A History

of Radioactive Liquid Waste Management at Los Alamos

By L. A. Emelity

Los Alamos
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Acronyms, Abbreviations, Symbols, and Units of Measu

α	alpha
β	beta
γ	gamma
A-E	architect-engineer
ACDR	abbreviated conceptual design report
AEC	Atomic Energy Commission
AL	Albuquerque Area Office
ALO	Albuquerque Area Office
ALOO	Albuquerque Operations Office
Am	americium
AWWA	American Water Works Association
BA	budget allocation
BAT	best available technology
CAS	Central Alarm Station
CDR	Conceptual Design Report
Ci	curies
CIP	cast iron pipe
CMP	corrugated metal pipe
CMR	Chemistry and Metallurgy Research
CP&D	construction planning and design
CPM	construction project manager
cpm/L	counts per minute per liter
cpm/mL	counts per minute per milliliter
CRT	cathode ray tube
CST	Chemical Science and Technology
D&D	decontamination and decommissioning
DMJM	Daniel, Mann, Johnson, and Mendenhall
DoD	Department of Defence
DOE	Department of Energy
DOE-HQ	Department of Energy Headquarters
DOM	Director's Office Memorandum
DP	TA-21 "D" building production plant
DPE	DP Site, East
dpm/g	disintegrations per minute per gram
DPW	DP Site, West

DRD	Division of Reactor Development Administration
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ES&H	environment, safety, and health
ESAAB	Energy Systems Acquisition Advisory Board
FRP	fiberglass-reinforced pipe
ft	foot
FTE	full-time equivalent
FY	fiscal year
g	gram
gal.	gallon
GPP	General Plant Project
GR	graded series employee
GRA	graduate research assistant
HDO	Health Division Office
HEPA	high-efficiency particulate air
HP	Hewlett-Packard
HRL	Health Research Laboratory
IAEA	International Atomic Energy Agency
in.	inch
INEL	Idaho National Engineering Laboratory
JCI	Johnson Controls, Inc.
KD	key decision
L	liter
LAAO	Los Alamos Area Office
LACI	Los Alamos Construction, Inc.
LAFO	Los Alamos Field Office
LAMPF	Los Alamos Meson Physics Facility
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory
lb.	pound
LD	liquid disposal
LIP	line item project
LOA	leave of absence
MAD	mechanical assembly and disassembly
MDA	material disposal area
MFP	mixed fission products
MNS	mission needs statement
MP	Meson Physics Division
MPC	maximum permissable concentration

MSA	major systems acquisition
MTF	main treatment facility
MUX	multiplexer
MW	megawatt
NASA	National Aeronautics and Space Administration
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NM	New Mexico
NMSU	New Mexico State University
NPDES	National Pollutant Discharge Elimination System
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
PE	polyethylene
PE&D	plant engineering and design
PLC	programmable logic controller
PMR	pug mill run
PSAR	Preliminary Safety Analysis Report
psi	pounds per square inch
PSR	proton storage ring
PTF	pretreatment facility
Pu	plutonium
PVC	polyvinyl chloride
R&D	research and development
RCRA	Research Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFP	Rocky Flats Plant; Request for Proposal
RLW	radioactive liquid waste
RLWCSI	Radioactive Liquid Waste Collection System Improvement
RLWTF	Radioactive Liquid Waste Treatment Facility
RMP	Ralph M. Parsons Company
RTG	Resource Technologies Group
SFBP	Solar in Federal Buildings Program (NASA)
SFDS	short form data sheet
SFOO	Santa Fe Operations Office, AEC
SGS	summer graduate student
SM	staff member; South Mesa
SNML	Special Nuclear Materials Laboratory
SOP	standard operating procedure
SWMU	sold waste management unit
TA	technical area
TBP	tributylphosphate

TCP	tricresylphosphate
TDS	total dissolved solids
TEC	total estimated cost
TRU	transuranic
TSL	Ten Site Laboratory
TSS	total suspended solids
TSTA	Tritium Systems Test Assembly
UGS	undergraduate student
UHTREX	Ultra-High Temperature Reactor Experiment
ULR	unlisted land reserve
UNM	University of New Mexico
USC	University of Southern California
USGS	United States Geologic Survey
USPHS	United States Public Health Service
UT	University of Texas
VCP	vitrified clay pipe
VE	value engineering
VSS	volatile suspended solids
WD	waste disposal
WIPP	Waste Isolation Pilot Plant
WM	waste management
WNR	weapons neutron research

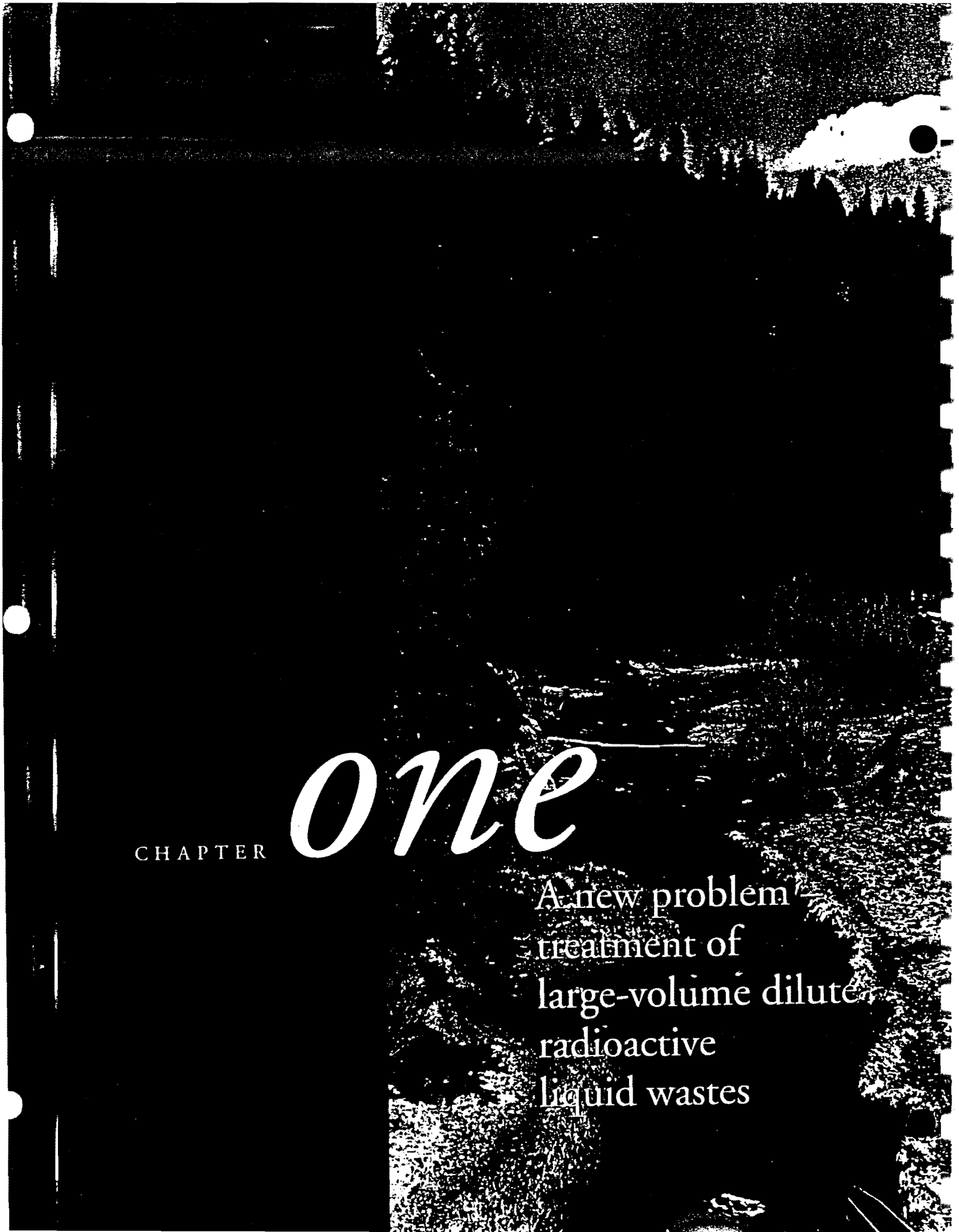
introduction

This document traces the development of the management of radioactive liquid wastes at Los Alamos from their first appearance in the early 1940s until 1996. This type of waste, contaminated with plutonium and other radioactive isotopes, was unknown before its generation at Los Alamos, and no library existed on appropriate collection and treatment systems. Management problems were more difficult than those associated with wastes of newly developed chemical compounds because of the emission of radioactive particles and rays and the inability to eliminate completely the radioactivity in a very dilute solution in a reasonable length of time (decay) or at a reasonable cost. Half-lives of many of the radioisotopes involved are thousands of years. Treatment systems, therefore, were narrowed to processes that would concentrate the radioactive nuclides into a minimum mass that would be stored safely while the nuclides decayed.

This document describes the history of radioactive liquid waste management from its earliest days under the Atomic Energy Commission (AEC) Health and Safety Division to its reorganization under Los Alamos National Laboratory (LANL) as Chemical Science and Technology (CST) Division, Radioactive and Industrial Waste Water Science Group (CST-13).

Covered briefly are data relating to activity levels of raw and treated wastes, names of personnel involved, many of the papers written reflecting activities relating to radioactive liquid wastes, major construction activities, research efforts, accidents and spills, and other topics.

For an interesting document tracing the development of the Laboratory and the town, the 176-page booklet, *Los Alamos: The First Forty Years*, by F. Lyon and J. Evans (published by the Los Alamos Historical Society) is highly recommended.



CHAPTER *one*

A new problem: treatment of large-volume dilute radioactive liquid wastes

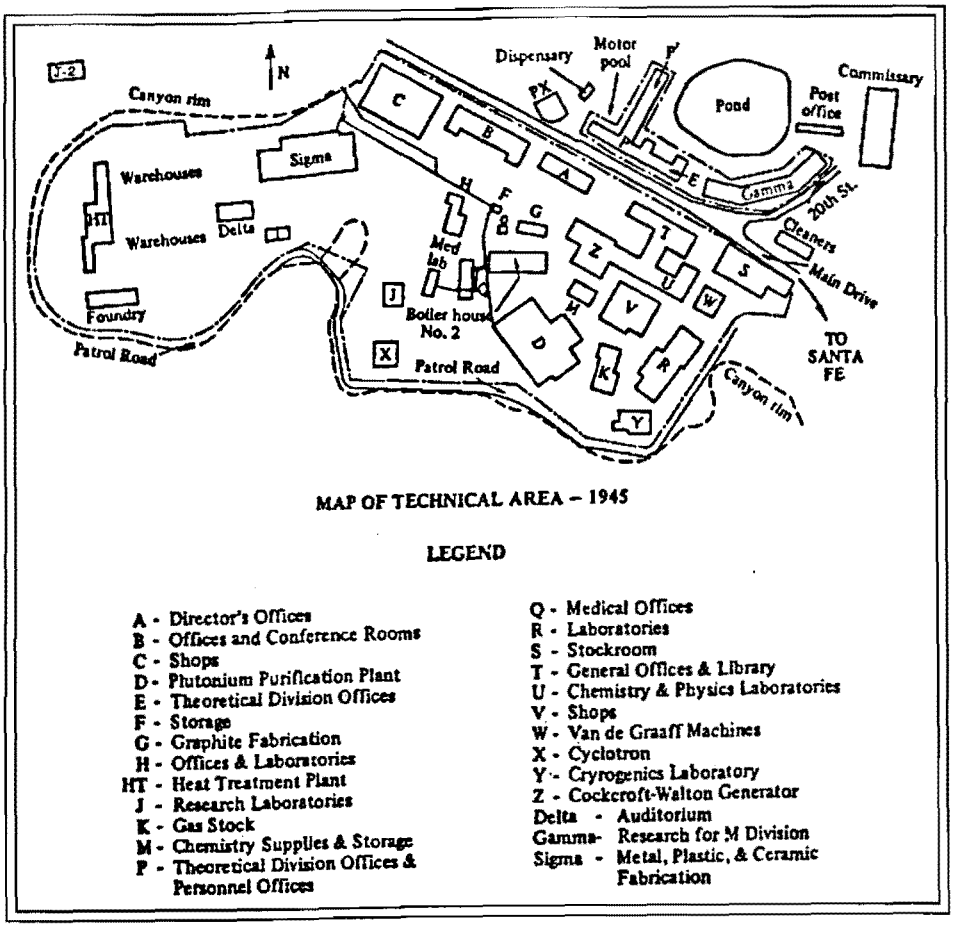


Fig. 1-1. Map of the technical area.

