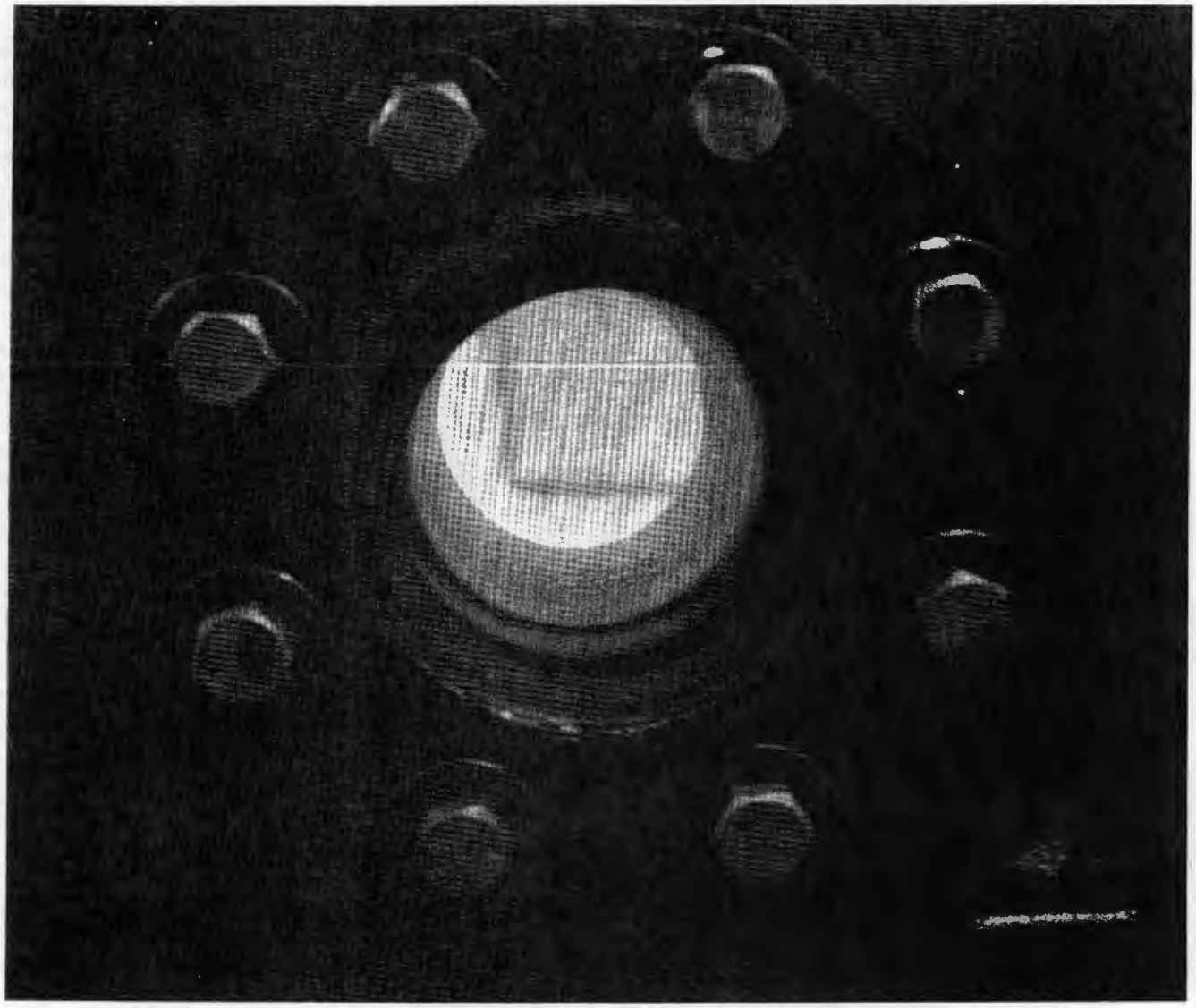
Reprint
from

the Atom

Los Alamos Scientific Laboratory

12005

2186 General

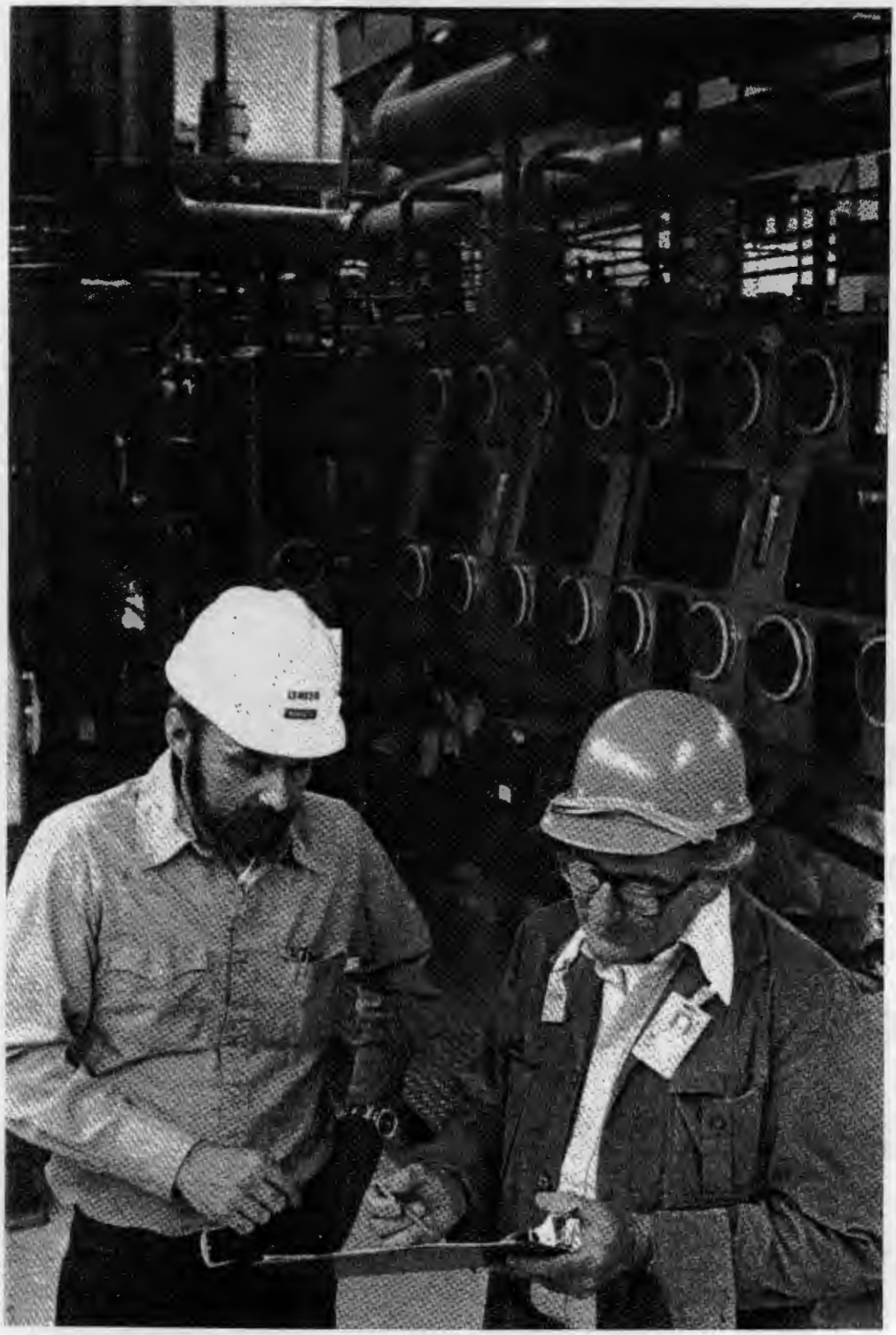


A porthole near the main chamber provides visual access to the interior of this special incinerator. The window is made up of two plates of one-half inch temperature resistant quartz. Two separate plates are used for added insulation.

Photos by Bill Jack Rodgers

Unconventional furnace for special waste

Unlike conventional trash, these items can't be hauled to the dump; they must be safely disposed of in some manner.



