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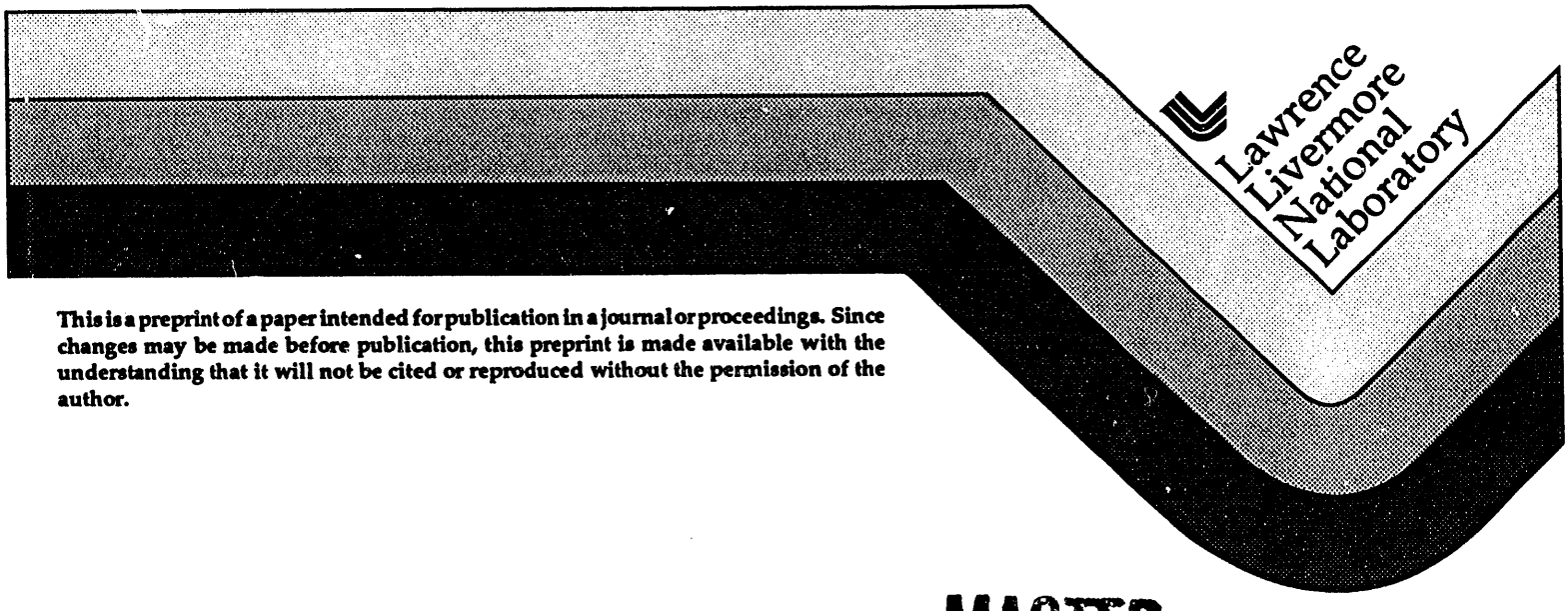

MIXED WASTE MANAGEMENT FACILITY

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ABSTRACT

The DOE has developed a National Mixed Waste Strategic Plan which calls for the construction of 2 to 9 mixed waste treatment centers in the Complex in the near future. LLNL is working to establish an integrated mixed waste technology development and demonstration system facility, the Mixed Waste Management Facility (MWMF), to support the DOE National Mixed Waste Strategic Plan. The MWMF will develop, demonstrate, test, and evaluate incinerator-alternatives which will comply with regulations governing the treatment and disposal of organic mixed wastes. LLNL will provide the DOE with engineering data for design and operation of new technologies which can be implemented in their mixed waste treatment centers.

MWMF will operate under real production plant conditions and process samples of real LLNL mixed waste. In addition to the destruction of organic mixed wastes, the development and demonstration will include waste feed preparation, material transport systems, aqueous treatment, off-gas treatment, and final forms, thus making it an integrated "cradle to grave" demonstration. Technologies from offsite as well as LLNL's will be tested and evaluated when they are ready for a pilot scale demonstration, according to the needs of the DOE.