North central New Mexico was the area selected by General Leslie R. Groves and Dr. J. Robert Oppenheimer in November 1942 for construction of a laboratory to design and develop a nuclear fission device, or bomb, that would be instrumental in hastening the defeat of the Axis powers in World War II [1]. Some of the land selected was occupied by the Los Alamos Ranch School for Boys in the Jemez Mountains of Sandoval County, 35 road miles from Santa Fe. Most acreage was transferred from national forest and other Sandoval County properties. The project had the full support of President Franklin D. Roosevelt and senior US scientists.

It was christened "Project Y" of the Manhattan District by General Gro on April 15, 1943, it was formally o On April 20, 1943, an agreement w signed designating the University of California as primary contractor.

THE FIRST TECHNICAL AREA

Construction of the various laboratories and office facilities by th Army Corps of Engineers began in 1943 with only minor concern for di of radioactive solutions. The laborat area was remote, and radioisotopes very valuable, unlikely to be discarde even in dilute solutions. (The first plutonium [Pu] sample, 200 µg, arri Los Alamos from the Clinton, Tenn reactor in 1943 by car in a suitcase. thought to be too risky to bring it in air. On orders of General Groves, t uranium-235 from Oak Ridge, Tenn was shipped by rail.) Therefore, was lines were initially extended to the the mesas or canyon bottoms with lit thought of continuous sampling. 1-1 is a map of the technical area later known as TA-1, as it existed in Building J-2, an additional research laboratory, was added later, and the radioactive waste sewer was extend to serve it. The radioactive waste li called the "acid sewer" on the early drawings, was constructed of vitrifi pipe (VCP) with cast iron pipe (CI road crossings. Construction metho materials were the same as those us sanitary sewer systems. It is importa note that the "acid" and sanitary se systems were, from the first, install

completely separate systems. The sanitary system discharged primarily to septic tanks that generally overflowed to Los Alamos Canyon; the "acid" system from TA-1 was extended north to a small branch of Pueblo Canyon. The branch eventually became known officially as Acid Canyon. At the rim of the canyon, a trough probably 12 in. wide and 12 ft long with a V-notch weir at the end was installed to measure the flow. A head recorder was added, and a continuous record of flow variation was thereby provided. Figure 1-2 is a copy of one of the charts, and Fig. 1-3 provides flow data for December 1950 as taken from the head recordings.

When Project Y was first considered, it was believed that the number of people involved at Los Alamos would be in the hundreds. However, by the end of 1943, Los Alamos population exceeded 2000. As the various requirements of the project became evident, efforts were made to employ personnel of the highest caliber from anywhere in the world. Health and safety needs were recognized, and Dr. Louis H. Hempelmann, M.D., was employed to manage these aspects of the project.

In January 1945, fire destroyed C-Shop in TA-1 and raised concerns about airborne plutonium near the community if a plutonium facility burned. Immediate steps were taken to move all plutonium operations to a new facility to be constructed on the east end of the mesa, which became known as TA-21, DP site. The "D" was carried over from "D" Building at TA-1, which was the plutonium purification plant, and the added "P" was an abbreviation of "prime" as in D'. TA-21 was constructed in 1945-46. Building 20 at the west end of DPW was a laundry staffed by about 17 people who washed and dried all contaminated and "suspect" contaminated clothing. Also early in 1945, Chemistry and Metallurgy Research (CMR) -12 established a small, fenced waste disposal field called Area A for burial and storage of solid wastes. The field was located on the east end of DPW.

On July 16, 1945, the intense efforts to develop an atomic device culminated in the successful test of a plutonium implosion bomb called "Fat Man" at Alamogordo, New Mexico. On August 6, 1945, the uranium bomb,

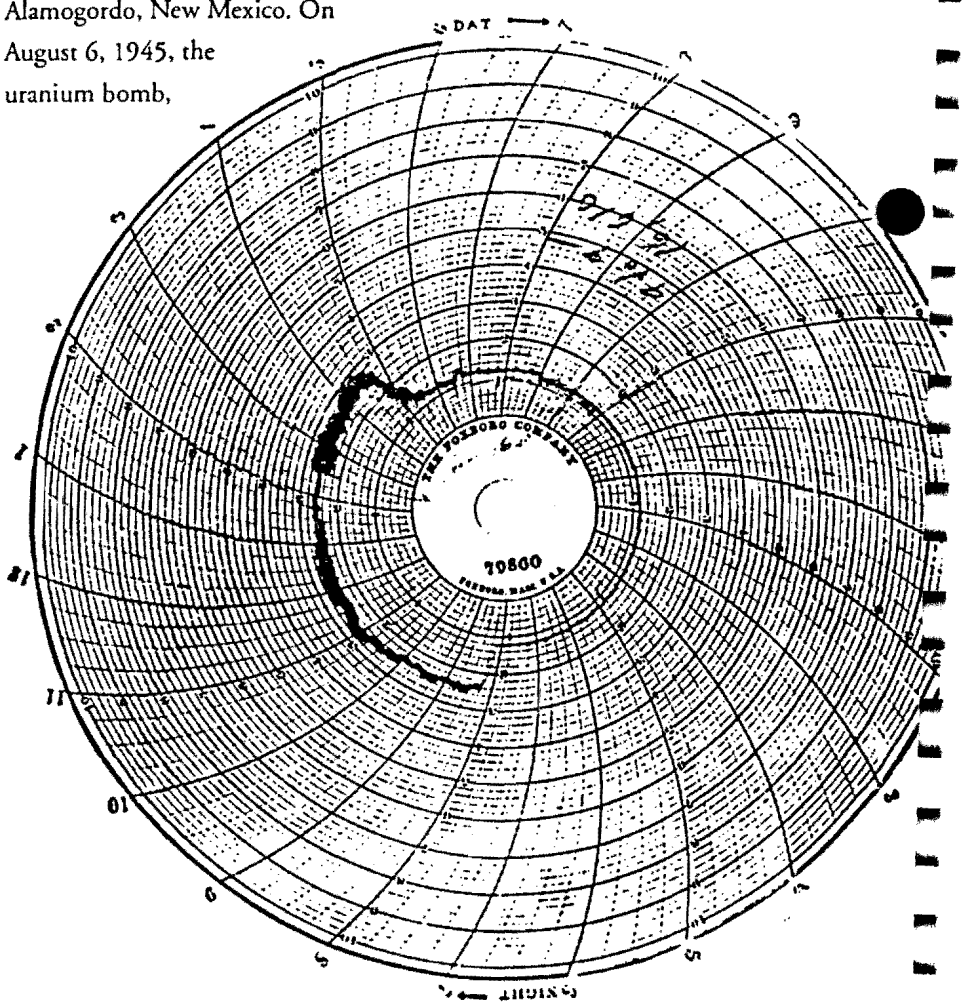


Fig. 1-2. *A flow variation chart.*

CONFIDENTIAL

TXCH AREA

DISCHARGE RECORDS

DECEMBER 1950

DATE		Volume in Gallons Period 8 AM - 5 PM	Period 8 AM - 8 AM
December 1 - 2	(Friday)	8,958	13,266
2 - 3	(Saturday)	8,688	11,844
3 - 4	(Sunday)	1,296	3,642*
4 - 5	(Monday)	8,478	16,038
5 - 6	(Tuesday)	10,818	17,886
6 - 7	(Wednesday)	8,682	15,930
7 - 8	(Thursday)	8,502	16,536
8 - 9	(Friday)	11,334	19,044
9 - 10	(Saturday)	9,330	17,610
10 - 11	(Sunday)	4,050	10,800
11 - 12	(Monday)	7,542	15,510
12 - 13	(Tuesday)	7,542	12,198
13 - 14	(Wednesday)	10,992	20,844
14 - 15	(Thursday)	9,144	20,088
15 - 16	(Friday)	8,670	12,744
16 - 17	(Saturday)	9,354	16,998
17 - 18	(Sunday)	3,444	9,462
18 - 19	(Monday)	10,674	18,186
19 - 20	(Tuesday)	9,228	15,246
20 - 21	(Wednesday)	9,204	16,746
21 - 22	(Thursday)	9,006	15,978
22 - 23	(Friday)	9,282	17,526
23 - 24	(Saturday)	6,366	10,068
24 - 25	(Sunday)	—	3,744
25 - 26	(Monday)	1,198	2,224*
26 - 27	(Tuesday)	—	8,304*
27 - 28	(Wednesday)	8,280	15,288
28 - 29	(Thursday)	12,774	22,404
29 - 30	(Friday)	8,298	14,526
30 - 31	(Saturday)	7,890	11,478
31 - Jan. 1	(Sunday)	—	4,032
25 Working Days	Max.		22,404
	Min.		8,304*
	Avg.		15,331
6 Non-Working Days	Max.		10,800
	Min.		2,224*
	Avg.		5,650
All Days	Avg.		13,458

1807 1705

E. W. Whittemore Vice President
E. Gallagher Phys. Dept. U.S.
1/31/54

CONFIDENTIAL

Fig. 1-3. December 1950 flow data taken from a head recording.

"Little Boy" was dropped on Hiroshima, Japan, and on August 9, 1945, the plutonium bomb, Fat Man, was dropped on Nagasaki. Japan surrendered on August 14, 1945. Anxious to resume his university studies, Dr. Oppenheimer decided to return to the University of California at Berkeley, and on October 16, 1945, Dr. Norris Bradbury became director of the Laboratory.

THE ATOMIC ENERGY COMMISSION IS CREATED

On December 20, 1945, Senator Brien McMahon introduced Senate Bill S1717, which proposed formation of an Atomic Energy Commission (AEC) to direct all activities in the United States concerning the use of radioactive materials for peaceful and military applications. The bill was passed by Congress in 1946, and David Lilienthal was appointed as the first chairman.

On April 1, 1946, operation and maintenance of all Los Alamos post services and facilities of the Manhattan Engineer District, War Department Project Y, were turned over to the Zia Company, an organization established for the purpose by the Robert McKee Construction Company of Santa Fe.

Executive Order 9816 of December 31, 1946, signed by President Harry S. Truman, transferred all of the government property in Los Alamos to the AEC. (Fig. 1-4).

RADIOACTIVE LIQUIDS IN THE ENVIRONMENT

In the early years of Project Y, radioactive liquids were discharged untreated to Pueblo (Acid) Canyon and Los Alamos Canyon. First concerns resulted in environmental sampling at outlets and along the stream bed. Detection of plutonium, uranium, and polonium in areas accessible to the public resulted first in installation of warning signs in Spanish and English and later in fencing of the areas near the outfalls. Figures 1-5–10 are memos reflecting the concern of project management and particularly that of Dr. Hempelmann, head of the Health Group. To provide time to determine the optimum management method for the liquid wastes while eliminating most waste discharges to the canyons, absorption beds were constructed in 1945 at DPE (two beds, now called Area U), DPW (four beds, now called Area T), and at the DPW laundry (three beds, now called Area V). Also, for the more concentrated alpha (plutonium and americium) wastes from DPW, two 50,000-gal. steel tanks nicknamed the "General's Tanks" were buried in what is now called Area A (Fig. 1-11). Wastes were brought to the tanks in containers ranging from 9-L bottles to 200-gal. steel tank trailers. A memo estimating total activity in the tanks appears in Fig. 1-12. The tanks are discussed in more detail in Chapter 9.