By John Ahearne

Anything used in a "hot" area—a laboratory where radioactive materials are handled—is considered radioactive waste. Kleenex, cartons, pliers, beakers, cans, paper, rags, lab coats, booties, pipettes, filters, even large machines and actual sections of buildings, must be discarded, whether they are really contaminated or not.

Even low-risk items like these are treated with the utmost care and caution, as are all materials used in laboratories dealing with transuranic elements. But unlike conventional trash, these items can't be hauled off to the municipal dump; they must be safely disposed of in some manner.

Isolation of waste varies from shielded bins or tanks for high-level contaminants to storage arrays of packaged transuranics with long half-lives to land burial of low-activity materials. Radionuclides range from the short-lived (a few days or weeks) to those with half-lives of thousands of years; all must be managed for the duration of their radioactive lives.

But the sheer bulk of the waste material poses a storage problem. While compaction can indeed reduce the *volume*, it does little to change the chemical and physical form of the waste. It was this problem of chemical change, along with volume reduction, that led to the construction of the Treatment Development Facility (TDF) to house demonstration projects

Waste Management (H-7) Group leader Tom Keenan, right, discusses the progress of the experiment with TDF research, development, and demonstration project leader Leon Borduin. The TDF research is only part of LASL's extensive program of waste management headed by Keenan. He is also responsible for the liquid treatment facility, burial/retrievable storage management, and a wide range of research activities.

The result of this pilot project is an assembly that ingests two-cubic-foot boxes of combustible waste. Air flow is so stable that a box will often retain its shape in the chamber after burning.

aimed at improved treatment processes for transuranic waste.

Equally important as volume is "waste form stabilization," the ultimate goal of the research facility. "Stabilization," says project manager Lee Borduin, "pertains to the chemical and physical make-up of the final product; that is, a form easy to handle and store.

"The purpose of the research is demonstration of engineering methods to stabilize transuranic waste. Our work demonstrates production-scale models and ultimately will provide a base for waste problems throughout the Department of Energy and in private industry."

(Borduin heads the research and development efforts for LASL's waste management group, H-7, under Tom Keenan. Working with Borduin in this part of the Health Research (H) Division are engineers Wiley Draper, Ralph Koenig, Al Neuls, Jack Newmyer, Larry Stretz, and Charles Warner.)

Controlled air incineration

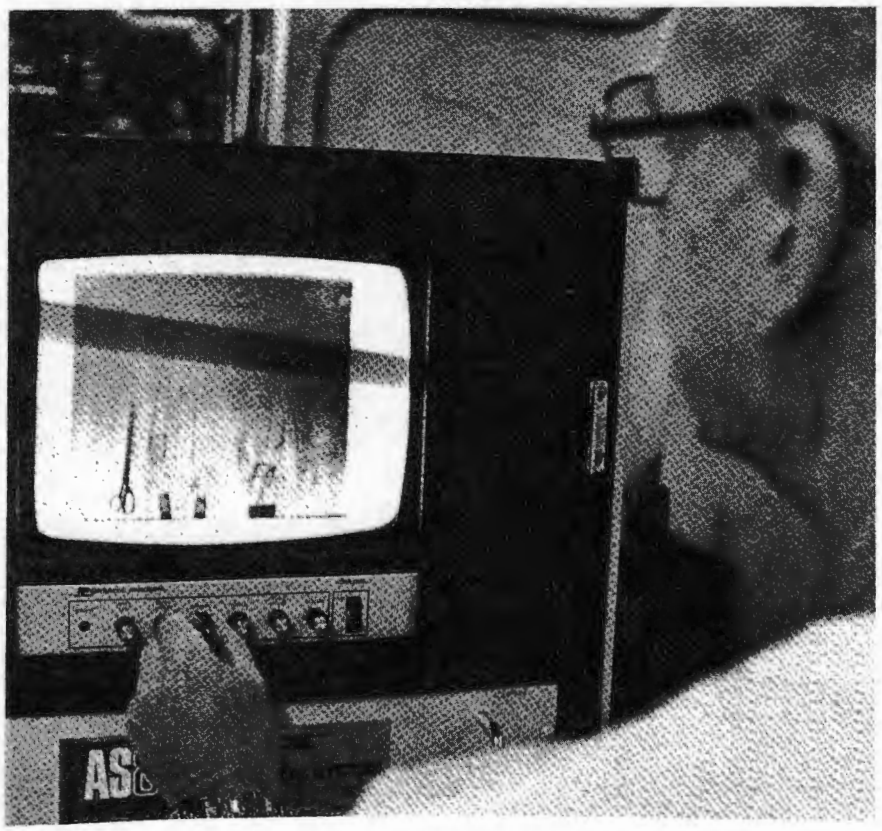
The first process chosen for evaluation at TDF was controlled air incineration, selected after reviewing technologies available in 1973. This project aims to stabilize and reduce the volume of combustibles—paper, rags, plastics, and rubber—that contain transuranics. These items measure above 10 nanocuries per gram (a curie is the basic measurement of decay, the amount of a nuclide that undergoes 3.7×10^{10} disintegrations per second; a nanocurie is one billionth of a curie).