INTRODUCTION

Under the sponsorship of the Department of Energy's Office of Environmental Restoration and Waste Management Lawrence Livermore National Laboratory is designing a facility for the demonstration of low-level mixed waste treatment. The Mixed Waste Management Facility's (MWMF) mission is to demonstrate technologies which are alternates to incineration for destroying organic constituents in mixed waste. This facility will support the DOE National low-level Mixed Waste Treatment Program. It is an adjunct to another program at LLNL, the Decontamination and Waste Treatment Facility. It is intended to support the DOE in the development of a plan for the treatment and disposal of mixed waste. Engineering and permitting issues and cost and schedule performance information will be transmitted the DOE MWTP for use in the deployment of full scale facilities elsewhere in the complex. The treatment technologies will be of modular design, thereby, enabling easy exchange of systems for testing and comparison. Therefore, this facility will be a flexible test bed for current and future technologies. An existing building at the LLNL site, has been assigned for this mission. EM-30 has requested that this test bed capability be maintained for 10 to 20 years.

Balanced flow sheets are being developed to insure compatibility of scale between all the various operations and technologies. This is important since we are trying to demonstrate an integrated systems approach for treatment; that is to demonstrate handling and treatment from receiving the waste, characterization and sorting, waste preparation, treatment, secondary stream treatments, off gas treatment, final waste forms production, repackaging, and shipping. This systems approach will provide a complete picture of what is required to support a specific treatment technology. The facility will accept, integrate equipment and evaluate (technologies) of modular design from other DOE facilities and industry. By having an integrated facility, technologies may be compared side by side. The design will minimize worker exposure, secondary waste generation and plant maintenance requirements.

FEED STREAMS

Five specific feed streams have been identified for treatment in the Mixed Waste Management Facility. These are;

Organic liquids-halogenated and nonhalogenated solvents, oils
Organic matrix solids-sludges, containing organics
Combustible debris
Predominately combustible
Lab packs-scintillation cocktails

Since the current mission of this facility is specifically to evaluate alternatives to incineration, other feed streams will be segregated as much as practical at the receiving and the feed preparation areas and will be returned for storage in the LLNL Hazardous Waste Management Facility.

Material Flow

The MWMF will consist of five functional areas. Receiving and Feed Preparation, Primary Treatment, Secondary Streams Treatment, Off-Gas Treatment, and Final Waste Forms Production (Fig.1).

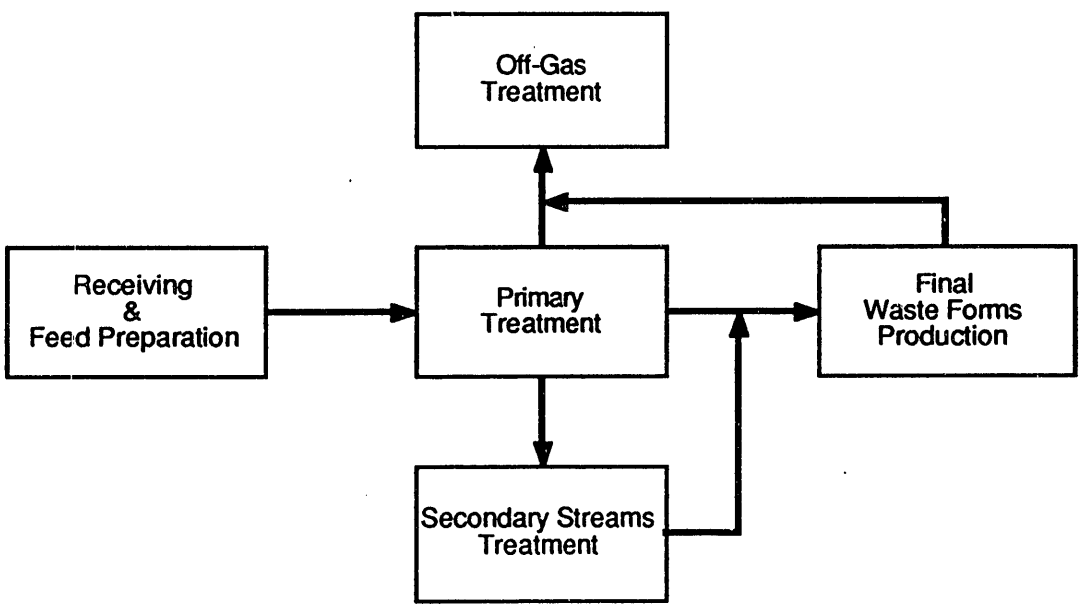

Figure 1. Mixed Waste Management Facility Functional Block Diagram.

