THE DECOMMISSIONING OF TA-21-153,
A ²²⁷Ac CONTAMINATED OLD FILTER BUILDING

by

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ABSTRACT

An exhaust air filter building contaminated with ²²⁷Ac was decommissioned at the Los Alamos National Laboratory, Los Alamos, New Mexico, in 1978. The building was constructed in the late 1940s to clean exhaust air from several buildings at TA-21, DP Site. It was in service until March 1970.

The project involved preliminary decontamination, dismantling the building, and burying the debris at an on-site waste disposal/storage area.

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

I. INTRODUCTION

In the late 1940s a filter building was constructed at the Los Alamos National Laboratory, Los Alamos, New Mexico, to clean the exhaust air from several buildings at Technical Area (TA)-21, DP East Site. The structure, designated as TA-21-153 (Fig. 1) consisted of

- a. a two-story frame and masonry building (Figs. 2 and 3) with 200 m² of ground floor area and 84 m² of second story floor area;
- b. 42 lineal meters of metal duct (Fig. 4);
- c. transitional plenums, filter housings with electromatic filters, (Fig. 5); and
- d. two blowers and two stacks.

The primary radioactive contaminant in the building was ^{227}Ac in secular equilibrium with its decay daughter products. Precleaning after the 1970 shutdown removed most of the contamination in accessible parts of the building. However, contamination remained in the ductwork, plenums, blowers, and stacks.

The building became a candidate for decommissioning because its deteriorating condition, the radioactive contamination, and its sole use construction made it unsuitable for any beneficial occupancy.

II. DECOMMISSIONING PROCEDURES

Planning for the decommissioning operation began in late 1977. As-built drawings were obtained from records storage and preliminary contamination surveys were performed. The structure and equipment were inspected for conformity to the as-built drawings. The structure was determined to have been constructed similarly to TA-21-12, a filter building decommissioned in 1972.¹

The preliminary contamination surveys indicated widespread nonfixed contamination within the ground floor story, the transitional plenum, the metal ductwork, and in the soil under the deteriorating ducts.

Decommissioning work began in April 1978 with the removal of the duct leading to the transitional plenum (Fig. 6). The interior of the duct contained an estimated total activity of 2 mCi. Prior to removal, it was isolated from the filter building. Auxiliary filtered exhaust ventilation for the plenum was established at a rate of $1.1 \text{ m}^3/\text{s}$. Small openings were cut into the ductwork to coat the interior surfaces with water-based spray paint. Roofing tar was applied to the deteriorating duct that was then externally reinforced with plywood. Each section of duct was surveyed internally for contamination. The maximum internal alpha surface contamination was 33 dis/s/cm^2 . Plastic sheets were placed under each section to contain any loose contamination. A crane was used to separate the duct sections. Openings were sealed with plastic and then with tin sheeting.

Building exhaust ventilation was re-established through a temporary bank of four high efficiency filters (Fig. 7) sited where the duct had connected to the transitional plenum (Fig. 8). Air flow through this system was $3.4 \text{ m}^3/\text{s}$.

The blowers and stacks were isolated from the building and were removed, sealed, and transported to the radioactive waste disposal/storage site (Figs. 9

and 10). Only 0.3 dis/s/cm^2 of alpha activity was detected inside the blowers and stacks.

The dry filters (Fig. 11) were removed. No alpha activity was detected probably because they had been installed after the filter building was no longer in operation during a precleaning operation in 1970. Access doors were cut into the precipitator frames (which housed the dry filters) to expose the electromatic filters (Fig. 12). These filters were cut into sections and spray painted prior to removal. The maximum alpha activity detected was 12 dis/s/cm^2 .

