LA-UR -82-2323

Conf-821005--9

LA-UR--82-2323

DE82 021768

TITLE: THE DECOMMISSIONING OF A TRITIUM-CONTAMINATED LABORATORY

AUTHOR(S): Johnny R. Harper and Raymond Garde

MASTER

SUBMITTED TO 1982 International Decommissioning Symposium,
Seattle, WA, October 10-14, 1982

DISCLAIMER

Los Alamos Los Alamos National Laboratory
Los Alamos, New Mexico 87545

THE DECOMMISSIONING OF A TRITIUM-CONTAMINATED LABORATORY

Johnny R. Harper and Raymond Garde
Los Alamos National Laboratory
Los Alamos, New Mexico, USA

ABSTRACT

A tritium laboratory facility at the Los Alamos National Laboratory, Los Alamos, New Mexico, was decommissioned in 1979. The project involved dismantling the laboratory equipment and disposing of the equipment and debris at an on-site waste disposal/storage area.

The laboratory, constructed in 1953, was in service for tritium research and fabrication of lithium tritide components until 1974. The major features of the laboratory included 25 meters of gloveboxes and hoods, associated vacuum lines, utility lines, exhaust ducts, electrodryers, blowers, and laboratory benches.

This report presents details on the decommissioning, health physics, waste management, environmental surveillance, and costs for the operation.

INTRODUCTION

A tritium laboratory[1] was constructed at the Los Alamos National Laboratory in 1953 to handle kilocurie amounts of lithium tritide components. The laboratory was located in the basement of Building 1 in Technical Area 35 and occupied three rooms designated as A-12, A-12-A, and A-12-B (Fig. 1). It consisted of two glovebox lines totaling 25 meters in length (Figs. 2 and 3) and several equipment items such as heat exchangers, electrodryers, a refrigerator unit, a recombiner, and a gas blower (Fig. 4) that were interconnected with copper pipes (Fig. 5). The laboratory had its own air supply and exhaust stack (Fig. 6).

The laboratory was retired in 1974 and became a candidate for decommissioning because the radioactive contamination and the sole-use construction made it unsuitable for any beneficial occupancy.

In 1979 the gloveboxes in room A-12 were estimated to contain less than 100 curies of residual tritium oxide contamination each whereas the two electrodryers and associated equipment in room A-12-B were estimated to contain less than 1000 curies of residual tritium each, probably in the form of oxide. Preliminary surveys indicated nonfixed contamination of 10^6 dis/s/cm^2 inside the gloveboxes and up to 250 dis/s/cm^2 on the laboratory floor and cabinets.

DECOMMISSIONING PROCEDURES

Decommissioning began with the removal of work benches and utility lines. Existing electrical power was disconnected and temporary power was provided only to the lights, exhaust and ventilation blowers, and wall outlets to reduce the potential for electrical accidents. Thermal fire detectors were installed for local alarm and improved notification to the Fire Department.

A commercially available asphalt gun (Fig. 7) was used to apply tar undercoating to the interiors of all gloveboxes and hoods to fix residual dust and particulate material (Fig. 8). A 5-meter deep pit was excavated adjacent to the building to provide access to a removable portion of the south wall of Room A-12-A. Reinforced concrete walls were poured for shoring in the pit, a plywood door was installed between the excavated pit and Room A-12-A, and the top of the pit was covered with a removable roof. All equipment was removed through this pit for transfer to waste disposal.

The removal of the more highly contaminated equipment items began with the copper pipes (Fig. 9), which were cut and capped with metal caps (Fig. 10). During this operation, a portable exhauster was used. Silicon rubber adhesive applied to the caps before insertion over the separated pipe ends adequately sealed them to prevent spreading of contamination. After the adhesive had hardened (1-2 days), roofing tar was applied generously over the sealed pipe end. The sections of pipe were placed for disposal in 1.3- by 1.3- by 2.3-m fiberglass reinforced polyester (FRP)-coated plywood boxes.