Receiving and Feed Preparation

Waste materials will be received at the facility in a variety of containers. For initial operation, 55-gallon drums will be the largest containers accepted. However, provisions in design will be made to handle sizes up to and including DOT 7A (4'x4'x7') steel boxes. Prior to delivery to the facility, the smaller containers (55-gallon drums and smaller) will be examined by nondestructive means -- real time radiography, active-passive tomography, etc. Accepted containers will then be opened and unpacked. Initially, this task will be done with extensive operator involvement. As automated techniques evolve they will be integrated into the facility to reduce hands-on operation.

The feed streams will be sorted into two categories -- liquids and solids (Fig.2). The liquids will be analyzed, if required preprocessed by filtering to remove particulates, and stored according to type in queue to await treatment . The solids will be treated to remove the inorganic constituents, which will be returned for storage in the LLNL Hazardous Waste Management Facility. The combustible solids will then be pulverized and blended. In some cases, they will be mixed with liquids depending upon the treatment process to be used. They will be stored in queue to await treatment. Specific feed materials will be held until enough material has been accumulated for a one-week campaign using a specific technology. The material will be transported as required to the corresponding process technology for organic destruction. The transportation will be accomplished in a batch mode, and initially will be done manually. The intent is to upgrade this operation in the near future to be fully automated.

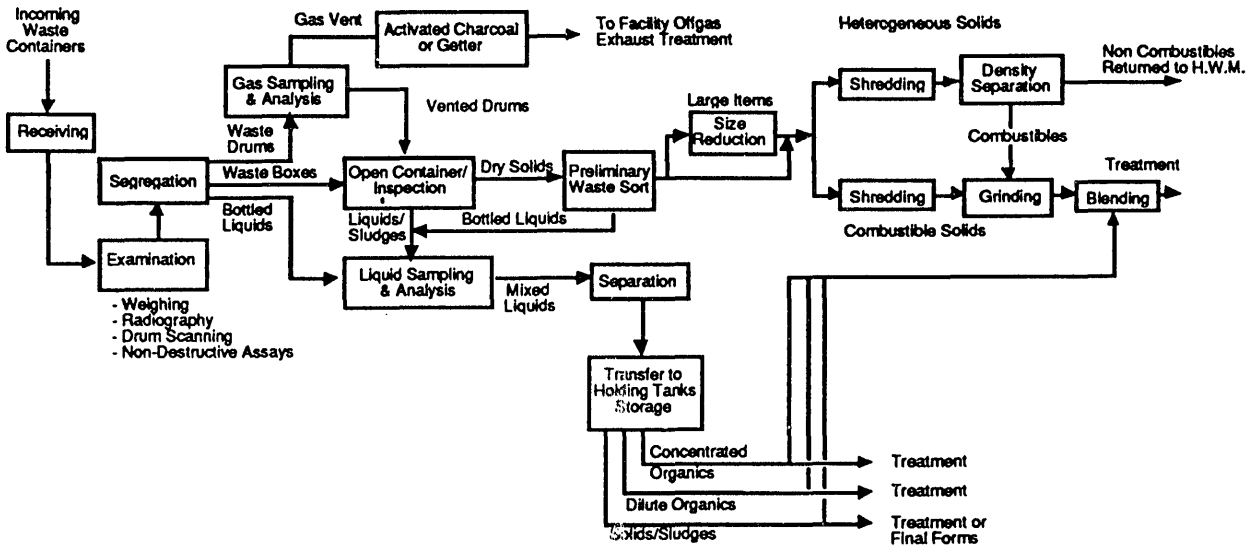

Figure 2. Receiving and Feed Preparation Diagram

Primary Treatment Technologies

Initially, four primary treatment technologies will be incorporated into the facility. These technologies will be modular, and will be complete with their unique supporting equipment, e.g., chemical regeneration, unique gas scrubbing equipment, power supplies, etc. The initial technologies to be used are Molten Salt Destruction, Mediated Electrochemical Oxidation, Wet Oxidation, and Ultra-Violet Photolysis. These technologies are described in accompanying papers. Other technologies considered were super-critical water oxidation and direct chemical oxidation. At a later date, these technologies may be installed for testing.