The transitional plenum was isolated from the building. Its interior sheet rock walls were stripped and placed in plastic-lined cardboard boxes (Fig. 13). The surfaces were painted. The exterior surfaces of the blower room and the transitional plenum (Fig. 14) were manually stripped of their asbestos transite siding. The remaining sheet rock walls of the transitional plenum were removed. A chain saw was used to sever the blower room (Fig. 15) and the transitional plenum from the building proper, then a front-end loader was used to collapse the structures (Figs. 16 and 17). Water was used for dust control. The ensuing rubble was loaded into plastic-lined dump trucks (Fig. 18).

For protection of the workers during the next phase, a second high efficiency filtered ventilation system with an airflow rate of $1.9 \text{ m}^3/\text{s}$ was connected to the building (Fig. 19). The remaining electromatic filters inside the building were removed in plastic-lined cardboard boxes and barrels. The maximum alpha activity detected was 12 dis/s/cm^2 on the ground floor. No activity could be detected in the second story.

The building interior was mopped with water and spray painted (Fig. 20). Asphalt mixed with latex paint was poured into all drain lines. The floors were coated with 1.25 cm of the mixture. Examination of the building interior indicated no detectable alpha activity, and the airborne contamination was (for the first time during the operation) lower than the maximum permissible concentration values.

The building was razed with a bulldozer (Figs. 21 and 22) and a front-end loader.

Metal structures were cut into manageable pieces with torches for ease of transport. The debris was sent to the radioactive waste disposal/storage site in plastic-lined, tarpaulin-covered dump trucks (Fig. 23). Contaminated soil was removed in a similar manner.

III. HEALTH PHYSICS

Personnel assigned to the project were experienced radiation workers and were reindocctrinated with formal health physics instructions. Decommissioning work was not permitted without the presence of a health physics surveyor.

Workers were provided protective (anticontamination) clothing for all work performed; this consisted of coveralls, gloves, hoods, and booties. No personal decontamination beyond normal showering and washing procedures was required.

All workers participated in a full-face respirator fitting, testing, and training program. Full-face respirators equipped with high efficiency particulate filters were the standard respiratory protection during phases of decommissioning involving a potential for airborne contamination. All workers were whole body counted before the operation to establish background levels in those workers. Nose swipes were collected from each worker after each risk period. Nose swipe analyses indicated no inhalation of contamination had occurred. However, the four most active workers were whole body counted a second time as a check on the swipe analyses. The second counts did not indicate any measurable exposure.

Air in the working areas was sampled by passing it through a HV-70 filter paper at a rate of $0.01 \text{ m}^3/\text{s}$. The papers were removed at the end of each workday and measured for alpha activity to provide a record of the workers' potential exposure to airborne contamination. Air was similarly sampled outside the buildings and from the high efficiency filtered exhaust/ventilation systems. The maximum interior airborne radioactivity detected was 2.5 dis/s/m^3 . This level fluctuated from day to day depending upon the work being performed and the loading on the exhaust prefilters. The interior activity detected the day prior to razing the building was 0.06 dis/s/m^3 .

All personnel working on the project were provided with monthly beta-gamma and neutron film badges to record accumulated radiation exposures. Of the 180 badges collected, 172 showed no exposure. The highest monthly beta exposure was 20 millirem and the highest monthly gamma exposure was 7 millirem.

A variety of instrumentation was used. A Ludlum 139 with a 60-cm^2 air proportional probe was used to determine the presence of alpha activity. A Ludlum 14C was used to determine the presence of beta-gamma activity. Soil and debris were examined with a Phoswich.² A continuous air monitor, Eberline, Alpha-3, was calibrated to detect alpha energies between 3.5 and 6 MeV.

IV. WASTE MANAGEMENT

All wastes generated by this operation were buried in shallow pits (Fig. 24) at the Laboratory's radioactive waste disposal/storage site (TA-54) located 14 km from the decommissioning site. Wastes consisting of 2 662 m³ of building debris and 285 m³ of contaminated soil were disposed of in this manner.