EXECUTIVE ORDER 9816

Dec 31-4

PROVIDING FOR THE TRANSFER OF PROPERTIES AND PERSONNEL TO THE ATOMIC ENERGY COMMISSION

By virtue of the authority vested in me by the Constitution and the Statutes, including the Atomic Energy Act of 1946, and as President of the United States and Commander-in-Chief of the Army and Navy, it is hereby ordered and directed as follows:

1. There are transferred to the Atomic Energy Commission all interests owned by the United States or any Government Agency in the following property: All fissionable material, all atomic weapons and parts thereof, all facilities, equipment and material for the processing, production or utilization of fissionable material or atomic energy; all processes and technical information of any kind, and the source thereof (including data, drawings, specifications, patents, patent applications and other sources) related to the processing, production and utilization of fissionable material or atomic energy; and all contracts, agreements, leases, patents, applications for patents, inventions and discoveries (whether patented or unpatented), and other right of any kind concerning any such item.

b. All facilities, equipment and materials devoted primarily to atomic energy research and development.

2. There are also transferred to the Atomic Energy Commission all properties, real or personal, tangible or intangible, including records owned by or in the possession, custody or control of the Manhattan Engineer District, War Department, in addition to the properties described in paragraph 1 above. Specific items of such properties, including records, may be excepted from transfer to the Commission in the following manner.

a. The Secretary of War shall notify the Commission in writing as to the specific items of property of records he wishes to except, and

b. If after full examination of the facts by the Commission, it concurs in the exception, these specific items of property or records shall be excepted from transfer to the Commission; or

c. If after full examination of these facts by the Commission, it does not concur in the exception, the matter shall be referred to the President for decision.

3. The Atomic Energy Commission shall exercise full jurisdiction over all interests and properties transferred to the Commission in paragraphs 1 and 2 above, in accordance with the provisions of the Atomic Energy Act of 1946.

Fig. 1-4. Executive Order 9816.

File

June 1, 1946

Personnel Concerned

N. E. Bradbury

Problem of disposal of contaminated waste water on project.

1. The following committee is appointed to consider the problem of disposal of contaminated waste water on this project:

   Dr. Eric Jette, Chairman
   Dr. J. Manley
   Dr. D. Froman
   Capt. H. Whipple
   Lt. Col. Fenley

2. It is requested that this committee have a preliminary report for the Technical Board meeting by June 14.

3. If geologic consultation is necessary it should be requested at once.

N. E. Bradbury
Director

NEB/b

Fig. 1-5. N. E. Bradbury memo regarding waste disposal, June 1946.

INTER-OFFICE MEMORANDUM

DATE June 14, 1946

TO: Captain Whipple

FROM: E. R. Jette

How

SUBJECT: Analysis of Water Specimens from the Sewer System.

The following three paragraphs have been taken from a report dated June 13, 1946 from James F. Tribby.

"I have just received the report from Herb Drager on the preliminary survey of the sewer system. This report covers the extent of our survey very completely. I would like, however, to emphasize that the tests made for contaminating agents, which were detected by measurement of Alpha, Beta and Gamma radiation on the surrounding ground, are by nature inaccurate and only qualitative at the best.

"An accurate quantitative determination of the individual contaminants may be made by collecting water specimens from each sewer line near the points of drain exits and assaying the samples for each of the radioactive elements with which we are concerned - namely, plutonium, polonium, and uranium.

"Our Group now has the personnel to do this work as well as the laboratory in which to carry out the assay. We will be ready to collect these samples and begin work on these tests at any time you say. We would also like to repeat the tests (conducted July 1945) on the streams in the Pueblo and Los Alamos Canyons and in the Rio Grande River. Dirt samples from dried-up parts of the streams would also be collected and checked."

E R Jette

Eric R. Jette

ERJ:rd

cc: Captain Whipple
Manley
Freman
Lt. Col. Penly
McCall
Drager
Tribby
file

Form 25

Fig.1-6. E. R. Jette memo regarding analysis of water samples, June 1946.

RDH 11/6/46

OFFICIAL USE ONLY

November 4, 1946

George Williams

E. R. Jette

Disposal of Contaminated Sewage

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The following is a copy of a memo from J. F. Tribby, dated October 28, which is in response to yours of October 15. Mr. Tribby will be authorized to proceed with the work which he outlines.

"In regard to the letter from G. L. Williams, I believe he is right in stating that a knowledge of the chemical contents and concentrations of the various chemicals in the drains from the Tech Area, Laundry and DP Site is essential in setting up a chemical disposal system. This obviously will necessitate a great deal of work as there are about six drains concerned with the disposal of chemical wastes from the above areas, two if we exclude the DP Site drains. Water probably should be collected from each drain exit, 2 to 3 times a week, for about 3 weeks. These results should give a fairly good cross section of the chemicals and concentration to be found in each drain.

"From a radioactive contamination standpoint, we have shown that the concentrations are very low by mass (less than 0.1 microgram/plutonium/liter) but sufficient when integrated over a period of years to render both Pueblo and Los Alamos Canyons highly contaminated. It is conceivable that this activity may eventually reach the Rio Grande Valley and enter the river itself. Los Alamos Canyon also, I believe, runs into Bandelier National Forest.

"Repeat radioassays of samples from each of the 25 sanitary and chemical drains have been made and water and soil samples have been collected from Los Alamos and Pueblo Canyons extending from the Tech Area to the Rio Grande River. The final results of the tests will be forwarded to you upon completion."

E R Jette

Eric R. Jette

ERJ:rd
cc: R. C. Hill
J. B. Graham
Sidney Ingham
Louis Hempelman
N. E. Bradbury
file

OFFICIAL USE ONLY

Fig. 1-7. E. R. Jette memo regarding disposal of contaminated sewage, November 1946.

INTER-OFFICE MEMORANDUM

DATE March 24, 1947

TO: Col. Betts

FROM: L. H. Hempelmann

SUBJECT: Construction of Fence Around Pueblo Canyon.

This morning, March 24, Major Gerry came to my office to discuss with Mr. Tribby and me the time worn matter of the fence around the contaminated area in Pueblo Canyon.

I cannot understand why our attempts to have the contaminated area adjacent to the residential section fenced off have been blocked, repeatedly, by various individuals and groups on this project. (This criticism is not directed at Major Gerry, who merely acted as the agent whose unfortunate duty it was to convey the bad news to me.) I would like to reiterate the feeling of Mr. Tribby and myself about the need for such a fence:

1. The actual physical hazard to adults, children and dogs who go into this contaminated area despite warning signs is slight.

2. The bad publicity, however, resulting from the general knowledge that we have not done everything in our power to prevent persons and animals from coming in contact with the effluent from D building would be extremely serious. We would be particularly open to criticism since the effluent is discharged in a region so near the residential area.

3. The estimated cost of the fence ($30,000) is small compared with the cost of possible lawsuits against the project.

Having stated my position, I would like to place the responsibility for the possible consequences of continued delay of construction of this fence squarely on the shoulders of those "experts" who have delayed the construction so far.

It is also believed by Mr. Tribby and myself that good stout fences should be placed around the contaminated sewer outlets from D.P. Site. The construction of these fences is less urgent than that expressed above since these outlets are in restricted and rather inaccessible regions.

Will you please consider this an official request for the construction of such fences. Details as to the number and placement of the fences can be obtained from Mr. Tribby.

Louis H. Hempelmann, M. D.

LHH:hk
cc/ J. Tribby
Maj. Gerry
Files

Form 15

Fig. 1-8. L. H. Hempelmann memo regarding fencing Pueblo Canyon, March 1947.

INTER-OFFICE MEMORANDUM

DATE March 31, 1947

TO: Dr. Jette

FROM: Louis H. Hempelmann

SUBJECT: Contaminated Streams

The Health Group is concerned by the fact that the amount of plutonium in the stream discharged into Pueblo Canyon is above tolerance. According to Mr. Tribby's assays, the water in stagnant pools, opposite Louderwilk Camp, near the Frijoles Road, is ten (10) times tolerance, (2×10^{-2} micrograms 1 liter). Although the tolerance value probably is conservative enough so that this situation is not truly hazardous, I do not think it would be advisable to continue discharging plutonium into open streams, as the concentrations will gradually build up in the stream bed.

I understand from Mr. Pittman the amount of plutonium in D. P. effluent is diminishing and I am sure that you have made plans to cover this problem in the future. Nevertheless, I did want to call to your attention the fact that the tolerance value for plutonium in drinking water is being exceeded.

Louis H. Hempelmann, M. D.

cc/Frank Pittman
James Tribby
Files

LHH:hk

Form 25

Fig. 1-9. L. H. Hempelmann memo regarding contaminated streams, March 1947.

CONFIDENTIAL

INTER-OFFICE MEMORANDUM

H-2 Waste Disposal

OFFICIAL USE ONLY

TO: L. H. Hempelmann, M.D. DATE April 14, 1948.

FROM: J. F. Tribby

SUBJECT: Radiological safety in connection with disposal of radioactive and chemical wastes.

REFERENCE: LAB-CMR-12

This is in answer to your request for information concerning the work currently being done to determine chemical and radioactive contamination of the canyons and surrounding areas and the effluent lines from the chemistry division. We are also conducting routine analyses of drinking water from water sources, mostly for the heck of it, rather than due to a belief that there is any immediate danger of the well-water becoming contaminated.

I. Health survey of the canyons. Soil samples are collected from locations in the canyon beds and canyon walls extending from the Site to the Rio Grande River, and from the DP West and Laundry seepage pits, and from the areas surrounding the effluent exits and pit run-offs. Soil samples are analysed for Pu, Po, U, β, γ radioisotopes and fluorine. Water samples are collected from stagnant water pools in the seepage pits and canyon beds extending from the project to the Rio Grande River, and from the Rio Grande River. Water samples are quantitatively analysed for Pu, Po, U, Radioisotopes, fluorine, toxic metals-Ba and Cd. All this is done twice per year to determine the extent and degree of canyon and surrounding area contamination, and to detect the spread of an unusual amount of contamination throughout the area. Direct instrument survey (α, β, γ) of the area surrounding the effluent exits is done twice per year.

II. Analysis of waste effluents from the chemistry area. Samples of the waste effluents from all chemical disposal lines are collected periodically and analysed for radioactive contaminates, toxic heavy metals, fluorine, Ba, Cd, etc.

III. Analysis of water samples from the project drinking water sources. Water samples are collected each month from all wells and reservoirs supplying drinking water to the project. The samples are analysed to detect the presence (and concentration) of the contaminates listed in (II). The results of the analyses are reported in the CMR-12 Monthly Progress Report.

IV. In addition:
(a) Air tests, to detect and measure alpha contamination in the dust blown around the seepage pit areas at DP Site, are run during dry periods and/or during periods of strong winds.
(b) This group is assisting other organizations in developing improved liquid waste disposal method, ie; chemical, activated biological sludge, etc.

This document contains restricted data within the meaning of the Atomic Energy Act of 1946 and/or information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U. S. C. 31 and 32 as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited and may result in severe criminal penalty.

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Fig. 1-10. J. F. Tribby memo regarding rad safety in waste disposal. April 1948.