Secondary Stream Processing

By far, the largest waste stream generated in the facility will be used process water. Water will be used in the sorting of organic from inorganic solids; it will be generated in the destruction of hydrocarbons and recovered from scrubbers. Water will be cleaned up and reused within the facility. Excess water will be further cleaned to meet discharge standards. Mediated electrochemical oxidization uses silver nitrate and nitric acid in its process. Silver recovery and reuse will avoid having to dispose of radioactivly contaminated silver. Acid recovery will limit the inventory of acid required. Solvents used in the feed preparation area for rinsing organics from inorganic components and the rinsing of filters and strainers will be recycled, reused, or destroyed. Solid secondary streams are also accounted for. Carbonate salts from the molten salt process will be recovered and recycled. Non-metal filters and ion exchange resins will be sent through the solid feed preparation line and then will be treated to destroy the organic components.

Off-Gas Treatment

There are three component areas to the off-gas treatment -- the facility off-gas treatment, experimental off-gas treatment systems, and specific process equipment off-gas systems (Fig. 3). The facility off-gas system will use the Best Available Control Technology (BACT) described in the MWMF air permit. We anticipate this will consist of HEPA filtration, scrubbers, NOX removal, and activated carbon filtration for volatile organic compounds. The experimental off-gas treatment is an area where new and emerging technologies may be demonstrated. These could include catalytic converters, advanced wet scrubbers, secondary oxidation, and metal HEPA filters. The specific process offgas treatment systems will be tailored to the requirements for each process i.e. MSD, MEO, and WETOX.

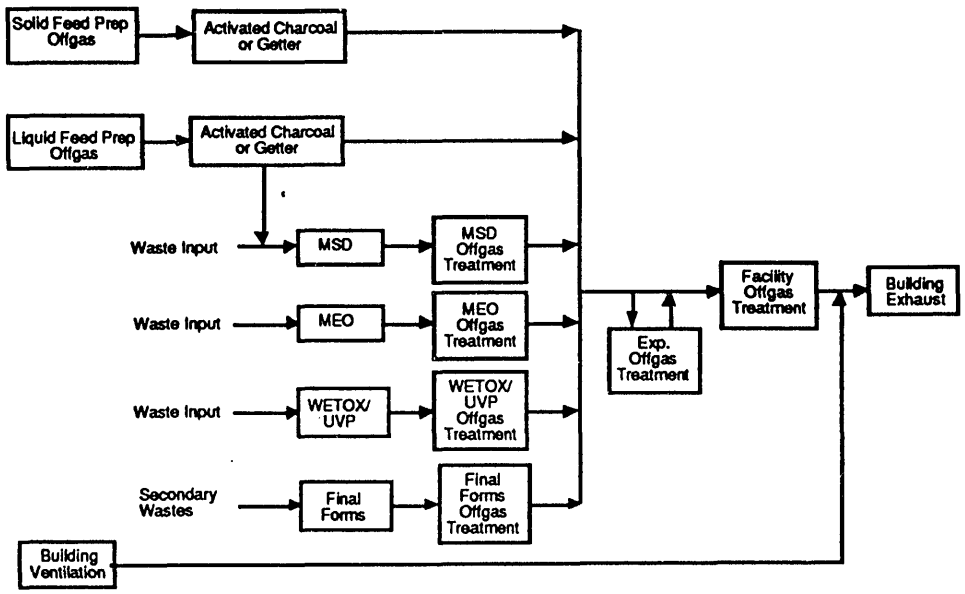

Figure 3. Off Gas Treatment Diagram

Final Waste Forms Production

The primary final waste forms for the Mixed Waste Management Facility will be ceramics. Hydraulic cement will serve as a back-up waste form. The types of ceramics to be used are oxide, oxide-sulfide, and reaction-bonded phosphate. All will be made in the form of 1-cm sized pellets. The first two types will be produced by a cold press and 1200° C sinter process, while the phosphate type will be formed by phosphate bonding at room temperature followed by firing at 400°C. All final forms must pass the Environmental Protection Agency's Toxicity Characteristic Leaching Procedure (TCLP) and the State of California's Waste Extraction Test.

