOGY, WASTE MINIMIZATION)
- COST AND SCHEDULE ESTIMATES FOR FOLLOW-ON PHASES
- ECONOMIC EVALUATIONS OF DISPOSITION COSTS, \$/kgU

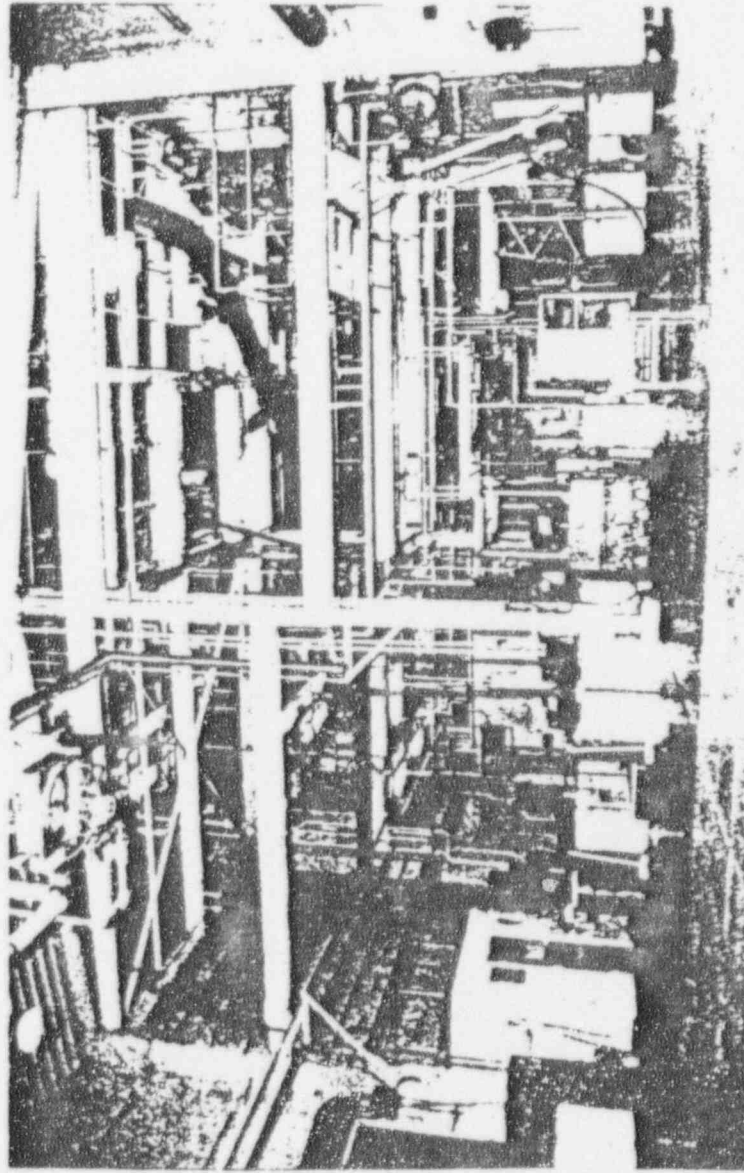


## PHASE 2 DEVELOPS PLANT DESIGN MODIFICATIONS

- LAB SCALE DEVELOPMENT OF PROCESS DESIGN PARAMETERS\*
- DETAIL DESIGN (P&IDs, EQUIPMENT DESIGN AND SPECIFICATION, OPERATING PROCEDURES, ETC)
- PREPARATION AND SUBMITTAL OF LICENSE APPLICATION
- COST AND SCHEDULE FOR PILOT PLANT MODIFICATIONS
- UPDATE ECONOMIC ANALYSIS