All wastes were transported to the disposal site in tarpaulin-covered dump or flat-bed trucks. Trucks, loaders, and bulldozers used to load or transport contaminated materials were monitored during the job and decontaminated as necessary. Washing with water was sufficient to remove the contamination.

V. ENVIRONMENTAL SURVEILLANCE

The Laboratory's Environmental Surveillance Group monitored the operation with its routine air sampling network³ (Table I). Four of the nearby sampling stations were selectively examined for ²²⁷Ac and its decay daughters (Table II). Filter papers from the 25 sample locations were collected weekly and analyzed after a 7-10 day decay period. No measurable elevation in gross alpha activity was detected during the period of decommissioning.

When decommissioning personnel thought the job was completed, the environmental group sampled the area for concurrence. A value of ≤ 30 pCi gross alpha/gm of soil (the detection limit of the Laboratory's ZnS gross alpha measurement system²) was determined to be as low as practicable (ALAP). The Laboratory's Health Division Office and the Los Alamos Area Office of the US Department of Energy concurred (Appendix).

The area was contoured and revegetated with native grasses (Fig. 25).

VI. COST

The project required 102 working days (over a 6-month period) and a total cost of \$276 300. Subcontractor manpower and equipment (Table III) costs were \$188 500. Laboratory costs for health physics and management were \$87 800.

TABLE I
SUMMARY OF ROUTINE AIRNET SAMPLING DATA

<u>Sampling Period</u>	<u>Location</u>	<u>Gross-Alpha fCi/m³</u>	<u>Gross-Beta (fCi/m³)</u>
4/10 - 5/7/78	Regional (R) ^a	0.6 $\pm$ 0.3	95 $\pm$ 46
	Perimeter (P) ^b	0.4 $\pm$ 0.4	117 $\pm$ 86
	On-site (O) ^c	0.3 $\pm$ 0.5	115 $\pm$ 80
5/08 - 6/5	R	1.1 $\pm$ 1.2	135 $\pm$ 80
	P	1.1 $\pm$ 0.19	147 $\pm$ 82
	O	1.2 $\pm$ 0.8	122 $\pm$ 83
6/08 - 6/30	R	0.4 $\pm$ 0.2	79 $\pm$ 29
	P	0.4 $\pm$ 0.5	71 $\pm$ 68
	O	0.3 $\pm$ 0.3	70 $\pm$ 55
7/03 - 7/31	R	0.9 $\pm$ 1.0	48 $\pm$ 66
	P	1.3 $\pm$ 1.7	56 $\pm$ 56
	O	1.7 $\pm$ 1.1	64 $\pm$ 48
7/31 - 8/28	R	0.7 $\pm$ 0.4	28 $\pm$ 22
	P	1.5 $\pm$ 1.5	45 $\pm$ 40
	O	1.1 $\pm$ 1.1	32 $\pm$ 29
8/28 - 9/25	R	1.4 $\pm$ 0.8	26 $\pm$ 19
	P	2.4 $\pm$ 2.6	35 $\pm$ 30
	O	1.8 $\pm$ 2.1	26 $\pm$ 29
9/25 - 10/23	R	0.7 $\pm$ 0.7	49 $\pm$ 7
	P	2.0 $\pm$ 1.5	60 $\pm$ 42
	O	2.3 $\pm$ 1.0	65 $\pm$ 26

^aRegional - 3 stations (Española, Pojoaque, Santa Fe).

^bPerimeter - 11 stations 0.4 km from the Laboratory boundary.

^cOn-site - 11 on-site stations.