The result of this pilot project is an assembly that ingests two-cubic-foot boxes of combustible waste. After suitable inspection, burning, cooling, scrubbing, washing, and extensive off-gas filtering, an ash residue results that will be stabilized for terminal storage.

The massive equipment is sequestered within three levels of ever-lower negative atmospheric pressure. This prohibits any possible air flow from the incinerator toward the laboratory or other working areas.

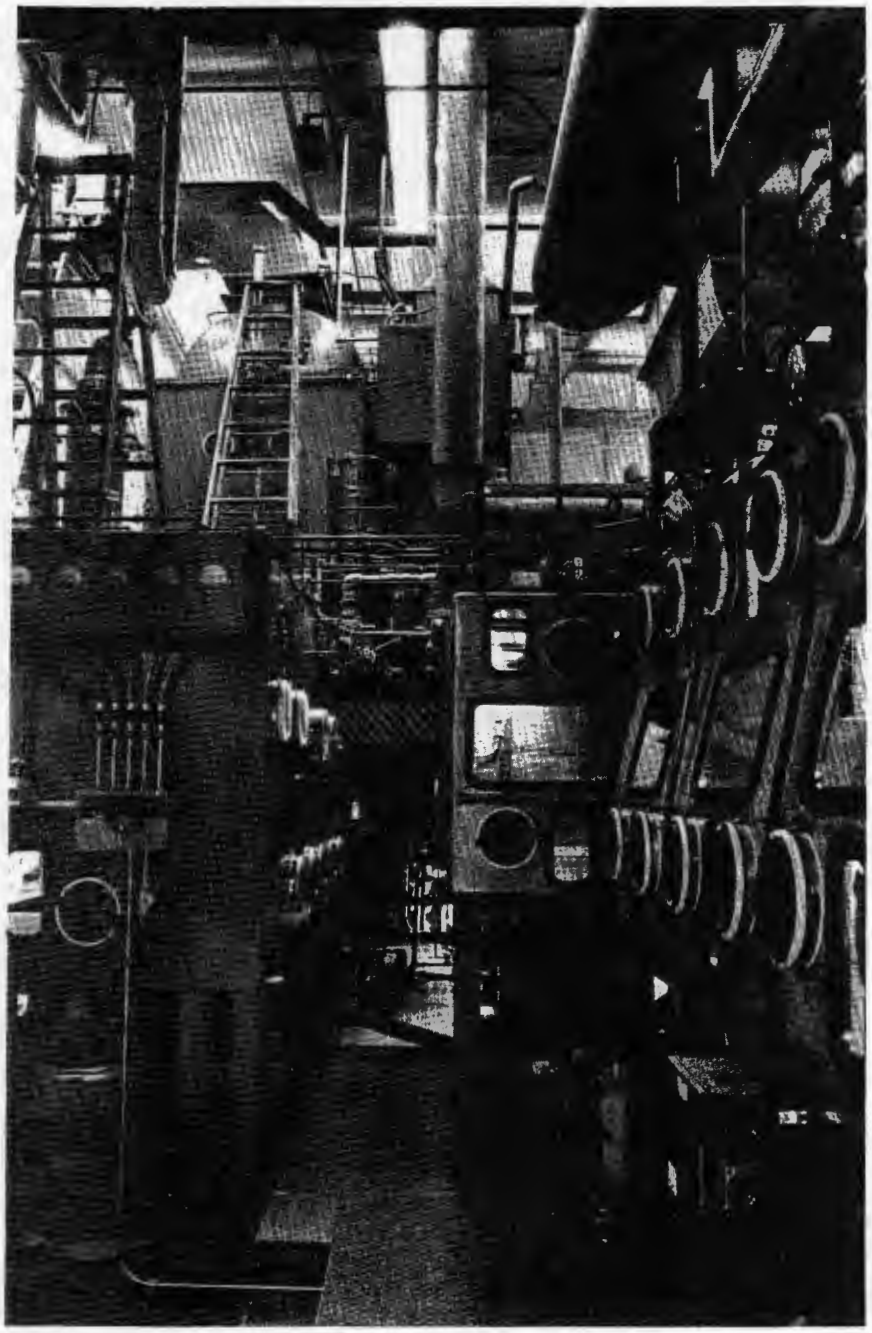
All combustible materials received by the TDF are first assayed to keep track of all transuranics contained in the wastes. The H-7 programs partially support H-1's assay section, under John Umbarger. A sophisticated device known as a Multiple Energy Gamma Assay System (MEGAS) is capable of detecting radiation levels of transuranics in the low nanocurie range.