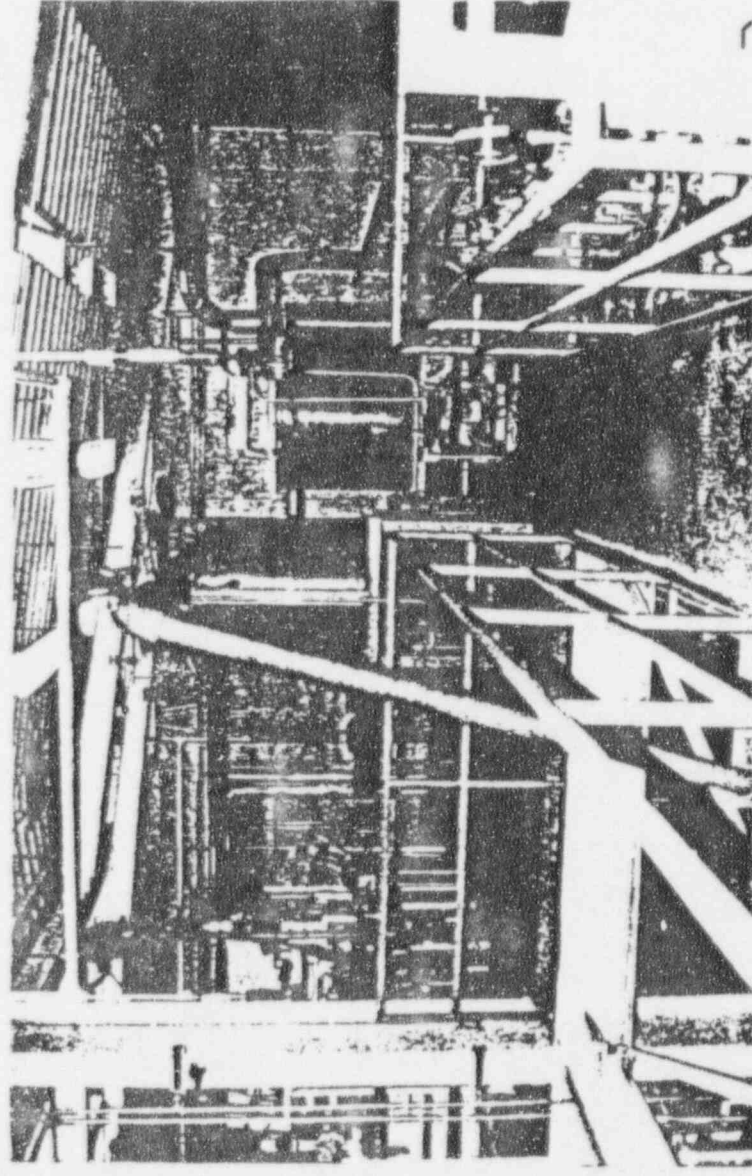
\* SBIR PROPOSAL SUBMITTED TO PERFORM THIS FOR SEQUOYAH FUELS PATENTED PROCESS

ADDITIONAL AREA AVAILABLE FOR EXPANSION



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**ENVIRONMENTAL PROTECTION SYSTEMS  
AUTOMATICALLY MONITOR FACILITY**



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## PHASE 3 MODIFIES PLANT DESIGN

- OBTAIN CONSTRUCTION PERMIT
- PROCESS EQUIPMENT PROCUREMENT
- EQUIPMENT INSTALLATION
- PROCESS CHECKOUT
- UPDATE ECONOMIC ANALYSIS