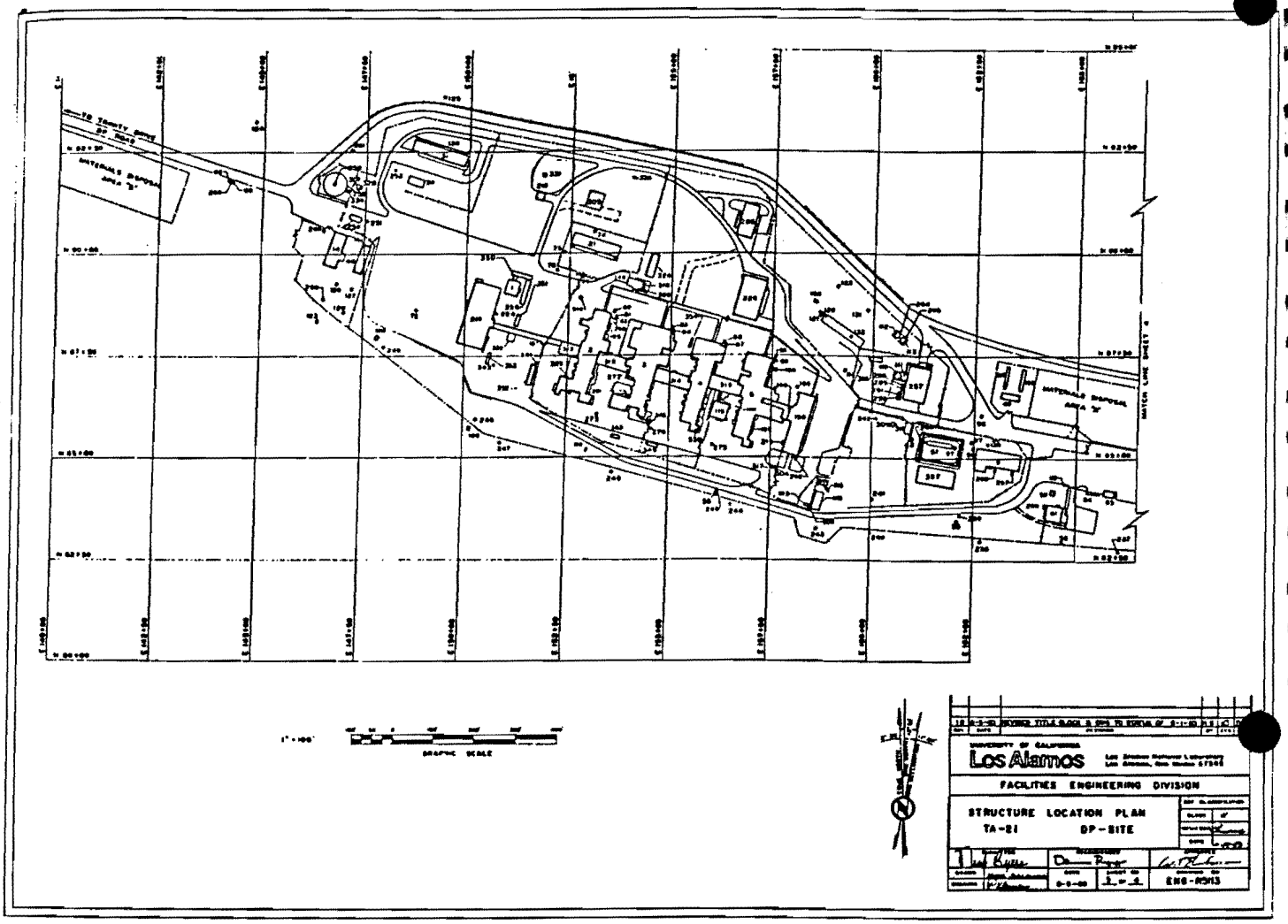


Fig. 1-11. "General's Tanks" site, Area A.

LOS ALAMOS, NEW MEXICO 87544

OFFICE MEMORANDUM

TO : W. J. Maraman, CMB-11 DATE: December 6, 1971

FROM : W. B. Gibson, CMB-11

SUBJECT: General's Tanks - Memo from Dean D. Meyer, December 3, 1971

SYMBOL : CMB-11

Champion's records, which were made at the time solutions were transferred into the tanks, on the basis of radioassay (total alpha) of the individual trailer tank loads, showed a total of 344 grams into the two tanks.

Inasmuch as records at that time were kept to the nearest 0.01 grams, this is probably a reasonable figure for total alpha equivalent.

A corroborative sampling of each tank was performed about 1950 or 1951, and the results were in good enough agreement with the above that no corrections were thought to be necessary. So far as I know, no records of this sampling are still in existence, but I seem to vaguely recall that the NaOH supernatant tank had about 180 grams in 50,000 gallons, and the NH_4OH tank had about 160 grams in 35,000 gallons.

How much of this is actually Pu, and how much is due to Am is open to speculation, but a reasonable guess might be about 20-30 grams of Pu, and the rest due to Am, but that is probably irrelevant, since the primary question is not how much Pu, but rather how much activity.

W. B. Gibson

WBG:arm

Fig. 1-12. Memo estimating tank activity.

In May 1947, John F. Newell was employed by the Zia Company as superintendent in the Maintenance Division in charge of sanitary engineering activities, including all aspects from garbage collection, restaurant inspection, and rodent control to water quality control and sewage treatment.

In September 1947, a committee on health and safety representing the AEC visited Los Alamos to survey the status of operations under the control of Newell. The committee included:

- Dr. Frank Parker, Health Physicist, Hanford;
- Dr. Phillip Drinker, Harvard School of Public Health;
- Dr. Abel Wolman, Johns Hopkins University, and
- Mr. Arthur Gorman, Sanitary Engineer, AEC Washington, DC.

In its report on the survey, the committee recommended that the sanitary engineering functions (water quality, domestic waste disposal, and industrial waste treatment) be separated from the sanitation functions; that these functions remain under Newell; and that Newell be transferred within Zia Company to the health office under the direction of the Los Alamos Hospital. Zia Company accepted the recommendations. In meetings with the AEC, Zia Company, and the Los Alamos Scientific Laboratory (LASL) in 1948, a research and development program on industrial waste treatment, under John Newell, was established. To assist him, C. W. Christenson, chief chemist at the El Paso water plant, was hired effective early September 1948.

During late 1949 and early 1950, discussions were held on the most appropriate control of the community sanitation program and the industrial waste activities. On April 30, 1950, both functions reverted to the AEC, and John Newell was made chief of the industrial waste branch. Ed Hermann was appointed chief of the community sanitation operation.

In November 1948, the manager of the Santa Fe Operations Office (SFOO) of the AEC directed the organization of a radioactive waste treatment study group. The sanitary engineer of the SFOO was authorized to organize and supervise experts in the waste treatment field from:

- LASL;
- US Public Health Service Sanitary Engineering Center, Cincinnati, Ohio;
- US Geological Survey;
- SFOO Sanitary Engineer Office; and
- US AEC, Los Alamos.

The personnel assembled for the work included:

- John F. Newell, C. W. Christenson, and E. R. Mathews, US AEC, Los Alamos;
- H. L. Krieger and D. W. Moeller, US Public Health Service, Los Alamos;
- C. Ruchhoft, consultant, Director, US Public Health Service, Cincinnati, Ohio; and
- M. B. Ettinger and G. G. Robeck, Sanitary Engineers, US Public Health Service, Cincinnati, Ohio.

A photograph of several of the men

Fig. 1-13. Left to right: C. W. Christenson, AEC-LASL; Arthur Gorman, AEC; Gordon G. Robeck, US Public Health Service; Joseph A. Lieberman, AEC; Morris B. Ettinger, US Public Health Service.

involved is shown in Fig. 1-13. Appendix A, a report by J. F. Newell dated January 10, 1950, describes the organization of the study group and some of the early work accomplished. Appendices B, C, and D are documents describing the organization and functions of the Industrial Waste Section, Los Alamos Field Office (LAFO).

Agreement could not be reached on the best method of treating the organic laundry wastes, but physical and chemical treatment using an iron salt and a high pH was determined to be the optimum method of concentrating alpha activity from a large volume of dilute inorganic wastes. Biological treatment systems, such as trickling filter and activated sludge, for the laundry waste were studied but adopted. Black & Veatch of Kansas Ci a well-established consulting company sanitary engineering, was contracted to design pilot plants to treat the nonorgar radioactive liquid wastes from TA-1 and South Mesa development and from TA- DPW. The plant designed to treat TA-1 and South Mesa wastes (Chapter 3) was on Canyon Road at the site called TA-45 Waste Disposal. Reference 2 is the 1953 Operating Report that includes a thorou description of the facility and treatment records for 1953; Reference 3 is the set o Black & Veatch construction drawings. Reference 4 includes some history of the site and outlines the restoration program.

TRANSFER TO H-DIVISION, LASL

The following table (Table 1-1) summarizes the staff of the Industrial Waste Branch at the Los Alamos Area Off (LAAO) and LASL. Appendix E is a cop of a letter from LAAO manager Frank DiLuzio to LASL Director Norris Bradbu authorizing the transfer of the Industrial Waste Branch from the AEC to LASL. Figure 1-14 is a memo from J. R. Maddy, Chief of the LAFO Health and Saftey Branch, to personnel transferring the AEC to LASL and explaining the details of the move.

Dr. L. H. Hempelmann was leader of the Medical Group, later Health Group, then Health Division, from the beginnings in 1943, until May 25, 1948, when Dr. H. O. Whipple was appointed acting division leader. Effective November 1, 1948, Dr. T. L. Shipman accepted the post of head of the division.

Position	LAAO 1950	LASL 1955 (Group H-7)
Group Leader	John Newell	C. W. Christenson
Alternate Group Leader	C. W. Christenson	J. Paul Hutchinson
Chief Sanitary Engineer	E. R. Hermann	J. Paul Hutchinson
Senior Sanitary Engineer		R. G. Thomas
Technician	C. G. Martinez	C. G. Martinez
Technician	J. P. Valdez	J. P. Valdez
Chief Chemist	E.R. Mathews	
Senior Chemist	E. H. Rex	E. H. Rex
Chemist	E. Wiederhold	G. L. Johnson
Chemist	C. Fogle	N. M. Ewbank, Jr.
Chemist	W. M. Webster	W. M. Webster
Chemist/Bacteriologist	L. M. Reading	
Chemist	R. L. Taylor	
Secretary	L. B. Gallegos	L. B. Gallegos
PHS Advisor	H. Krieger	
PHS Advisor	D. Moeller	D. Moeller
Consultant	Dr. E. R. Ruchhoft, Johns Hopkins	
Consultant	G. G. Robeck, US Public Health Service, Cincinnati, Ohio	
Consultant	M. B. Ettinger, US Public Health Service, Cincinnati, Ohio	

Table 1-1. *Staff, Industrial Waste Branch, LAAO, 1950; LASL, 1955.*

STANDARD FORM NO. 64

Office Memorandum · UNITED STATES GOVERNMENT

TO : Those Listed Below DATE: May 23, 1955

FROM : James R. Maddy, Chief, Health & Safety Branch

SUBJECT: TRANSFER OF INDUSTRIAL WASTE SECTION TO LASL

SYMBOL: LP:JJK

This is to advise you that negotiations have been completed for the transfer of the Industrial Waste Section to the Health Division of the Los Alamos Scientific Laboratory. We are advised that firm offers will be directed to each of you, outlining salaries, employment conditions and fringe benefits you may expect as Laboratory employees. In all cases, present salaries will be preserved and adjusted at a subsequent date. Such future adjustment will be consistent with revisions made affecting similar employees as a result of salary and wage surveys.

Your attention is invited to the fact that you will be paid in lump sum for annual leave remaining to your credit as of the date of separation, providing it does not exceed your leave ceiling (30 days or more) carried over on January 1, 1955. Those of you who have an unused balance of leave accrued this year which exceeds your leave ceiling are encouraged to discuss appropriate plans with your immediate supervisor to liquidate such current leave accruals to avoid forfeiting leave on June 3.

Federal provisions regarding sick leave preclude the direct transfer of such leave to a contractor upon transfer of federal employees. However, under the Laboratory contract with the AEC, the Laboratory, when necessary, may grant sick leave in excess of your LASL accumulation without charge to future leave accrual.

To each of you I would like to extend my deep appreciation for a job well done during our association. The Manager and all of us here join in wishing you the best of luck in your new assignment with the Laboratory.

Addressees:
Conard W. Christenson
John P. Hutchinson
Richard G. Thomas
William M. Webster
Francisco A. Guevara
George L. Johnson
Cornelio G. Martinez
Jose P. Valdez
Lorraine B. Gallegos

Fig. 1-14. J. R. Maddy memo regarding transfer of Industrial Waste Section to LASL, May 1955.