PLANT CONTROL SYSTEM

The MWMF control system will consist of a central supervisory control room with operator consoles and computer servers networked to equipment in each of the functional areas as depicted in the data flow diagram in Fig. 4.

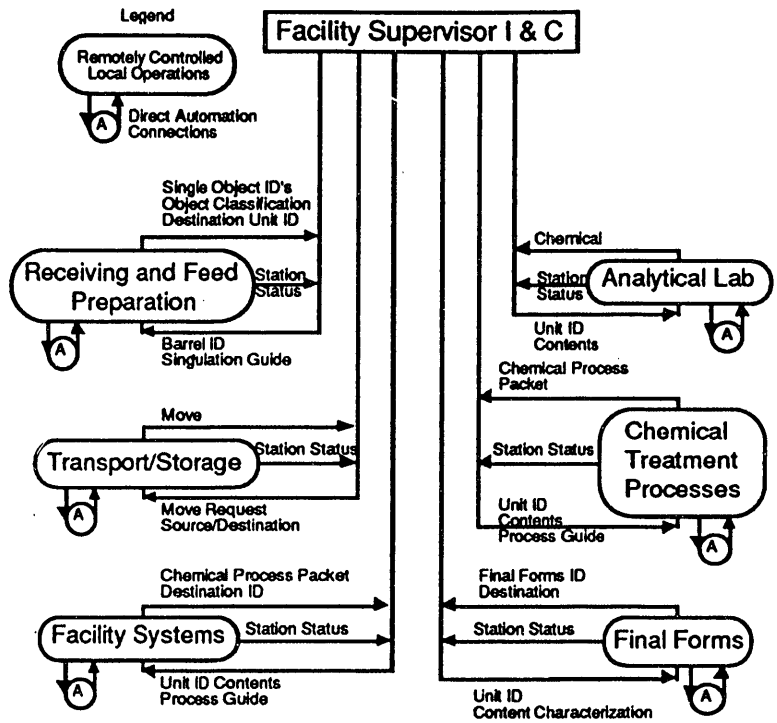

Figure 4. Plant Control System Diagram

Each area will include monitoring, controlling, data gathering, remote view, and listening equipment. Communications will take place between central control and the functional areas over a distributed network.

The central control room will contain a control console at which the operator can monitor both global and local facility activities via computer graphics displays, an ensemble of TV monitors, and an intercom. The central control room will also include telerobotic consoles at which operators can teleoperationally control robots and other mechanisms in the various pre-treatment work cells.

The central control supervisor will also provide an assortment of data gathering, archiving, retrieving, managing, and trending services. Important functions which will use these services include tracking of waste materials movements from receiving, characterizing, feed preparation transporting, storing, processing, etc. Another important function of central control will be displaying the current conditions of all subsystems making up the facility including operational state, fire alarm status, etc. Waste charateristics and analytical results from processing will be managed within the central control system database.

Each process treatment area will be equipped with a local controller. This local controller will interface with the facility network as well as all local sensors (temperature, pressure, ph, flow rate, etc,) and all local effectors (heaters, coolers, valves, augers, etc). The local controller includes a local operator console, and provides the PID and other controls necessary for running the process.

Environmental Safety and Health

The MWMF will meet all applicable ES&H requirements specified by Federal, State, and Local regulations as well as DOE orders. These include assessment of impacts under the National Environmental Policy Act and California Environmental Quality Act, permitting as a RD&D facility under the Resource Conservation and Recovery Act and California Hazardous Waste Control Law, air emissions controls and permits under the Clean Air Act and local air district requirements, as well as safety and health evaluations and operations under the Occupational Safety and Health Act and DOE orders. The successful completion of these tasks will require establishing an effective working relationship between regulatory agencies (EPA, DTSC, DHS, and BAAQMD), DOE, LLNL, and the public.

Conclusion

Progress to date includes: preconceptual design, draft Environmental Assessment, draft Preliminary Analysis, acknowledgement from California that MWMF is eligible for an RD& D permit and a preliminary cost and schedule.

MWMF will provide the DOE with engineering data and operational experience for new alternative technologies. These technologies may be deployed nationwide as a part of the mixed waste treatment solution.

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