## PHASE 4 CONSISTS OF PILOT PLANT OPERATIONS

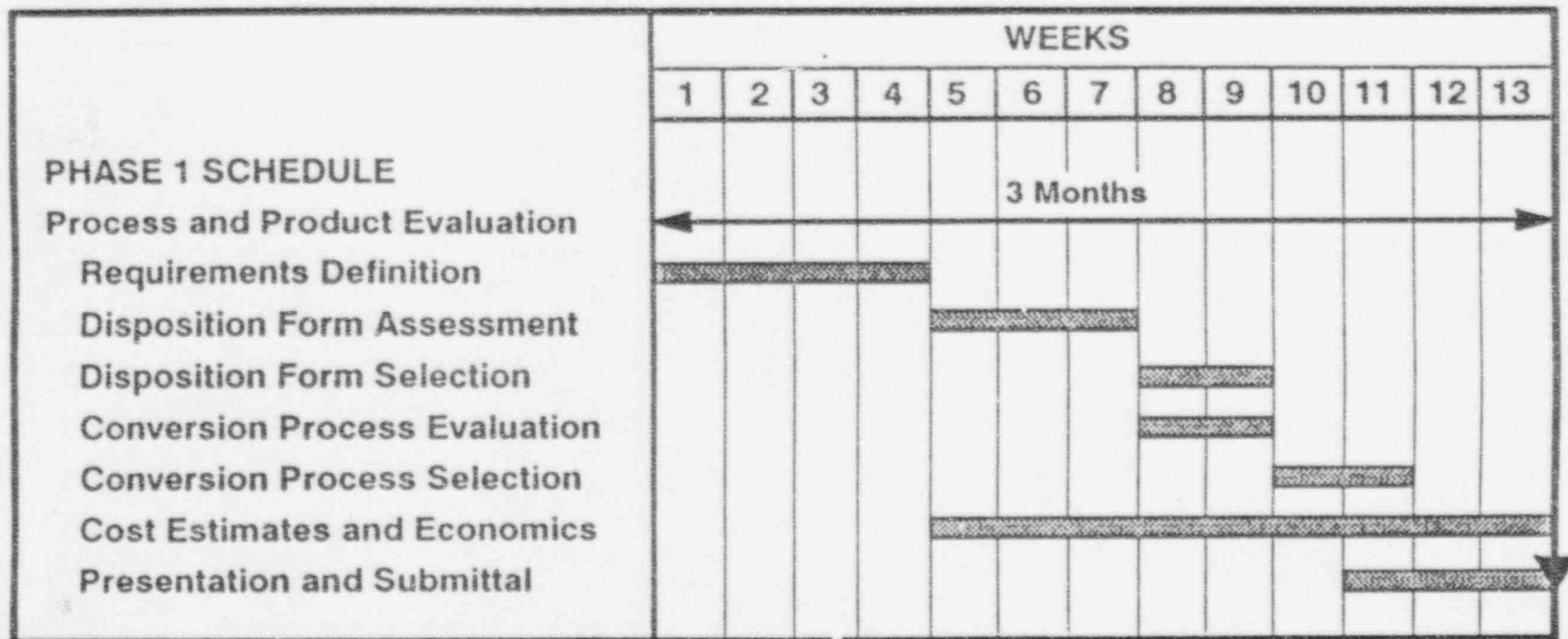
- OBTAIN OPERATING LICENSE
- 18 MONTH PERIOD
- ASSESSMENT OF OPERABILITY/MAINTAINABILITY/RELIABILITY
- COMMERCIAL ACCEPTANCE OF HF PRODUCT
- PACKAGE FOR COMPETITIVE PROCUREMENT OF PRODUCTION PLANTS



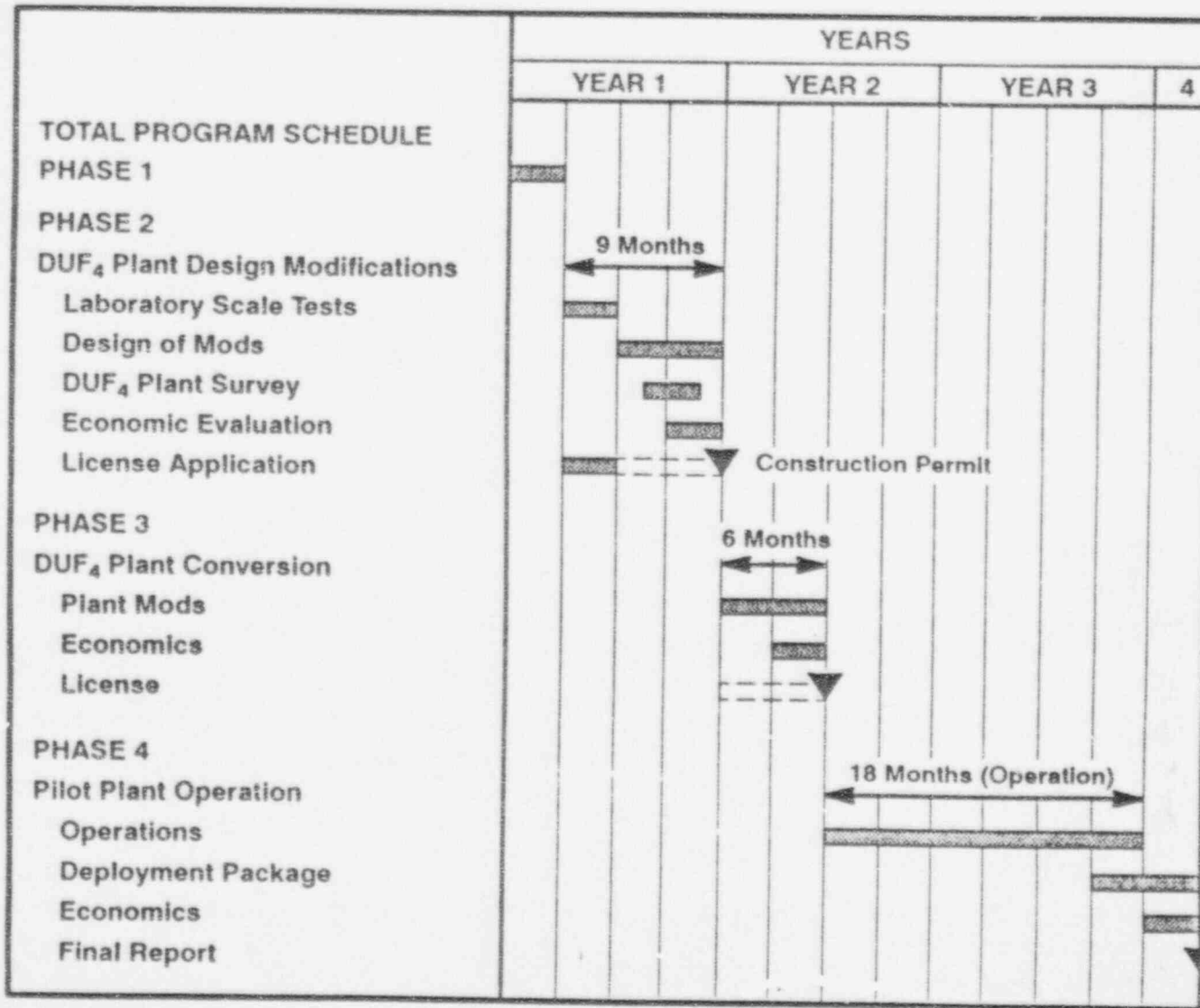
## **PROGRAM COMPLETION PROVIDES FOR COMPETITIVE COMMERCIAL CONVERSION SERVICES**