At the time that the branch became Group H-7, LASL, the responsibilities included:

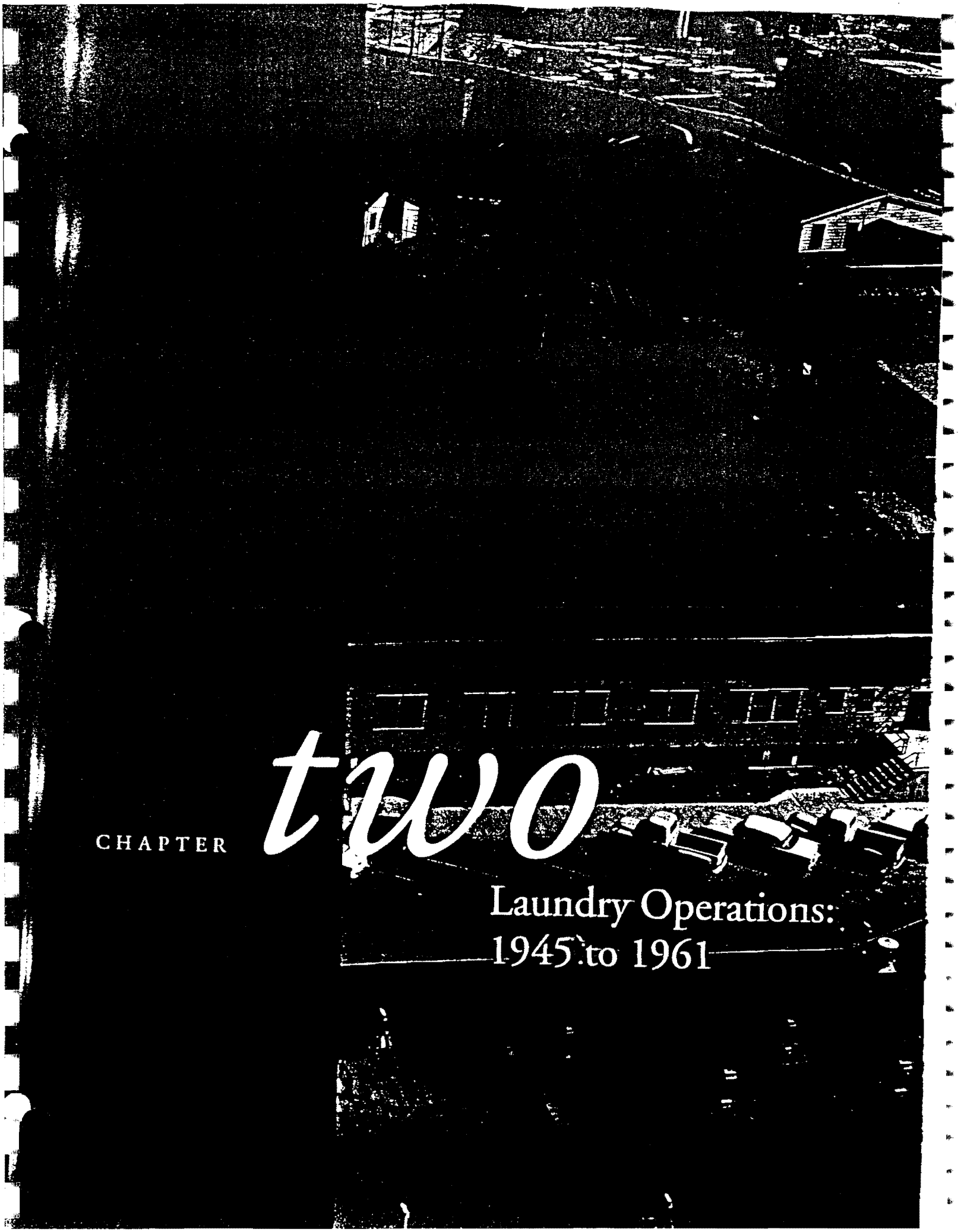
- operating and maintaining the treatment plant, TA-45, for radioactive liquids from TA-1 and South Mesa facilities;
- operating and maintaining the treatment plant, DP-35, for radioactive liquids from DPW TA-21;
- operating and maintaining the treatment plant, Ten Site Laboratory (TSL) - 7, -9, and -10, for radioactive liquids from TA-35;
- operating and maintaining the laundry, including sampling and analyzing laundry wastes discharged to Area V; and
- studying methods to treat radioactive wastes. The Division of Reactor Development (DRD) of the AEC funded these investigations.

At the time of transfer, group organization had evolved into a five-section operation including:

- the group office—Group Leader, Alternate Group Leader, secretary;
- the Engineering Section—section leader, staff member (SM), technicians;
- the Research and Development Section—one SM (working closely with the Group Leader and providing backup for the Engineering Section);
- the Chemistry Laboratory Section—section leader, SM chemist, chemistry technicians including one senior technician for research and development (R&D); and
- the Laundry Section—section leader SM, assistant section leader, technicians.

References

1. J. W. Kunetka, *City of Fire: Los Alamos and the Birth of the Atomic Age, 1943–1945* (New Jersey: Prentice-Hall, Inc., 1978).
2. 1953 Operating Report WD [waste disposal] -2 Plant, Santa Fe Operations Office, Los Alamos Field Office, US AEC.
3. TA-45 Waste Treatment Plant Plans and Specifications, Los Alamos, New Mexico, US AEC, 1951, Black & Veatch, Architects and Engineers, Kansas City, Missouri.
4. RFI [RCRA Facility Investigation] Work Plan for Operable Unit 1079, Environmental Restoration Program, Los Alamos National Laboratory report LA-UR-92-850 (May 1992).



CHAPTER *two*

Laundry Operations: 1945 to 1961

An early problem faced by the administration at Los Alamos was the most economical management of contaminated clothing—smocks, dungarees, underwear, socks, head cover, and booties—and other items such as towels. The items could be discarded as waste, or they could be laundered. It was decided to launder all clothing contaminated with radioactivity and to send such uncontaminated items as towels and smocks to a Santa Fe laundry. Because most contaminated clothing originated in D Building (plutonium facility), a small laundry was constructed adjacent to and south of D building in Building D-2. Wastes were discharged to a septic tank, which overflowed to Los Alamos Canyon.

Laundry soaps, such as Ivory Snow (Fig. 2-1), readily available on the market, were used as cleaning agents but were found to have a relatively low efficiency in removing isotopes of plutonium and polonium. Studies were conducted and experiments undertaken to discover agents that might be more effective. The chemicals investigated included 3% citric acid, 3% tartaric acid, 3% acetic acid, 2% oxalic acid, 3% hydrogen sulfate, 3% Igepal solution, and 3% Zoleo solution. As described in a report by J. F. Tribby [1], January 1948, the citric and tartaric acid solutions were the most effective decontaminating agents.

With the transfer of plutonium operations from D Building to DP Site at TA-21 and increasing laundry requirements, D-2 operations were replaced by a larger facility at DP site. Appendix F is a copy of a memo requesting the new facility.

A decision was made to provide a full-service laundry, and W. H. Kruger, Santa Fe was contracted to design the plant. The facility (Fig. 2-2) was built 1945, located at the west end of TA-21 and designated DP-20. Names of some the personnel assigned to the laundry are listed in a following paragraph. CMR Division operated the laundry until September 1, 1956, when it was transferred to H-7.

Treatment of the laundry wastes became an immediate problem with no recognized solution, so, as an interim measure, three absorption beds (Fig. 2-3) were provided. The bed area was designated as Area V. The beds, 25 ft × 200 ft, were filled with rock, gravel, sand, and earth and expected to percolate 0.5 gal. per square foot per day. The scientists attempting to resolve the treatment of the wastes from TA-1 and TA-21 also concentrated on designing a treatment system for the laundry wastes. The major difference in the problems was that the laundry wastes included considerable organic material and should have been conducive to biological treatment such as trickling filtration and activated sludge. A paper by J. F. Newell, *et al.*, describing the lab work devoted to treatment of the laundry wastes was published in 1951 [2].

When the laundry went into operation, wastes to the absorption beds were sampled periodically, and in 1955, weekly composites were analyzed to determine levels of gross alpha, beta,

[redacted]

-7-

B. Control.

Rubber gloves are provided for each person working with the material. Several changes each day are made by persons working with large quantities of the material, especially solutions. Hand counters, sensitive to 200 counts per minute are available in the washrooms. Filter paper swipes are taken from hands of persons in "hot" labs daily or twice daily. Check tests are made on a fraction of the laboratory personnel twice weekly upon leaving the washroom. Technicians are urged to determine certain areas as contaminated and regard them as such. These areas are never touched with the bare hands.

A preventive method has been provided in the washrooms and in the laboratories. If this method (which is outlined below) is used, virtually all (down to 200 counts per minute or less) of the contamination can be removed from the skin.

1. Before beginning work, coat hands with a thin layer of spindle oil. It is important to cover the hands thoroughly.
2. After finishing work, coat hands with West's Sulpho Hand Cleaner, work up a lather with water and rinse.
3. Repeat step 2.
4. Wash with Ivory Soap.

C. Methods.

No satisfactory method is known for removing contamination from hands other than the preventive measure outlined above. A 4 or 5 normal solution of HCl will frequently remove contamination from hands but because of the irritating effect on the skin, the method is recommended only in extreme cases.

VII. Laundry.

A. Personnel.

Untrained men and women can be used on this job. It is not believed that any protective measures are necessary other than using the method for preventing hand contamination outlined above. Protective clothing is provided if the personnel wish to wear it.

B. Control.

A sufficient supply of protective clothing of every type is kept on hand in order to permit frequent changes. Clothing is check-monitored after being laundered.

C. Method.

Shoe covers, coveralls, smocks, cloth gloves, surgeon's caps, and laboratory towels are washed repeatedly and the machines are cleaned between each washing. All shoe covers are washed, turned inside-out and rewashed. Ivory Snow and water is used.

D. Results.

Only about 0.5% of the garments (most of these are coveralls and smocks)

[redacted]