The electrodryers in Room A-12 were stripped of accessories and connecting copper pipes (Figs. 11 and 12). They were removed and sealed in a 1.9- by 2.3- by 3.2-m FRP-coated container (Fig. 13).

The gloveboxes in Room A-12 were unbolted and separated into manageable sections. The sequence of removal can be best understood by referring to Fig. 1. Hoods 11 and 20 were removed to provide space. Gloveboxes 6 and 7 were removed as one unit. The sequence was then to transfer line 25; box 1A; box 1B; line 22; hood 4; box 12; boxes 13, 14, and 15; line 24; hood 19; and finally gloveboxes 17 and 18. Glovebox 16 (the hydraulic press box) was cut with a saber saw into three sections and the separation openings sealed with sheet metal. Putty tape sealed the sheet metal and glovebox edges. Roofing tar then was applied over the entire seal (Fig. 14) and around the windows (Fig. 15) and the metal-sealed glove ports. Plywood was banded over the weaker portions of the gloveboxes (Fig. 16), such as windows and sealed glove ports.

The gas blower, three heat exchangers, and the recombiner in room A-12-B were separated, sealed, and placed in 1.3- by 1.3- by 2.3-m fiberglass-coated plywood containers. The remainder of the copper lines, the ventilation and exhaust ducts, and the exhaust blower were removed, and the base of the stack that entered Room A-12-B was sealed.

Tile was removed from the floors in all three rooms. Surveys of the rooms found up to 500 [illegible]/s/cm^2 swipeable contamination. The rooms were rehabilitated by patching holes and painting the walls and reinstalling tile on the floors (Fig. 1[illegible]).

HEALTH PHYSICS

Workers used protective (anticontamination) clothing for all work, including coveralls, gloves, hoods, and booties. Other protective items used, depending on exposure potential, were the following: (1) a 0.006-gauge polyvinyl chloride supplied-air suit consisting of a slipover jacket with sealed-on hood and trousers with sealed-on boots (Fig.18); (2) breathing air from compressors located outside the work area (Fig. 19); (3) self-contained breathing apparatus; and (4) arm-length plastic gloves.

The highest airborne tritium concentrations about (10^5 µCi/m^3) occurred during the separation of the two heat exchangers and the recombiner in Room A-12-B. The highest concentration measured during the removal of the electrodryers was 10^4 µCi/m^3. During the removal of the copper pipes the levels were in the 200 µCi/m^3 range. In each case the concentrations lasted only a few seconds.

Workers submitted urine samples after each potential exposure operation as well as on a weekly basis. Of the fifteen workers who submitted routine and special urine samples each month over a five month period, seven individuals received a measurable exposure. The highest total absorbed dose for the operation was 210 mrem, and the average total was 60 mrem.

Instrumentation included the Johnson Triton Model 755-B, the Los Alamos National Laboratory's Model 110 Tritium Sniffer, a Johnson Triton Model 1055-B, and a Kanne Chamber system installed on the exhaust stack.

WASTE MANAGEMENT

All wastes generated by this operation were buried at the Laboratory's Radioactive Waste Disposal/Storage Site in a 1.9-m-deep by 3.9-m-wide by 33-m-long trench at the bottom of a large burial pit (Fig. 20), located 8 km from the decommissioning site. Wastes were transported in plastic-lined dump trucks covered with tarpaulins. The 183 m^3 of contaminated debris containing an estimated 6 x 10^3 curies of tritium were placed in the trench, which was covered with noncontaminated soil. The pit was then used to receive other routine low-level solid radioactive wastes.

ENVIRONMENTAL SURVEILLANCE

The Laboratory's Environmental Surveillance Group monitored the operation with its routine air sampling network[2] and two additional on-site sampling stations. One of the on-site stations (Fig. 21) was at the excavated pit by the base of the stack and the other was nine meters away. Table 1 presents the results of the on-site special air samplers.

The data indicate that some tritiated water vapor was released outside the tritium laboratory during the decommissioning. The concentrations, however, were three to four orders of magnitude less than the DOE airborne concentration limits for tritiated water vapor (DOE Manual, Chapter 0524).