- **ACTUAL COSTS, PROCESS CAPITAL, OPERATION, AND MAINTENANCE**
- **ACTUAL PRODUCTION CAPACITIES, LBS PER DAY, PER YEAR**
- **PROVEN OPERATION AND MAINTENANCE PROCEDURES**
- **ACTUAL ENVIRONMENTAL HEALTH PHYSICS EXPERIENCE**
- **FINALIZATION OF DISPOSITION COST ESTIMATES**

# DUF<sub>6</sub> DISPOSITION PROGRAM PHASE 1 SCHEDULE



# DUF<sub>6</sub> DISPOSITION PROGRAM SCHEDULE



## SOME ISSUES REQUIRE DOE CLARIFICATION

- DISPOSITION FORM - DOE REQUIREMENTS AND PROGRAM OBJECTIVES, OR ANY ADVANCED THINKING
- STATUS REGARDING RCRA CLASSIFICATION
- DOE TIMING FOR DEPLETED UF<sub>6</sub> DISPOSITION - START/END
- PROGRAM BUDGET PROJECTIONS
- SEQUOYAH FUELS ELIGIBILITY TO BID ON COMMERCIAL PRODUCTION SERVICES

## SEQUOYAH FUELS PROGRAM IS LOW COST/LOW RISK (CONT'D)

- TRAINED PERSONNEL AVAILABLE
- LOCAL, STATE, AND CONGRESSIONAL POLITICAL SUPPORT
- PATENTED PROCESS AVAILABLE
- PROJECTED COST ~1/2 OF NEW PILOT PLANT

## ACTION PLAN PROPOSED BY SEQUOYAH FUELS

- DUF<sub>4</sub> PLANT SHUTDOWN JUNE, 1993
- UNSOLICITED PROPOSAL (ALL 4 PHASES) APRIL 7, 1993
- DOE DECISION REQUESTED JUNE 15, 1993
- PHASE 1 START DATE JULY 1, 1993



**SEQUOYAH FUELS PROGRAM IS  
LOW COST/LOW RISK**

- **MAKES USE OF AN EXISTING PLANT/SITE**
- **EXISTING PLANT IS A MODERN STATE-OF-THE-ART PLANT**
- **ENVIRONMENTAL CONTROLS ARE IN PLACE**
- **PLANT/SITE IS CURRENTLY LICENSED**

**SOME ISSUES REQUIRE DOE CLARIFICATION  
(CONT'D)**

- **ULTIMATE STORAGE/DISPOSAL SITE CONSIDERATIONS**
- **COMMERCIAL SALE OF HF**
- **SEQUOYAH FUELS SITE DECOMM/DECON**
- **RESPONSIBILITY FOR DEPLETED UF<sub>6</sub> FROM FUTURE PROCESSING  
BY U.S. ENRICHMENT CORPORATION**
- **RECYCLE OF CYLINDERS**