Fig. 2-1. *Page from R. A. Popham report on laundry operations, August 1944.*

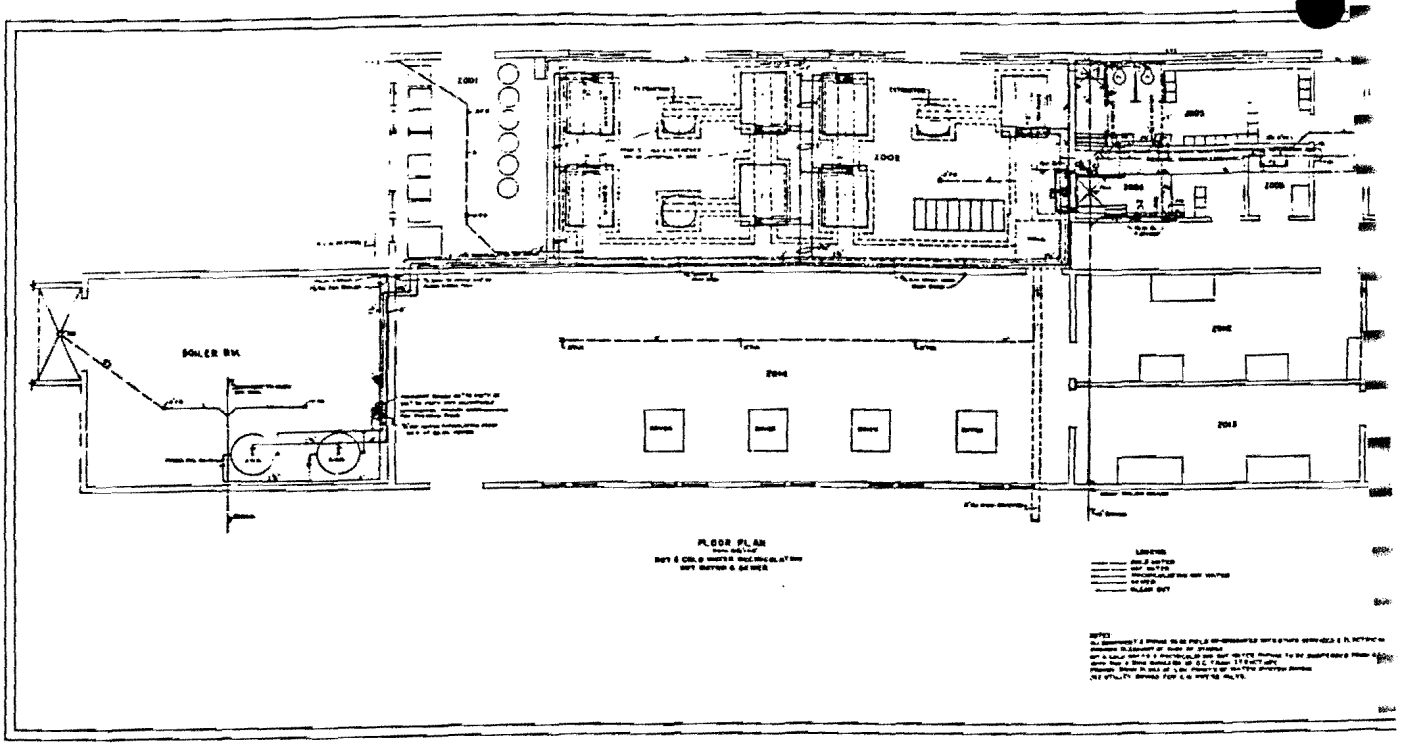


Fig. 2-2. *New full-service laundry facility.*

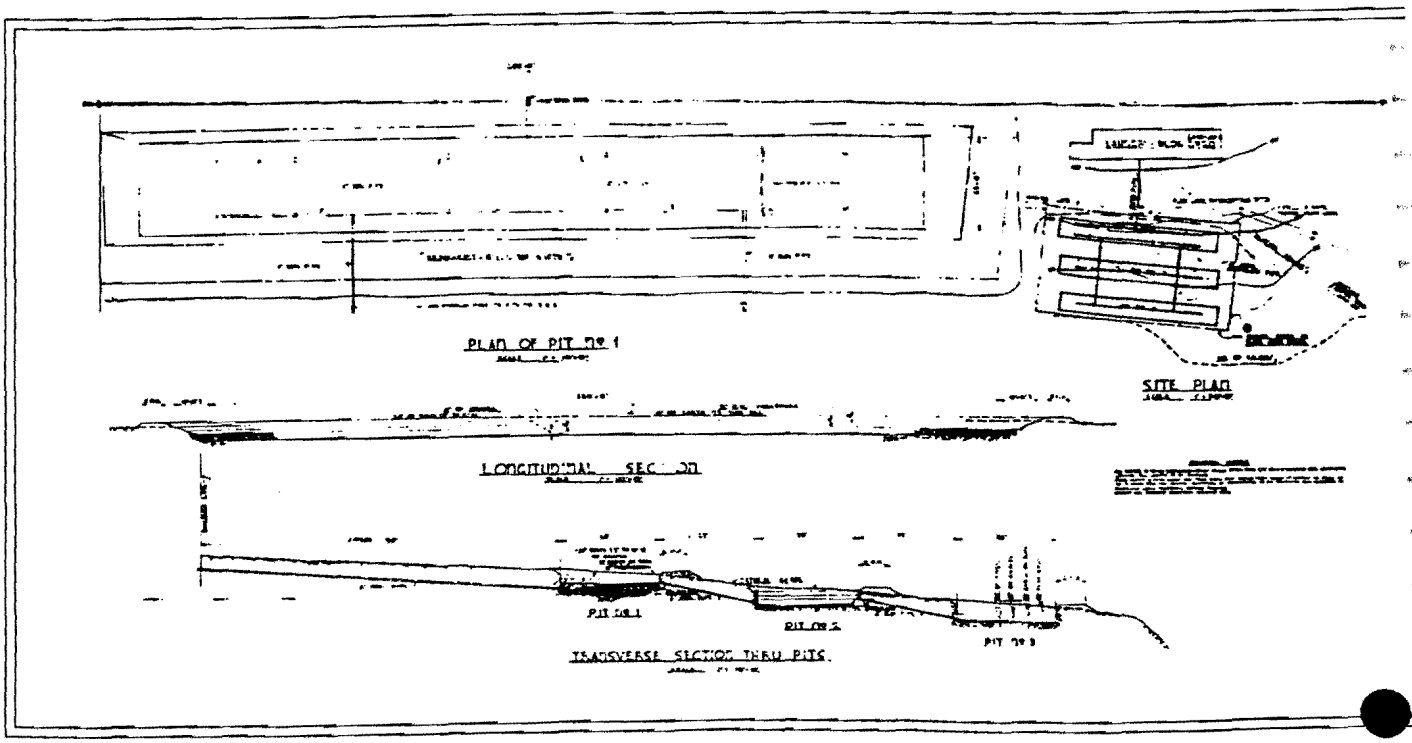


Fig. 2-3. *Plan of waste disposal facilities for DP-20.*

Year	Gross alpha	Plutonium*	Gross beta	Radioactive Strontium
1955	1907	655		
1956	1920	763		
1957	1282	539	25,682	563
1958	861	12	16,624	1898
1959	1244	715	3,088	234
1960	2313	1,053	22,636	887
1961	2903	882	38,140	995
Average	1776	717	2,234	915

Table 2-1. *Summary-laundry raw/weekly waste composites yearly averages, c/m-L.*
**Using counter with 50% shielding; therefore disintergrations/m-L=2 c/m-L.*

Dispensed (totals for the year)	1956	1957
Cheesecloth, bolts	5,595	2,281
Gloves, surgeon, dozen pairs	21,107	
Processed (totals for the year)		
Pieces	896,600	981,450
Pounds	422,833	457,204
Boots, single	527,500	611,300
Coveralls	80,500	84,430
Coveralls discarded because of wear and tear	2,154	3,025
Coveralls discarded because of contamination	92	154
Laboratory coats	61,150	60,600
Laboratory coats discarded due to wear and tear	1,828	1,557
Respirators	12,399	12,494

Table 2-2. *Comparison of laundry services for 1956 and 1957.*

plutonium, and radioactive strontium. A copy of a summary by chemist Elgin H. Rex (for the years 1955 through 1961) appears in Table 2-1.

The following employees worked at the DP-20 Laundry.

George B. Ponton - Supervisor
Joe Schaffer - Assistant Supervisor
Arturo Ortega - Foreman
Polly Montoya
Manuel Martinez
Filiberto Martinez
Frank Montoya
Pasqualita Tafoya
Austine Lujan
Elias Vigil
Richardo Varela
Agueda Salazar
Carlos Salazar
Juan B. Salazar
Benny Martinez
Jose Roybal
Eusebia Martinez
Margaret Nelson
Waldo Martinez
Joe Varos

Table 2-1 indicated that gross beta activities were of much greater concern than gross alpha, with some of the beta activity due to isotopes of radioactive strontium. A memo from E. R. Hermann (Fig. 2-4) describes plutonium activities. Reference 3 provides detailed information on the history of Area V with data on liquid and soil sampling. Laundry operating data for 1956 and 1957 are provided in Table 2-2.

Office Memorandum • UNITED STATES GOVERNMENT

TO : THE FILES, Industrial Waste Section DATE: July 6, 1953

FROM : E. R. Hermann, Chief. Sanitary Engineer, Industrial Waste Section ERH.

SUBJECT: DP LAUNDRY WASTE LEACHING BED

A preliminary sampling of the soils in the DP Laundry Waste Leaching Bed was carried out on June 15, 1953. A spot that had received considerable contamination was selected in the North Central portion of the bed about 20 feet West of the ditch in which the Waste Sampling Pump is located and about 20 feet South of the restrictive fence parallel to and nearest the Laundry building. Vertical core samples were obtained by means of a one inch pipe being driven into the soil at intervals as a three foot diameter hole was dug down into the underlying medium. This medium consisted of sand and gravel mixed with river rock ranging in size from one inch to fifteen inches. No stratification of sand, gravel or rock sizes was apparent below the first five inches. In addition to the soil samples three different types of plant life growing in the vicinity were sampled.

Plutonium analyses were carried out in the Industrial Waste Section laboratory by Elgin H. Rex.

RESULTS

Sample Number	Depth below Surface	Description	Plutonium dpm/dry gram
1	Surface	Loam (L.W. residue)	26,000
2	3"	Sandy soil	360
3	5"	Sandy soil	74
4	16"	Sand, gravel, and rocks	28
5	31"	" " " "	20
6	40"	" " " "	40
7	53"	" " " "	24
8	55"	" " " "	8
9	53"	" " " "	120
10	Surface	Stagnant pond slimes (bacterial?)	12,300
11	Surface	Weeds from pond	22
12	Surface	Algal slimes growing in clear waste water	5,080

Fig. 2-4. E. R. Hermann memo regarding DP Laundry Waste Leaching Bed.

In the 1950s, there was some concern about laundry operating costs, estimated for 1956 as $284,000. There was also pressure from AEC- Washington to transfer any possible routine operations to the private sector, and laundry operations was one of the first suggested. In a 1960 letter to Sen. Clinton P. Anderson, the Health Division Leader, Dr. T. L. Shipman expressed a certain reluctance to transfer laundry operations to an outside commercial firm, fearing its inability to protect employee health and safety (Appendix G). However, on June 1, 1961, the entire laundry operation was transferred to the Supply and Property Department for eventual transfer of much of the responsibility to a commercial subcontractor. Figure 2-5 is a memo regarding the transfer to the Supply and Property Department. Excluding such requirements as pickup and delivery, providing laundry bags, and respirator cleaning, the operation was then contracted by Supply and Property to the Interstate Industrial Uniform Rental Service of Santa Fe. The contract was revised and renewed numerous times and in June 1993, was held by Interstate Nuclear Services, Inc. No further wastes were discharged to the pits in Area V, and responsibility for their management was transferred in the 1960s from SP-2 to H-1. In a November 13, 1964, memo from the Los Alamos Area Office of AEC, LASL was granted authority to decommission (destroy) the laundry building DP-20, and this was done when funds became available.

George Ponton - Contaminated Laundry May 16, 1961

T. L. Shipman, M.D., Health Division Leader

TRANSFER OF CONTAMINATED LAUNDRY

X

At the request of the Director, the Contaminated Laundry with all of its personnel, buildings, equipment, etc., will be transferred to the administration of the Supply and Property Department effective June 1, 1961. It is no secret, I think, that this transfer anticipates the possibility of turning the laundry work over to a commercial subcontractor at some time in the fall. It is also no secret that I and the H-Division Group Leaders involved are fighting this proposal, and while I am not optimistic over the chances, I feel there remains a possibility that there would be no change.

I wish to assure you that the pressure to turn the laundry work over to an outside contractor comes from Washington and in no way represents any dissatisfaction with the way things have been going here. As a matter of fact, I wish to use this opportunity to offer my personal commendation to you, Joe Schaffer, and every individual on the laundry staff. Yours has not been a job with very much glory to it, but it has been a very essential one, and the fact that the work has gone on with most people being unaware of it is an indication of the fact that it has been done well. I am sending a copy of this memo to the Personnel Department so that it may be permanently retained with your personnel record.

If and when the laundry is transferred to a commercial operator there are certain parts of the operation which will not go with it. To the best of my knowledge at the present time we will retain all parts of the respirator cleaning, and we will also continue all of the pickup and distribution service, and the distribution through the dispensaries. It looks as though about a half of the existing personnel will be retained. I wish to give you my personal assurance that I personally will do everything in my power to see to it that other jobs are found for all of those who may be displaced. We are not unmindful of the fact that the average length of service of the laundry personnel is approximately 10.7 years. This must be a situation almost unique in the laboratory, and I personally feel a very real debt of gratitude to those who have served so long and so faithfully. Even though your administration will transfer on the first of next month from me to Harry Allen, you may feel sure that I and the H-Division Group Leaders will not drop our interest in your problems.

ORIGINAL SIGNED BY THOMAS L. SHIPMAN, M.D.

T. L. SHIPMAN, M.D.
Health Division Leader

TLS/mjt

cc: G. W. Christenson
Harry Allen
Personnel Department File

Fig. 2-5. T. L. Shipman memo regarding transfer of contaminated laundry, May 1961.

