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## COMMERCIAL INCINERATION DEMONSTRATION

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### ABSTRACT

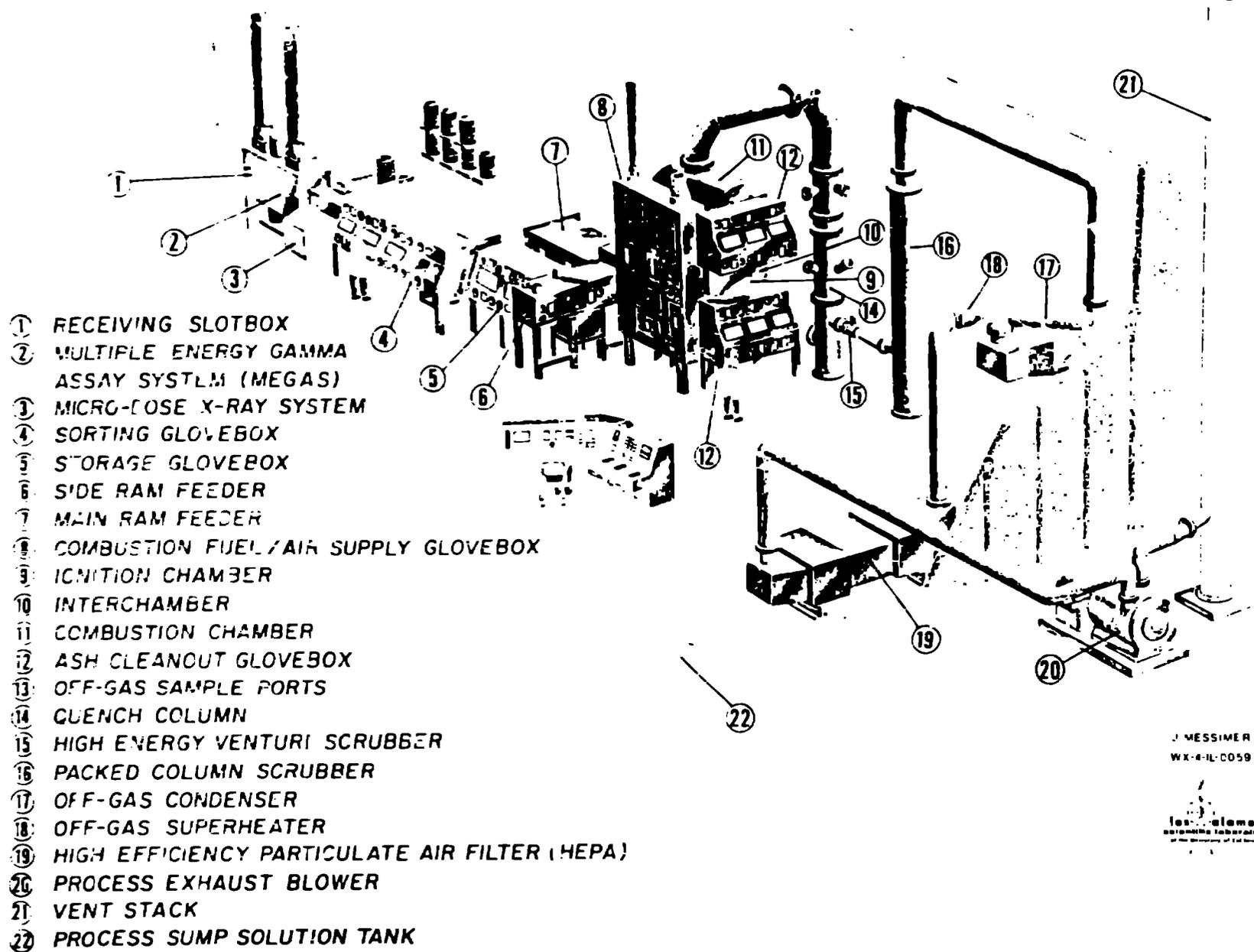
Low-level radioactive wastes (LLW) generated by nuclear utilities presently are shipped to commercial burial grounds for disposal. Substantially increasing shipping and disposal charges have sparked renewed industry interest in incineration and other advanced volume reduction techniques as potential cost-saving measures. Repeated inquiries from industry sources regarding LLW applicability of the Los Alamos controlled-air incineration (CAI) design led DOE to initiate this commercial demonstration program in FY-1980. The selected program approach to achieving CAI demonstration at a utility site is a DOE sponsored joint effort involving Los Alamos, a nuclear utility, and a liaison subcontractor. Required development tasks and responsibilities of the participants are described. Target date for project completion is the end of FY-1985.