Incoming boxes are lifted mechanically from the protective metal shipping drums, assayed, marked, and passed before an x-ray scanner similar to those used at airport baggage inspection stations. This insures that noncombustibles (bottles, metal, or liquids) do not make their way into the incinerator; they are removed and separately processed. A final



Wylie Draper demonstrates the x-ray system used to insure that the packaged wastes contain only combustible materials. The system is similar to those used in airport security systems. The packages are automatically lifted and rotated so they can be observed from a variety of angles. This prevents the operator from missing, for example, a thin piece of metal that is being viewed toward its edge.

steps then remove most particulate and soluble combustion products. The cooled gases go through a venturi scrubber which removes more than 99 per cent of any remaining particulates.



The feed preparation glove boxes, right, allow the operators to assay, x ray, open, shred, and compact boxes of waste. The preparation phase insures that noncombustibles, such as bottles, metals, and liquids, do not make their way into the incinerator. Wastes are moved by an elevator and side ram feeder to the main ram feeder assembly, foreground left, which automatically inserts the wastes into the incinerator.

An adjustable throat valve in the venturi introduces turbulence in the off-gas and causes a pressure drop, so particulates can be more easily removed downstream. After the gas has traveled down the quench column and laterally through the venturi scrubber, it passes through a packed column to remove any mineral acids that combustion may have left.

Special plastic rings fill the packed column, offering a vast area over which gas contacts a scrub solution traveling down the column.

The gas is now ready for the multiple banks of final filters. A condenser, mist eliminator, and reheater are included to condition the gas before this step. The condenser lowers the gas temperature and removes the bulk of the water vapor. The gas must then be reheated to avoid corrosion of the filters, ducting, and blowers.

The gas finally moves through roughing filters and two banks of High Efficiency Particulate Air (HEPA) filters before exiting the stack. Filters and their assemblies are extensively tested by H Division before and after installation. Hatch-like "bagout" doors are fitted onto the filter housings to expedite safe removal and changing of the filters.

Product outstrips standards

The off-gas that leaves the stack is as clean as modern technology can make it. It is clean enough after the venturi scrubbing operation to far outstrip Environmental Protection Agency standards, and that is before the lengthy filtration process.

The cycle of volume reduction is now complete, but two byproducts must also be handled—the ash and the scrub solution used to clean the gas.

Ash is removed from the lower incinerator chamber by a specially constructed vacuum system, and experiments are underway at TDF