TABLE II
AIR SAMPLING RESULTS FOR TA-21-153 OPERATIONS

Week Ending	Acorn Street ^a fCi/m ³	LAMPF ^b fCi/m ³	DP East STP ^c fCi/m ³	LA Airport ^d fCi/m ³
4/17/78	1.3 ± 0.4 147 ± 19	1.4 ± 0.4 150 ± 20	0.5 ± 0.2 66 ± 8	1.1 ± 0.3 148 ± 19
4/24/78	1.9 ± 0.5 190 ± 20	1.8 ± 0.5 190 ± 20	0.6 ± 0.2 86 ± 11	1.9 ± 0.5 180 ± 20
5/01/78	0.8 ± 0.3 170 ± 20	1.8 ± 0.5 190 ± 20	1.2 ± 0.4 107 ± 14	1.6 ± 0.4 150 ± 20
5/08/78	2.5 ± 0.6 52 ± 7	0.2 ± 0.4 122 ± 32	0.2 ± 0.6 440 ± 120	0.4 ± 0.4 136 ± 34
5/15/78	2.0 ± 0.5 330 ± 40	1.3 ± 0.4 180 ± 20	0.8 ± 0.3 106 ± 14	0.9 ± 0.3 147 ± 19
5/22/78	0.7 ± 0.3 147 ± 19	1.6 ± 0.4 220 ± 30	0.8 ± 0.3 170 ± 20	1.2 ± 0.4 230 ± 30
6/05/78	0.9 ± 0.5 95 ± 30	0.5 ± 0.3 35 ± 10	0.9 ± 0.4 72 ± 18	0.8 ± 0.4 180 ± 40
6/12/78	3.5 ± 0.8 260 ± 30	1.8 ± 0.5 139 ± 18	1.6 ± 0.4 113 ± 14	2.3 ± 0.5 160 ± 20
6/28/78	22 ± 0.5 35 ± 5	20 ± 0.5 160 ± 20	1.8 ± 0.4 104 ± 13	1.4 ± 0.4 87 ± 11
7/07/78	1.7 ± 0.4 47 ± 6	1.5 ± 0.9 62 ± 8	3.6 ± 0.8 150 ± 20	1.2 ± 0.3 63 ± 8
7/17/78	1.9 ± 0.5 151 ± 19	2.4 ± 0.7 180 ± 20	2.4 ± 0.6 142 ± 18	2.8 ± 0.7 180 ± 20
7/24/78	0.6 ± 0.2 40 ± 5	0.42 ± 0.19 30 ± 4	0.6 ± 0.2 25 ± 3	0.44 ± 0.17 29 ± 4
8/14/78	1.0 ± 0 45 ± 6	1.4 ± 0.4 46 ± 6	1.0 ± 0 36 ± 54	1.4 ± 0.4 43 ± 6
8/21/78	1.1 ± 0.3 48 ± 6	1.5 ± 0.4 47 ± 6	1.1 ± 0.3 31 ± 5	1.3 ± 0.3 40 ± 5
8/31/78*	20 ± 0.6 52 ± 7	1.2 ± 0.4 46 ± 6	1.6 ± 0.5 40 ± 5	1.5 ± 0.5 52 ± 7
9/05/78	5.8 ± 1.3 120 ± 15	1.2 ± 0.3 250 ± 30	4.4 ± 1.1 98 ± 13	5.1 ± 1.2 83 ± 11
9/18/78	2.4 ± 0.6 43 ± 6	3.1 ± 0.7 43 ± 5	2.0 ± 0.5 33 ± 4	3.1 ± 0.7 39 ± 5
10/31/78	2.0 ± 0.6 52 ± 7	1.2 ± 0.4 46 ± 6	1.6 ± 0.5 40 ± 5	1.5 ± 0.5 52 ± 7

*Gamma scan showed no evidence of actinium or its immediate daughters.

^aAcorn Street is approximately 2250 m east of Decommissioning Site.

^bLAMPF is approximately 1250 m southwest of Decommissioning Site.

^cDP East Sewage Treatment Plant (STP) is approximately 350 m northwest of Decommissioning Site.

^dLA Airport is approximately 550 m south-southwest of Decommissioning Site.