The Kanne Chamber system installed on the exhaust stack provided a record of the stack releases. Table II presents tritium release data from 1975 through June 8, 1979.

******************** TABLE I ********************

ATMOSPHERIC TRITIATED WATER VAPOR AT TA-35

Sampling Period (1979)	Sampler[a]	Atmospheric Tritiated Water Vapor, pCi/m^3
April 3 - April 17	A	64 ± 10[b]
	B	46 ± 8
April 17 - May 1	A	270 ± 40
	B	73 ± 12
May 1 - May 15	A	121 ± 19
	B	91 ± 15
May 15 - May 30	A	180 ± 30
	B	29 ± 5
May 30 - June 11	A	190 ± 30
	B	76 ± 12

---

[a] Sampler A adjacent to pit ; sampler B at 9-m distance.

[b] Results ± 2σ.

******************** TABLE II ********************

TRITIUM STACK RELEASES

Year	Total Ci Discharged	Volume of Air Discharged (m^3)	Average Concentration Ci/m^3
1975	2300	1.3×10^8	1.8×10^{-5}
1976	1700	1.2×10^8	1.4×10^{-5}
1977	790	1.1×10^8	7.1×10^{-6}
1978	520	9.8×10^7	5.3×10^{-6}
1979[a]	1300	5.6×10^7	2.9×10^{-5}

---

[a] Discharges ceased on June 8, 1979.

Of the 1300 curies released during 1979, approximately 1080 curies can be attributed to decommissioning activities.

TECHNIQUES AND LESSONS LEARNED

Use of the portable ventilation system proved to be extremely valuable and cost effective (Fig. 22). It reduced costs and time by eliminating the need to use supplied-air suits, which are expensive and pose problems such as limited maneuverability and increased tripping hazards. Donning and removing of the suits also reduce worker productivity.

Expanding polyurethane foam was introduced into some of the copper pipes before cutting . The foam displaced tritium gases and created a filled dead area for pipe cutting. Air suits were not required for cuts on pipe sections filled with foam.

Roofing tar provided an excellent seal for tritium contamination as did putty tape and silicon rubber. Asphalt coating also proved effective in holding down particulates inside gloveboxes.

A nucleus crew of experienced decommissioners can achieve the most cost-effective, safe, and successful program of decontamination and decommissioning.[3-6]

COST

One hundred twenty-five working days were required to complete the project at a total cost of $252 000. Contractor support costs for manpower and equipment (Table III) costs were $106 850 and Laboratory support operations costs were $145 150.

TABLE III

SUBCONTRACTOR CRAFT AND EQUIPMENT USAGE

CRAFT HOURS	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	Totals
Carpenters	53	39	137	34	16	6	92		377
Roofers	8	0	6	6					20
Painters	24	2					168	24	218
Masons		5	7				2		14
Laborers	196	160	224	434	527	361	395		2297
Teamsters	34	2	32	24	50	7	8		157
Operators		12	71	18	53	11	5		170
Ironworkers		102	104	66	150	47			469
Tinners	52	138	16	32	12	13			263
Fitters	111			8	10	13			142
Electricians	204	14		20	26	59	67		390
TOTALS									4517
EQUIPMENT HOURS									
Flat-bed truck	10				15				25
Crane		2	7	15	19	8	1		52
Loader		4	8						12
Dump truck			16	5	7				28
Forklift			2	2					4
Compressor						7	2		9

REFERENCES

1. Rinehammer, T. B., and P. H. Lamberger, "Tritium Control Technology," AEC Division of Operational Safety report WASH-1269, December 1973.

2. Environmental Surveillance Group, "Environmental Surveillance at Los Alamos During 1979," Los Alamos Scientific Laboratory report LA-8200-ENV, April 1980.

3. Harper, J., R. Garde, "The Decommissioning of The TA-42 Plutonium Contaminated Incinerator Facility", LA-9077-MS, November 1981.