### INTRODUCTION

Since 1975, low-level waste transportation costs have increased by 50 per cent and disposal fees have risen five-fold.(1) This adverse expenditure trend has caused many within the commercial nuclear industry to view advanced volume reduction techniques with renewed interest. Among the alternative technologies being considered, incineration of combustibles is recognized as one of the most effective methods for reducing both the mass and volume of waste shipments.

At present, several universities and hospitals are operating, installing, or have committed to install combustion processes to treat institutional wastes.(2) Nuclear utility commitment in this area, however, has been substantially less. Factors in this hiatus include cost, technical, and licensing uncertainties associated with reactor waste combustion systems. To fill this technical need and in response to continued, substantial utility interest in the Los Alamos controlled air incineration (CAI) system (developed for transuranic (TRU) waste treatment), DOE





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 WX-4-IL-C059



Figure 1. CONTROLLED-AIR TRANSURANIC WASTE INCINERATION PROCESS

containment throughout the process to prevent alpha contamination release, an instrumentation control package substantially upgraded from commercial nonradioactive systems, and a high degree of redundancy among critical process components. Each system modification and/or addition was a response to the extensive and formal safety analysis which proceeded in parallel with project planning and design activities.

### Los Alamos Program

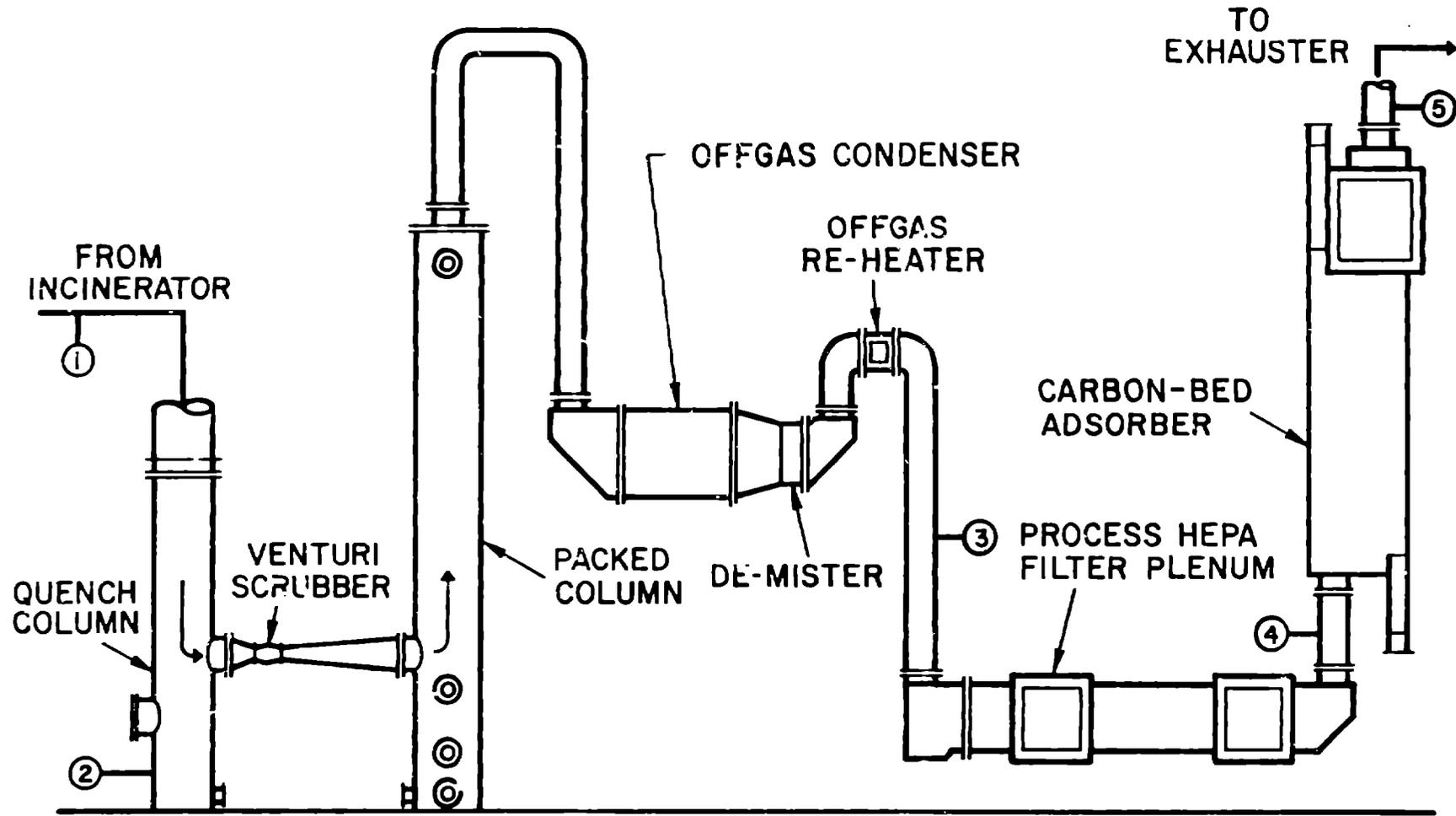
Objectives of the Los Alamos program in support of the CAI/LLW demonstration goal are to: 1) develop and transfer design and operating data to the liaison subcontractor, 2) select subcontractor and provide management review of his activities (beginning in FY-1982), and 3) provide technical assistance to both subcontractor and utility through licensing and demonstration completion. As such, Los Alamos assumes the technical lead role in determining the design and operating parameters for the CAI/LLW demonstration process.