References

1. J. F. Tribby, Organization and Function of the CMR-Contaminated Clothes Laundry, January 12, 1948.
2. J. F. Newell, *et al.*, "Laboratory Studies on Removal of Plutonium from Laundry Wastes," *Industrial and Engineering Chemistry*, V 43, 1516 (1951).
3. M. Devaurs, "History of Area V, TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Los Alamos National Laboratory report LA-UR-91-962 (May 1991).

CHAPTER *three*

Operations at TA-45: 1951 to 1968

January date	Volume (gal.)	
	8:00 a.m.-5:00 p.m.	8:00 a.m.-8:00 a.m.
1–2 (Monday)	1,587	4,680
2–3 (Tuesday)	9,530	18,272
3–4 (Wednesday)	8,561	17,631
4–5 (Thursday)	9,080	14,721
5–6 (Friday)	6,986	11,528
6–7 (Saturday)	6,165	10,256
7–8 (Sunday)	1,484	4,206
8–9 (Monday)	7,622	14,620
9–10 (Tuesday)	7,455	17,152
10–11 (Wednesday)	10,109	18,340
11–12 (Thursday)	10,666	16,211
12–13 (Friday)	8,457	14,170
13–14 (Saturday)	9,077	14,051
14–15 (Sunday)		5,340
15–16 (Monday)	11,752	20,481
16–17 (Tuesday)	8,372	15,004
17–18 (Wednesday)	10,009	16,843
18–19 (Thursday)	8,500	17,188
19–20 (Friday)	8,436	16,768
20–21 (Saturday)	7,988	13,373
21–22 (Sunday)	3,386	7,526
22–23 (Monday)	6,850	12,691
23–24 (Tuesday)	9,172	16,303
24–25 (Wednesday)	8,063	14,618
25–26 (Thursday)	7,625	12,227
26–27 (Friday)	7,363	12,955
27–28 (Saturday)	8,938	16,232
28–29 (Sunday)	3,195	8,060
29–30 (Monday)	10,719	17,183
30–31 (Tuesday)	10,219	16,756
31–February 1 (Wednesday)	9,678	19,662
TOTALS		
26 working days	227,392	405,236
5 nonworking days	9,652	29,812
GRAND TOTAL	237,044	435,048
AVERAGES		
for month	7,901	14,034
for 26 working days	8,746	15,586
for 5 nonworking days	2,413	5,962

Table 3-1. *Technical Area discharge record, January 1951.*

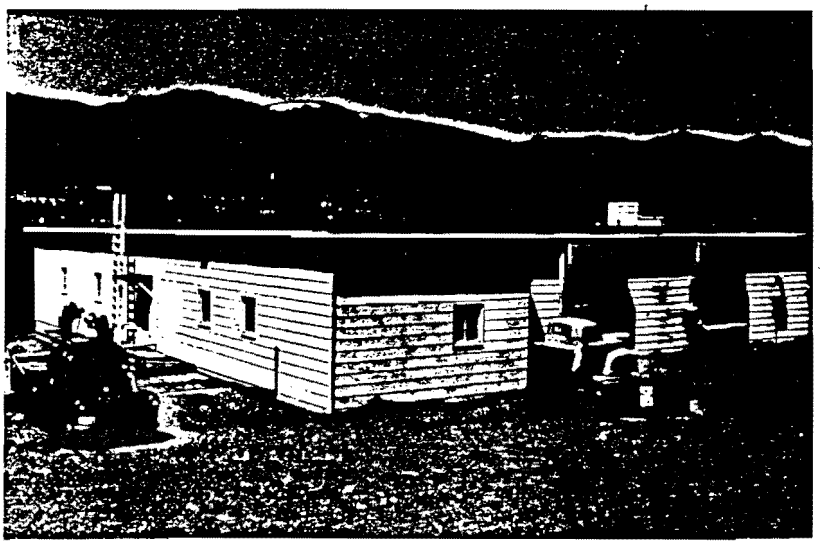


Fig. 3-2. *TA-45 Treatment Plant for plutonium-contaminated wastes.*

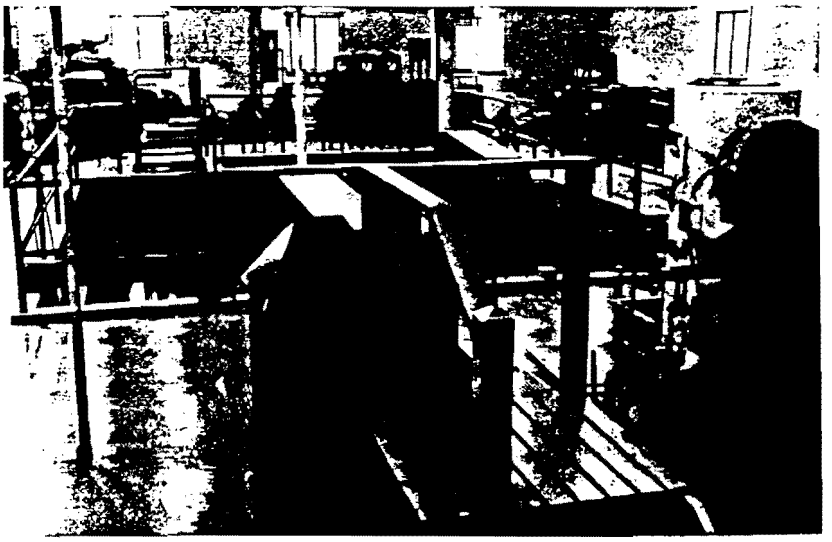


Fig. 3-3. *Plant operating floor, TA-45.*

February 7, 1951

TO: Dr. T. L. Shipman, H Division Leader

FROM: Engineering Department

SUBJECT: NEW TECHNICAL AREA DESIGNATION

REFERENCE: ENG-3

1. This is to advise that the recently completed Waste Disposal Plant on the north side of Canyon Road constructed on contract AT(29-1)-835 was accepted for beneficial occupancy on December 12, 1950 for use by the AEC Industrial Waste Branch. The Engineering Department, LASL, will assume responsibility for its maintenance.

2. For convenience of reference and cost accounting the contaminated area enclosed by the existing Pueblo Canyon fence together with the existing contaminated vehicle washing facilities and the new Waste Disposal Plant is to be designated as Technical Area 45, WD-Site. The Contaminated Vehicle Washing Facility will be designated as Building WD-1, and the Waste Disposal Plant as Building WD-2.

3. Individual signs for the buildings and site were ordered by Group ENG-4 and are presently being posted; also, a structure location plan map is being prepared by Group ENG-3 and proper distribution will be made as soon as it is available.

John Bolton

SER:daf

cc: A. D. Richardson
Roy Reider
P. A. Wilson
John Nevell
H. Hartmayer
Central Records (2)
Eng.D.O. (3)
Lab Job Files 409 & 347

Fig. 3-4. Engineering Department memo regarding new Technical Area designation, February 1951.

A "large item" decontamination facility, WD-1, was included in the site just west of the underground storage tanks adjoining the west side of the building. The decontamination section of the radiation monitoring group operated it. Wastes from decontamination operations were piped directly to Acid Canyon until early December 1955, when they were rerouted to treatment in WD-2.

Beneficial occupancy of WD-2 occurred on December 12, 1950; final acceptance by the AEC took place on March 2, 1951 (Fig. 3-5); and plant operations began on April 17, 1951. It was soon learned that the plant could not treat the flow it received during a 40-h single shift at a rate of 70 gpm. Therefore, considering the low level of radioactivity of the raw waste, treatment rates were often increased and weekend operation was occasionally necessary. Based on National Council on Radiation Protection (NCRP) drinking water standards, effluent quality remained satisfactory. A contributing factor to the low raw waste activity levels was the early transfer of plutonium operations from D Building, TA-1, to DPW, TA-21.

SOUTH MESA CONSTRUCTION

During the late 1940s and early 1950s, LASL was involved in a large construction program to transfer TA-1 operations to more permanent facilities on South Mesa. Those producing liquid radioactive wastes included:

- the SM-29 Chemistry Metallurgy Research (CMR) facility (Wings 1 through 7);
- the Sigma Complex (SM-35, -66, and -141);
- cryogenics facilities (SM-32 and -34);
- the Physics Building (SM-40);
- LASL shops (SM-29 and -101);
- the Source Storage facility (SM-65); and
- the Van de Graaff accelerator (SM-16).

The radiochemistry facility (RC-1, TA-48) began to generate radioactive liquid waste in 1957. Not included on the South Mesa, but also generating radioactive liquid waste were the Health Research Laboratories (HRL, TA-43) and reactor research facilities at Omega Site (TA-2) and Ten Site (TA-35).

To transfer South Mesa wastes for treatment at TA-45, the consulting engineers, Black & Veatch, were contracted to design a system that would include the waste line, a neutralization station, and a siphon drain facility. The neutralization station, SM-700, was constructed on the south rim of Los Alamos Canyon just west of Diamond Drive. The station included a bar screen, a large neutralization tank with mixers and facilities for automatically adding sodium hydroxide solution to maintain a caustic pH, and a large storage tank whose discharge was controlled remotely from the TA-45 operations office. The line from SM-700 to unlisted land reserve (ULR) -37 (the junction manhole with the line from TA-1) was a depressed sewer (inverted siphon) with a major depression in the crossing of Los Alamos Canyon and a minor one east of the Catholic Church. Because of very low flows over weekends,

Office Memorandum • UNITED STATES GOVERNMENT

TO : Engineering and Construction Division DATE: March 13, 1951
ATTN: John F. Newell, Chief, Industrial Waste Branch
FROM : Carl G. Nottrott, Chief, Official and Commercial Space C G N

SUBJECT: FINAL ACCEPTANCE - CONTRACT NO. AT(29-1)-835, WASTE TREATMENT PLANT

SYMBOL: TOR-2

This office has been advised of the final acceptance of the Waste Treatment Plant, Contract No. AT(29-1)-835, as of March 2, 1951.

The subject plant was assigned to the Engineering and Construction Division for beneficial occupancy by memorandum from this office dated December 13, 1950.

Fig. 3-5. *C. G. Nottrott memo regarding final acceptance of TA-45-2, March 1951.*

solids could settle and plug the line at the two low spots. To correct this possibility, drain (blow-off) facilities were built in the line in the bottom of Los Alamos Canyon (ULR-33) and east of the Catholic Church (ULR-36). Valving was provided to permit draining either leg of the line to a buried concrete storage tank. Piping to pump out the storage tank to a tank truck was included. Also included in the transfer line were two vent pipes, probably extending 8 to 10 ft above ground level, one at the Episcopal Church and the other behind the Catholic Church. The drain facility at Los Alamos Canyon may have been used one time when the leg of the line down the south wall of Los Alamos Canyon froze and had to be thawed. The vent lines froze shut several times and had to be thawed to permit design flow through the line.

Wings 2–7, SM-29, were each provided with two 5000-gal. concrete waste storage tanks. When a tank filled, it was sampled to determine the amount of plutonium that had been lost. If the determination was reasonably low, the drain valve was opened, and the waste flowed to SM-700. Bert Schnapp of H-6 performed the testing in the late 1950s and operated the valves at SM-29. He would notify H-7 that one or more of the SM-29 tanks had satisfactorily low plutonium levels and would be discharged to SM-700. This determination could be verified by analog depth recorders at TA-45. For a general record of waste flow from SM-29, a log of tank dumpings was maintained (Table 3-2).

Increasing flows from South Mesa resulted in higher operating rates and extended hours of operation. During a 40-hour week, the 3-ft-diameter by 1-ft-wide precoat vacuum filter could not dewater the precipitate (sludge) produced, and it had to be operated 24 hours, often including weekends. Early operations at TA-21-35, which had no means for dewatering precipitates, aggravated this problem because it was necessary to transfer the DP-35 concentrates by 200-gal. tank trailers to TA-45.