4. Harper, J., R. Garde, "The Decommissioning of TA-21-153, A ^{227}Ac Contaminated old Filter Building", LA-9047-MS, November 1981.

5. Harper, J., R. Garde, "Removal of Contaminated Air Scrubbers at TA-35-7," LA-9058-MS, November 1981.

6. Harper, J., R. Garde, "Decommissioning the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE I)", LA-9052-MS, November, 1981.

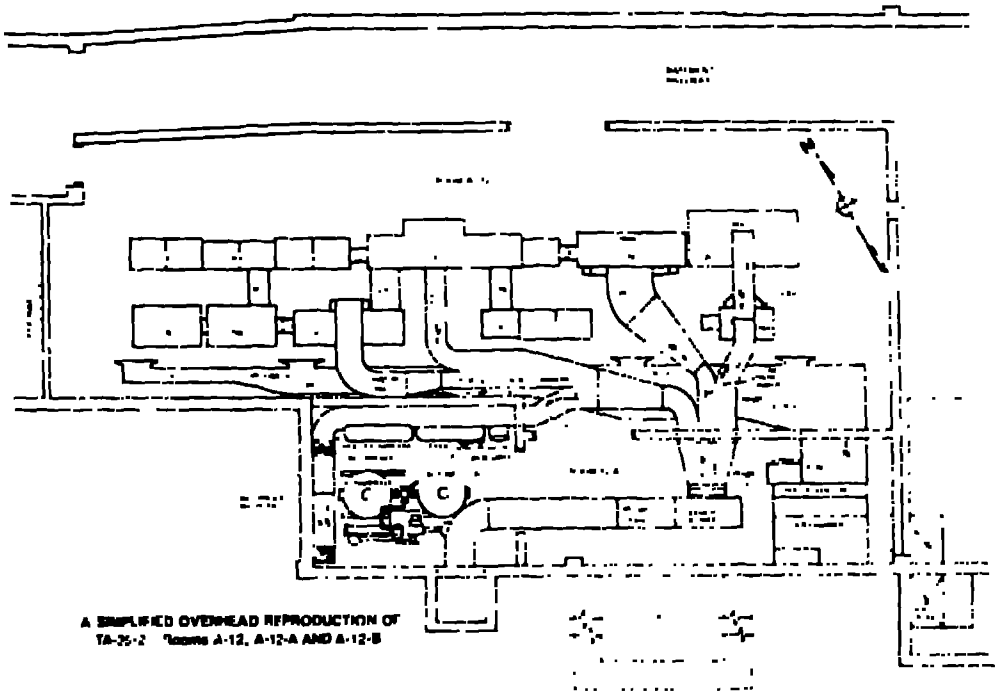

Fig. 1.
Tritium Laboratory

Fig. 2.
North glovebox line.

Fig. 3.
South glovebox line.

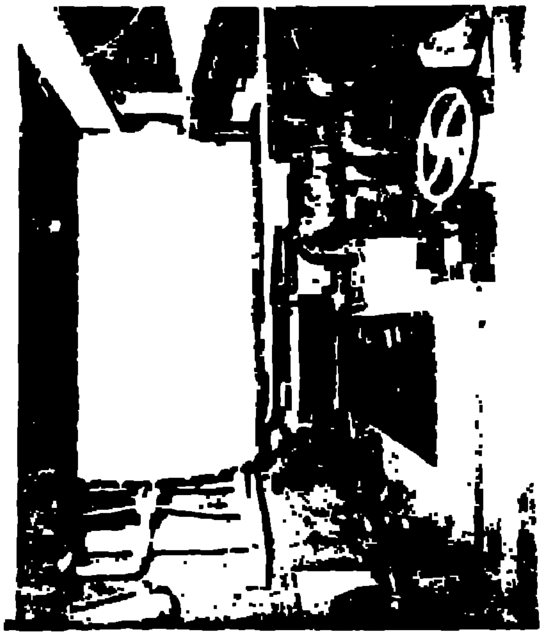

Fig. 4.
Clockwise from left corner to right corner: electrodryer, heat exchanger, and blower. Recombiner is in right rear corner.