#### FY-1981 accomplishments

During FY- 1980 and 1981, design information derived from CAI/TRU demonstration program was transferred to Koch Process Systems, Inc. (formerly Helix Process Systems, Inc.), the designated liaison contractor under provisions of a DOE/ALO contract. This information served as a starting point for preliminary design and engineering of the CAI/LLW system and also was incorporated in a Technical Support Document (TSD) which will be submitted to NRC as technical basis for licensing proceedings. Koch completed a preliminary design in FY-1981; a draft TSD is expected early in FY-1982.

In addition, development studies to determine the behavior of fission and activation products within the CAI system were initiated. A five-day test burn was conducted with solid waste spiked with selected fission products (Fe-59, Co-60, Ru-106, I-131, and Cs-137). The charged solid waste mix is shown in Table 1; included radionuclides were those with chemical and physical characteristics of potential concern to process operations. Before conducting this experiment, a carbon bed adsorber was incorporated in the offgas system to trap volatile species and five hybrid germanium detectors were installed to determine decontamination factors for individual isotopes (see Figure 2). Experimental data indicated excellent process performance with a volume reduction ratio well in excess of 100:1 and extremely effective overall containment of the radionuclides. Detector data is being analyzed to provide insight into individual isotope behavior within the process.

# OFFGAS CLEANING SYSTEM



## O-DETECTOR LOCATIONS

Figure 2. Controlled Air Incinerator Offgas Systems Including Hybrid Germanium Detector Locations.

Table 1. Incinerator Feed Mix  
Fission Product Distribution Test

Waste	Composition
Cellulosics	35%
PVC	12%
Polyethylene	23%
Rubber	30%

Efforts related to incineration of spent IX resins likewise were initiated in FY-1981. At the end of the LLW test burn, several IX resin types were charged to the CAI in 0.06 m<sup>3</sup> batches. Although the resins used were clean and nonradioactive, observation of burning characteristics showed the absence of problems reported with other incineration systems (e.g., violent spalling reactions and melting). In addition, a liquid burner design, which will provide a continuous resin slurry burning capability, has been cold tested successfully and installed in the lower CAI chamber (see Figure 3).

#### FY-1982 plans

At the end of FY-1981, DOE transferred management responsibility for this program from the Transuranic Waste Systems Office to the Low Level Waste Management Program Office (LLWMPO). Subsequent LLWMPO program review resulted in some redefinition of the Los Alamos role, specifically, the Laboratory will be responsible for management review and approval of subcontractor activities. A milestone schedule (Figure 4) provides an overview of planned FY-1982 Laboratory and subcontractor efforts.