TABLE III
CRAFT AND EQUIPMENT USAGE - (HOURS)

CRAFT	3-78	4-78	5-78	6-78	7-78	8-78	9-78	TOTALS
LABORERS		731	56	728	752	1,433	772	4,472
TEAMSTERS		130	4	31	87	314	339	905
OPERATORS		123		88	16	187	200	614
PAINTERS		168		348	273	417	233	1,439
CARPENTERS		38	46	337	240	314	91	1,066
IRONWORKERS	68	68		97				233
SHEETMETAL WORKERS	16	71						87
ELECTRICIANS	50	28	8	6	9	116	14	231
FITTERS						2		2
UTILITIES-ELEC.							18	18
TOTAL HRS.								9,067
GENERATOR		66						66
DUMP/SMALL		91	4	13	75	258	253	654
LORAIN CRANE		35		26				61
LOADER, BUCKET		38			4	63	73	178
TRACTOR		6				45	30	81
COMPRESSOR		3		7				10
SCRAPER		2						2
FORK LIFT				10				10
SPREADER/LG. DUMP					10			10
DUMP/LARGE					3	117	91	211

REFERENCES

1. E. L. Christensen, R. Garde, and A. M. Valentine, "Demolition of Building 12, An Old Plutonium Filter Facility," Los Alamos Scientific Laboratory report LA-5755 (January 1975).
2. A. J. Ahlquist, C. J. Umbarger, and A. K. Stoker, "Recent Developments for Field Monitoring for Alpha Emitting Contaminants in the Environment," Health Physics 34 5, 486 (1978).
3. Environmental Studies Group, "Environmental Surveillance at Los Alamos During 1976," Los Alamos Scientific Laboratory report LA-6801-MS (April 1977).

Fig. 1.
TA-21, DP East.

Fig. 2.
East elevation, Structure TA-21-153.

Fig. 3.
South elevation TA-21-153.

Fig. 4.
Metal duct.

Fig. 5.
Schematic of building.

Fig. 6.
Removal of duct.

Fig. 7.
Temporary filtered exhaust system for
transitional plenum.

Fig. 8.
Transitional plenum after duct removal.

Fig. 9.
Removal of stack.

Fig. 10.
Packaging of stack.

Fig. 11.
Removal of dry filters.

Fig. 12.
Electromatic filters.

Fig. 13.
Gutting of transitional plenum
interior.

Fig. 14.
Stripping exterior off transitional
plenum.

Fig. 15.
Separation of blower room from
building.

Fig. 16.
Collapsing the blower room.

Fig. 17.
Collapsing the transitional plenum.

Fig. 18.
Water used for dust control.

Fig. 19.
Temporary filtered exhaust system
for building.

Fig. 20.
Gutted building interior.

Fig. 21.
Razing the building.

Fig. 22.
Razing the building.

Fig. 23.
Loading of debris.

Fig. 24.
Typical burial pit at radioactive
waste disposal/storage site.

Fig. 25.
Rehabilitated site.

APPENDIX

REPRODUCTION OF DEPARTMENT OF ENERGY MEMO

Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

AUG 7 1979

Harry S. Jordan, Assistant Division Leader
for Operations, H-Division, LASL (M.S. 400)

DECONTAMINATION, TA-21-153 FILTER BUILDING

I reviewed the memorandum (and the attached three figures), from A. John Ahlquist, H-8, to Raymond Garde, H-1, dated July 18, 1979, and I toured the TA-21-153 area with Ray Garde on June 14, 1979, and I concur in the LASL opinion that the area associated with the TA-21-153 filter building has been decontaminated to as-low-as-practicable (ALAP).

Please call if you have questions.

Original Signed By:
W. CRISMON, JR.

William Crismon, Jr., Chief
Technical Programs Branch

LTP:WC

cc: Ray Garde, H-1, LASL
M.S. 336

REPRODUCTION OF FIGURES TO DEPARTMENT OF ENERGY

Fig. A-1.
Surface soil sampling results.

Fig. A-2.
Spot clean-up sampling results.

Fig. A-3.
Postcontouring sampling results.