Fig. 5.
Typical copper piping.

Fig. 6.
Exhaust stack.

Fig. 7.
Asphalt gun.

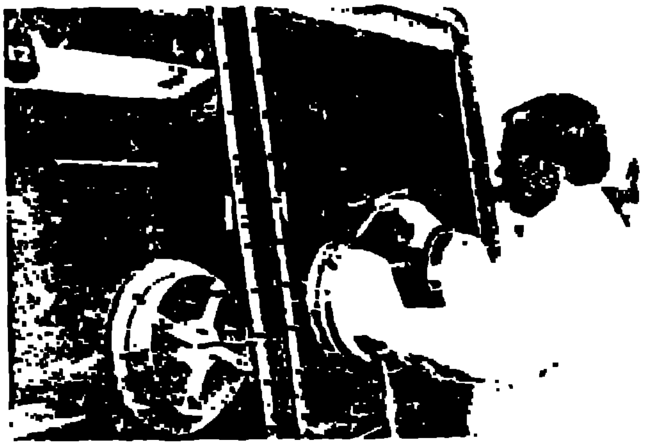

Fig. 8.
Applying of tar undercoating.

Fig. 9.
Copper piping before removal.

Fig. 10.
Sealing copper pipes with metal caps.

Fig. 11.
Disconnecting the electrodryers.

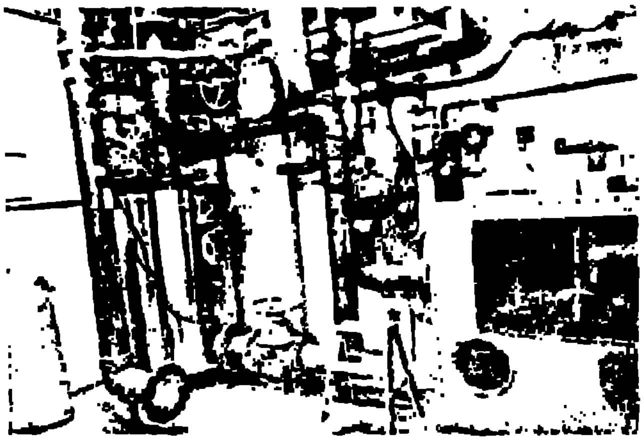

Fig. 12.
Room A-12-P after removal of electrodryers. Clockwise from left corner: Recombiner, heat exchanger, and blower.

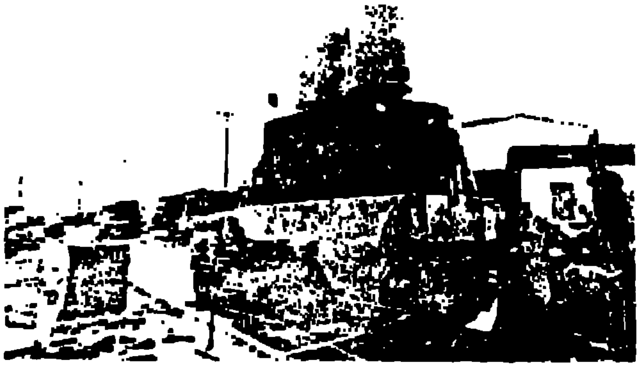

Fig. 13.
Placement of electrodryers into a fiberglass-coated plywood box.