Likely the single most important Los Alamos task during FY-1982 is the selection of a subcontractor for the commercialization effort. A request for proposal will be issued in December with contract award planned prior to April 1st. As a minimum, the industrial firm selected for this role must be familiar with: 1) nuclear utility waste management requirements and construction practices, 2) NRC licensing procedures, and 3) process design practices.

Technology development studies will include both spent IX resin and fission product distribution test burns. Final installation and mechanical checkout of the new liquid burner which will accept IX resin/mineral oil

# LIQUID BURNER SYSTEM SCHEMATIC

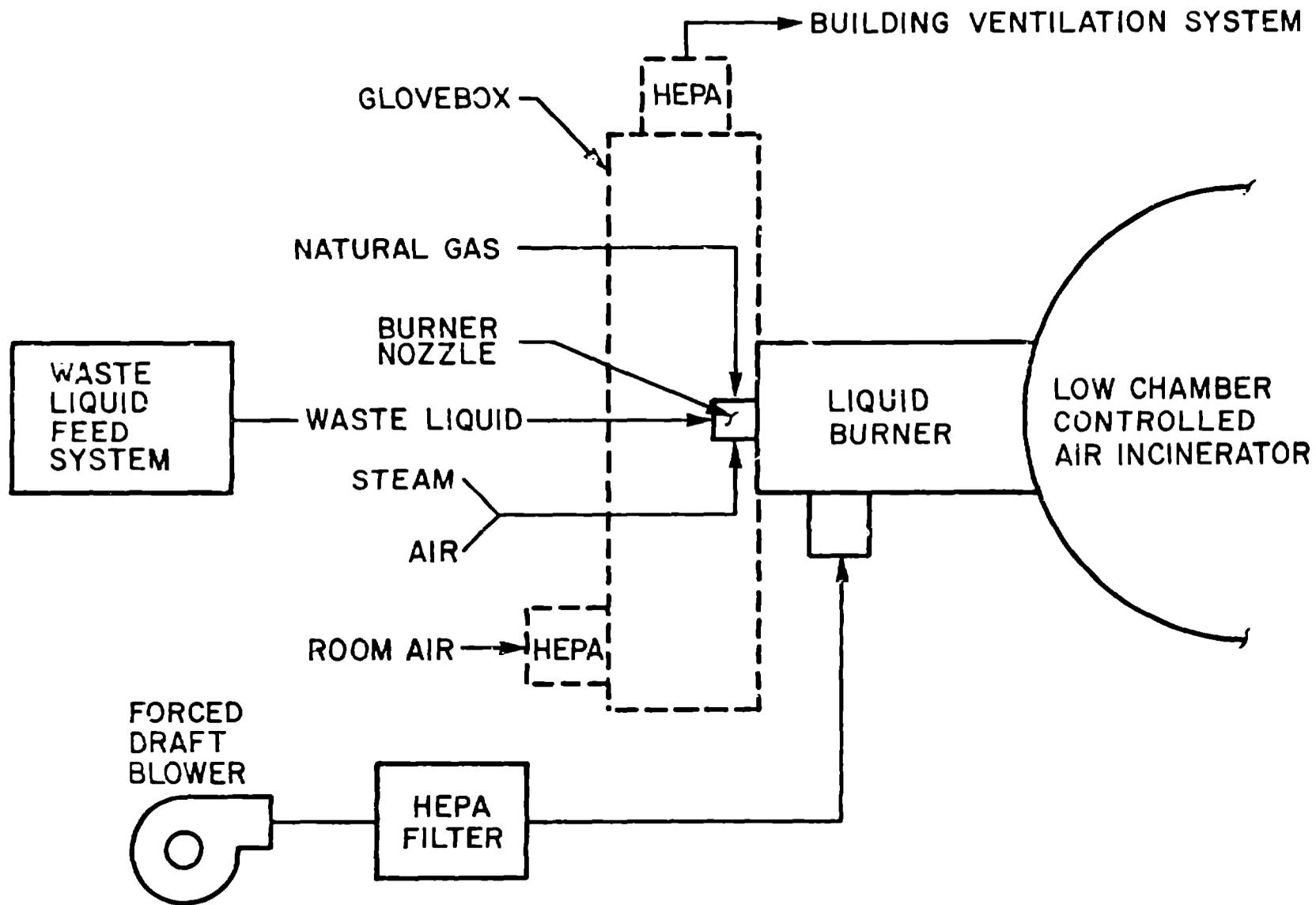


Figure 3. IX Resin/Oil Burner System

Figure 4. Commercial Incineration Demonstration Milestone Schedule for FY-1982

WORK ELEMENT: INCINERATION DEMONSTRATION	O	N	D	J	F	M	A	M	J	J	A	S
Incineration Demonstration												
1. Program Management			A ▽			B ▽						
2. Technology Development												
2.1 Resin Incineration			A ▽						B ▽			C ▽
2.2 Tracer Testing								A ▽	B ▽	C ▽		D ▽
3. Commercialization Support						A ▽				B ▽		
4. Subcontractor Services (Proposed)									A ▽		B ▽	C, D ▽

**EXPLANATION OF MILESTONES**

<b>1.0 PROGRAM MANAGEMENT</b>		
A. Request for proposal (A/E service) issued	Dec.	15
B. Subcontract placed	March	30
<b>2.0 TECHNOLOGY DEVELOPMENT</b>		
<b>2.1 RESIN INCINERATION</b>		
A. New burner checkout completed	Dec.	31
B. Resin incineration testing completed	June	30
C. Resin combustion letter report issued	Sept	30
<b>2.2 TRACER TESTING</b>		
A. Tracer experiments designed	May	30
B. Calibration run	June	30
C. Tracer test	July	30
D. Letter report issued	Sept.	30
<b>3.0 COMMERCIALIZATION SUPPORT</b>		
A. Technical support document issued	March	31
B. New preliminary design reviewed	July	30
<b>4.0 SUBCONTRACTOR SERVICES</b>		
A. Project schedule issued	June	30
B. Preliminary design completed	Aug.	31
C. Commercialization site identified	Sept.	30
D. Economic evaluation completed	Sept.	30

slurry feed is in progress and nonradioactive experiments are planned for early CY-1982.

A second fission/activation product distribution test is scheduled for the final quarter of FY-1982. The purpose is to supplement data obtained during the initial run to provide information required for NRC licensing, offgas design data, and to establish a basis for shielding calculations.