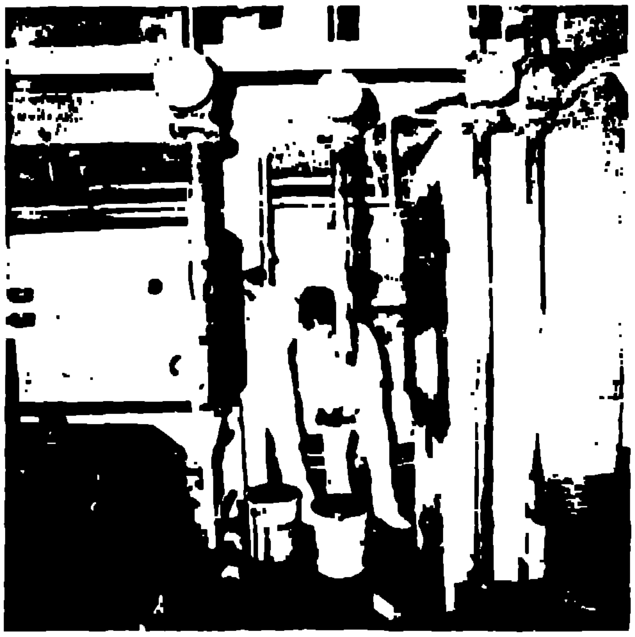

Fig. 14.
Applying roofing tar after a glovebox separation.

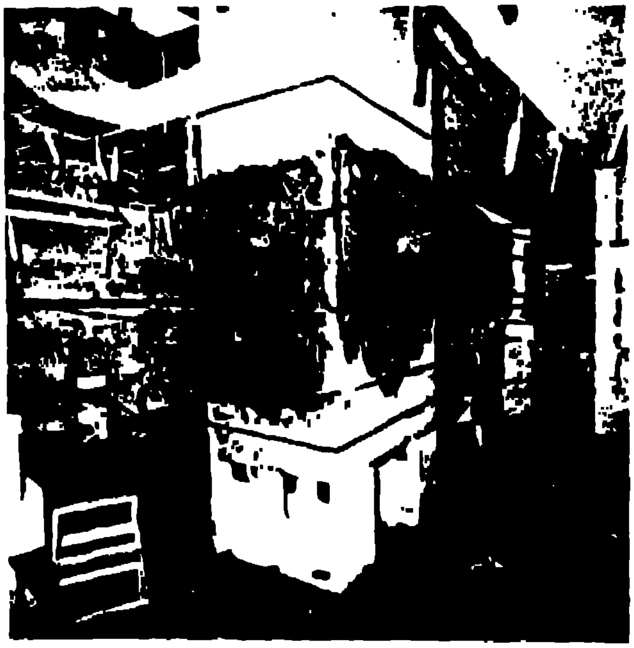

Fig. 15.
Windows and seals covered with roofing tar.

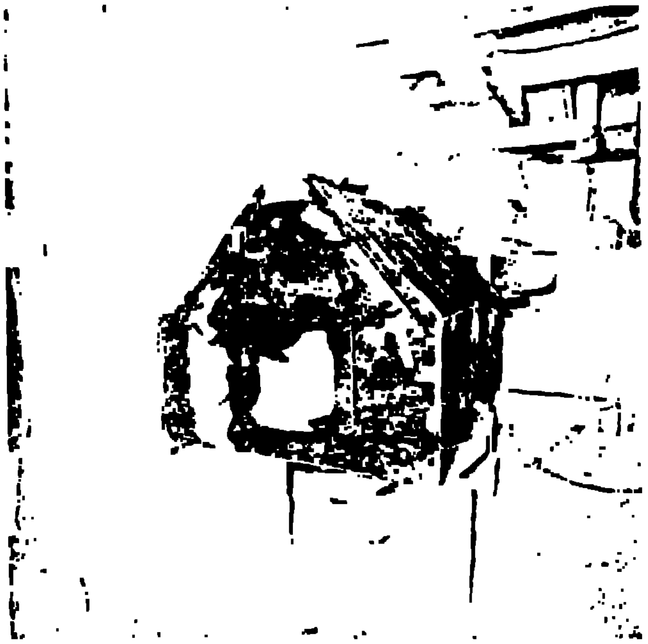

Fig. 16.
Plywood-protected windows and sealed sleeveports.

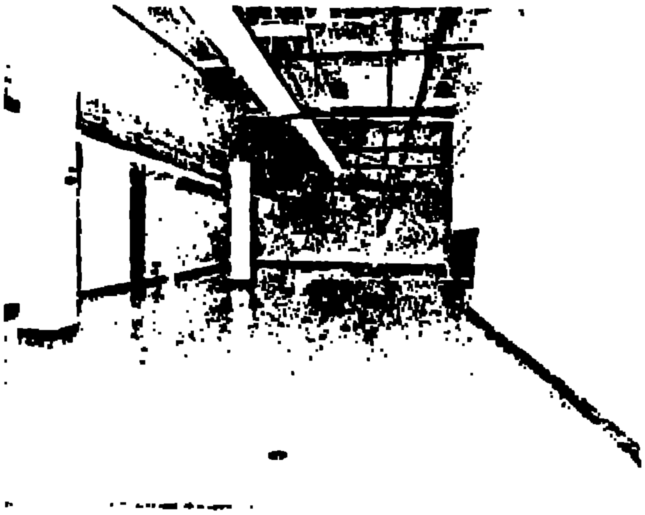

Fig. 17.
Rehabilitated room A-12.

Fig. 18.

Supplied-air suits.

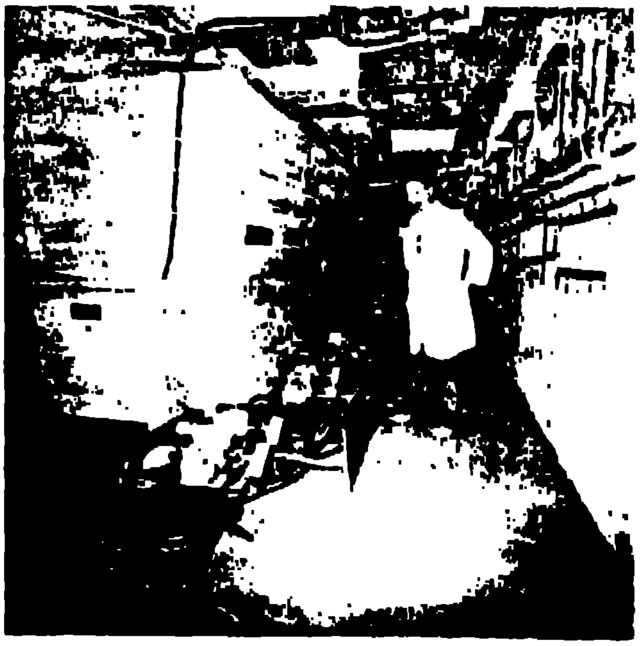

Fig. 19.

Breathing air compressors.

Fig. 20.
Disposal of tritium waste.

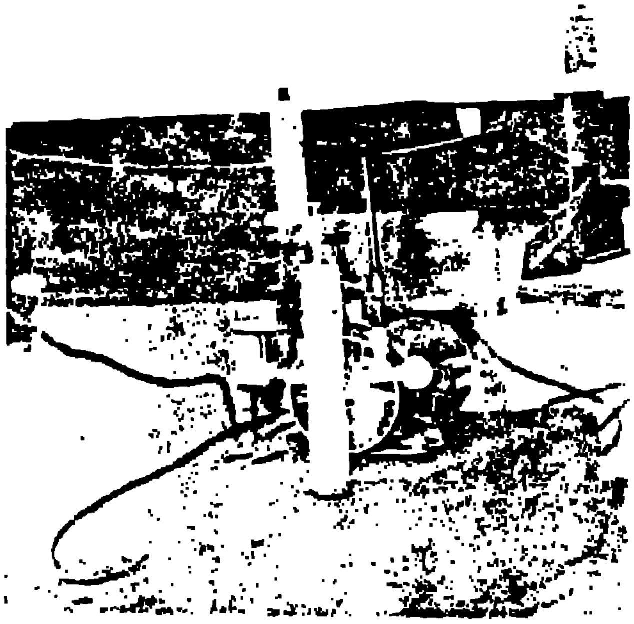

Fig. 21.
Environmental air sampler.

Fig. 22.
Portable ventilation duct in use during pipe cutting.