Direct commercialization support will include transfer of base design information to the liaison subcontractor. In addition, the TSD prepared by Koch Process Systems, Inc. will be reviewed, revised as necessary by Laboratory staff, and forwarded to NRC. This initial TSD draft will be used for generic review by NRC staff.

#### Subcontractor Role

The subcontractor will be responsible for both liaison and facilitating functions within the demonstration program. Although specific elements of the contractor package will be refined after subcontractor selection, currently identified tasks include: 1) preparation of the CAI/LLW design incorporating Los Alamos input and utility requirements, 2) demonstration site selection, 3) active participation in NRC licensing proceedings, and 4) continued involvement through demonstration completion.

In FY-1982, the subcontractor will be required to establish an overall project schedule, complete a preliminary CAI/LLW process design, identify the commercial demonstration site, and prepare an economic evaluation of the project reflecting specific waste management circumstances at the demonstration site.

#### Program plans beyond FY-1982

Utility involvement, scheduled to begin in FY-1983, will require, as a minimum, the definition of site-specific waste management needs, participation in the licensing proceedings, and CAI/LLW operation. At the outset, tasks, objectives, and responsibilities will be redefined to reflect the capabilities and circumstances of all participants.

In addition to continued management overview of subcontractor activities, anticipated Los Alamos activities will include the conduct of incineration tests using site-specific wastes. These experiments will serve to verify design and operating parameters for the CAI demonstration unit. Further, assistance will be provided to the subcontractor and host utility during start-up, nonradioactive tests, and demonstration operation of the CAI/LLW system.

Utility and subcontractor activities in FY-1983 will focus on licensing of the demonstration process and preparation of final design documents. Following NRC approval, fabrication, site preparation, and installation are expected to require 14 to 18 months for completion. Demonstration tests are targeted for the end of FY-1985.

#### REFERENCES

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## FIGURE LIST

- Fig. 1 Controlled-Air Transuranic Waste Incineration Process.
- Fig. 2 Controlled Air Incinerator Offgas Systems Including Hybrid Germanium Detector Locations.
- Fig. 3 IX Resin/Oil Burner System.
- Fig. 4 Commercial Incineration Demonstration Milestone Schedule for FY-1982.