Date	Time called	No. tanks to be dumped	Dumping			
			Start time	Stop time	Start time	Stop time
6/16/60	11:00	1	12:15	14:15		
6/17/60	10:55	2	12:10	14:00		
6/20/60	11:25	2	12:10	15:30		
6/21/60	10:20	2	11:00	15:30		
6/22/60	08:10	4	09:00	09:15	11:45	12:45
6/23/60	11:15	1	12:30	14:00		
6/27/60	11:20	3	12:15	13:15		
6/28/60	10:27	1	12:15	15:00		
6/29/60	11:08	2	13:15	14:15		
6/30/60	?	2	12:15	13:15		
7/6/60	11:10	1	11:30	13:00		
7/7/60	11:00	2	12:15	13:30		
7/8/60	11:00	2	12:30	13:30		
7/11/60	11:25	3	12:30	13:45		

Table 3-2. *Typical record of tank dumping, CMR building.*

IODIDE WASTES AT TA-45

Many 55-gal. drums of liquid waste contaminated with radioactive iodine were stored aboveground at the east end of TA-21, Area A. H-7 realized that the drums were corroding and the solution was draining to the surface of the burial ground. In addition to the beta activity, the waste was contaminated with an unidentified alpha emitter. After discussions with all interested parties, it was decided to treat the wastes through the TA-45 and TA-21-35 plants. Accordingly, the solutions were pumped from the drums to a tank trailer and the tank trailer contents were siphoned off into the influent flow channels of the two plants. The operation lasted from May through August of 1960 [illegible] of the waste were treated through [illegible] A page of the record book appears i[illegible] Fig. 3-6.

Date	Time	cpm-mL gross alpha	cpm-mL gross beta
09/20/61	11:00	1.83	4.7
10/19/61	09:30	3.26	3.4
11/14/61	08:40	0 .63	8.5
12/15/61	10:00	0.93	0
1/24/62	13:15	0.80	3.8
2/13/62	11:00	1.88	5.3
3/23/62	11:30	0.27	0.4
4/19/62	12:00	0.78	10.9
5/22/62	10:45	0.16	2.3
6/14/62	13:30	0.17	0.5
7/19/62	08:25	0.22	1.0
8/14/62	13:45	0.03	1.3
9/6/62	11:30	0.01	2.4
10/23/62	08:40	0.03	2.5

Table 3-3. *ULR-60 samples (extracted from one of the data sheets).*

THE QUESTION OF HRL BUILDING WASTES

The Health Research Laborato[illegible] (HRL), TA-43, originally Medical [illegible] Laboratory (ML-1), was provided wi[illegible] separate plumbing systems for sanit[illegible] radioactive liquid wastes. The radioa[illegible] wastes drained by gravity from the [illegible] northeast corner of the building thr[illegible] two manholes (ULR-61, ULR-60) to [illegible] junction manhole ULR-35 on the r[illegible] line from SM-700 to TA-45.

In 1959, the first steps were bei[illegible] taken to replace TA-45 with a larger [illegible] treatment facility on the south [illegible] of Los Alamos Canyon. The question [illegible] the disposal of the HRL Building w[illegible] arose, and preliminary investigations [illegible] determined that these wastes had ve[illegible] low levels of radioactivity and might [illegible] reasonably be directed to the sanitar[illegible] sewer system of Los Alamos County. [illegible] system provided trickling-filter proces[illegible] at the Central Plant just north of Tri[illegible] Drive on the east end of town directly [illegible] behind a veterinary medicine facility.

To provide backup data for a de[illegible] a program of grab-sampling of the radioactive wastes began in late 1960. Samples were collected several times [illegible] week from manhole ULR-60 and ana[illegible] for gross alpha and gross beta (Table [illegible] Based on this information, the radioa[illegible] waste line was connected in the [illegible]

August 8, 1960

Date	Raw Iodide Waste to Tech Raw: Tech Log No.	Gals.	pH	Gross α c/m/ml	Iodide ppm	Tech Final Iodide ppm
7/22/60	15	240	13.0	3090	15000	10
7/22	16	235	13.1	10,153	12000	
7/25	17	235	13.2	3,222	10000	40
7/26	18	240	13.4	3,521	15000	65
7/27	19	225	12.9	1884	20000	100
7/27	20	225	13.2	1167	25000	
7/28	21	230	13.5	912	18000	180
7/29	—	—	—	—	—	60
8/1	—	—	—	—	—	14
8/2	22	245	13.5	188	10000	55
8/2	23	230	13.5	463	5500	
8/3	—	—	—	—	—	100
8/4	—	—	—	—	—	40
8/5	24	235	13.2	163	27000	40

8/8/60 L. A. Emmitt

August 17, 1960

8/1/60 thru 8/7/60 – TRWC – 151 c/m/ml Gross β
8/1/60 – 8/7/60 – TFWC – 56 c/m/ml Gross β

Date	Mean β (c/m/ml) Tech Raw	Tech Final
8/6-7	68	
8/8	73	16
8/9	65	12
8/10		10

Daily analysis of Tech samples for Mean β were discontinued due to the decreasing low beta activity. Both raw & final samples will be taken of the composite only until greater amounts of iodide waste are received.

8/17/60 L. A. Emmitt

August 24, 1960

Dale Peterson C.W. Christiansen said he had received word that 1.0 mc I^{129} had been lost down a sink drain at the CMR Bldg. The P.W. will be caught in one of the holding tanks at CMR. So that the influent to TA-45 will not be too highly radioactive, it was decided

Fig. 3-6. A page from the TA-45 treatment record book.

subbasement of the building to the sanitary line about March 5, 1963, and thereafter no radioactive wastes from HRL were included in the TA-45 collection system.

The combined wastes from HRL were pumped to a municipal sanitary sewer in Trinity Drive and flowed to a trickling filter plant (Central Sewage Plant, East Road) behind the veterinary offices (124 East Road). This plant was abandoned in 1966 when the sewers were extended to a new municipal trickling filter plant in Bayo Canyon at the far east end of town.

For several years before the waste line change at HRL and many years after, personnel from H-7 sampled the raw waste—and eventually the sun-dried sludge from all municipal and LASL sewage treatment plants—and analyzed the samples for gross radioactivities, organics, and metals. (For a brief period, sanitary sludge from the Santa Fe sewage treatment plant was also sampled and analyzed, and background da ere obtained by analyzing sludges of 3 for plutonium, a project of Dr. E. B. Fowler.) Activity levels found were generally in the background range l April 1975, generators of radioactive wastes at HRL were requested to pl radioactive wastes in containers in th labs and to call H-7 for pickup whe containers filled.

In 1981, in a decision to remove LASL liquid wastes from the munic collection system, a new line was inst and connected to an existing inverted siphon crossing Los Alamos Canyon behind the HRL. The downstream e of the siphon was connected directly the influent chambers of the TA-3 se treatment plant. All of the combined wastes from HRL were pumped into new line, and the tie-in to the s Trinity Drive was disconnected.

LAST OF THE TA-1 RADIOACTI LIQUID WASTES

By early 1960, Sigma Building at TA-1 was the last TA-1 facility gener liquid radioactive wastes. Replacemen facilities on South Mesa were being provided at SM-35, -66 and -141. Sl was the new Sigma.

To obtain an estimate of flow vo and gross radioactivity of Old Sigma Building wastes flowing to TA-45, tim were installed on the two discharge pumps, and samples were collected beginning in 1960. Some of the radioactivity data collected in 1962 a 1963 appear in Table 3-4.

Date	pH	Cond	Gross alpha (cpm-mL)	Gross beta (cpm-mL)	Uranium (cpm-mL)
12/04/62	8.2	12	7.36	5.5	6.79
12/13/62	8.4	18	10.84	11.3	7.41
12/27/62	7.8	11	0.41	1.8	0.30
01/10/63	8.0	10	0.52	0	0.40
01/22/63	8.4	14	0.89	1.6	0.55
01/31/63	8.2	16	0.72	1.7	0.51
02/12/63	7.9	11	2.50	3.1	1.69
02/21/63	7.4	11	0.47	0.2	0.36
03/05/63	7.7	8	2.31	1.3	1.57
03/14/63	8.2	11	2.41	0.9	1.67

Table 3-4. *Waste samples from the Old Sigma Building, TA-1.*

As various activities in the building were transferred to the new South Mesa facilities, volumes and activities of wastes from TA-1 decreased. In April 1964, gross beta was determined to be zero, and gross alpha and uranium concentrations were negligible. Sampling was discontinued on April 14, 1964, and the flow to TA-45 was diverted to Acid Canyon on May 27, 1964. The last day of operation of TA-45 was May 26, 1964. The waste treated was primarily that from TA-1 because the line from SM-700 was closed permanently on May 20, 1964. The new treatment facility at TA-50 had been in operation for almost one year.

Sigma Building, TA-1, was transferred officially from LASL to the AEC on June 3, 1964.

THE TUNNEL KILN STUDIES

A major problem in the first years of AEC operations was safely managing high-level wastes produced in fuel reprocessing. Recovery of plutonium, uranium, strontium, and cesium was a consideration. Large storage tanks were the immediate answer at Hanford, Idaho Falls, and Savannah River, but these were considered only a temporary measure.

AEC DRD funded major projects at the primary sites to develop systems for volume reduction and safe storage of the wastes. Several proposals for recovery of strontium and cesium were received, but they were eventually considered to be uneconomical.

At Los Alamos, C. W. Christenson, H-7 Group Leader, became interested in these studies concerning disposal of waste and initiated a project to develop ceramic balls (sponges) that could absorb large amounts of wastes, then be fired in a kiln to seal the activity within the sponge (Fig. 3-7). Christenson and R. G. Thomas, a sanitary engineer in the group, spent much of their time in lab bench studies of ceramics and developing the process, including the air-cleaning, soaking and drying, kiln design, and cooling operations. Several papers [3-4] were written on the results of the studies, and presentations were made at several AEC and professional organization meetings. To assist in developing the optimum clay sponge (Fig. 3-8), AEC DRD awarded a contract in late 1958 to the Coors Porcelain Company of Colorado, which

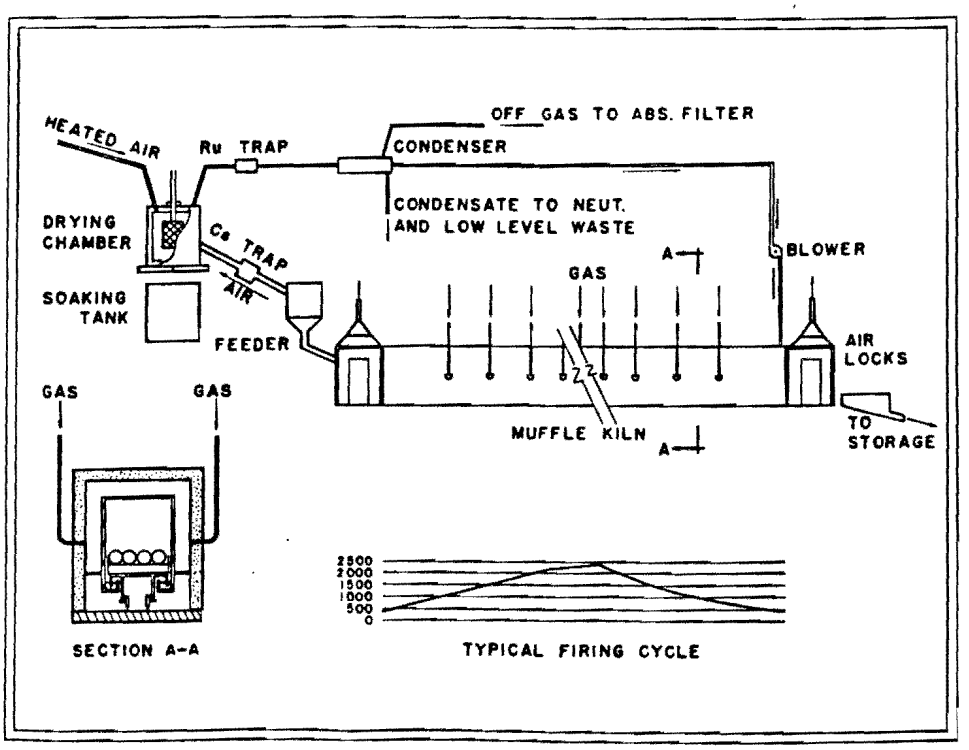


Fig. 3-7. Schematic of conceptual design for Ceramic Sponge Radiological Treatment Plant.

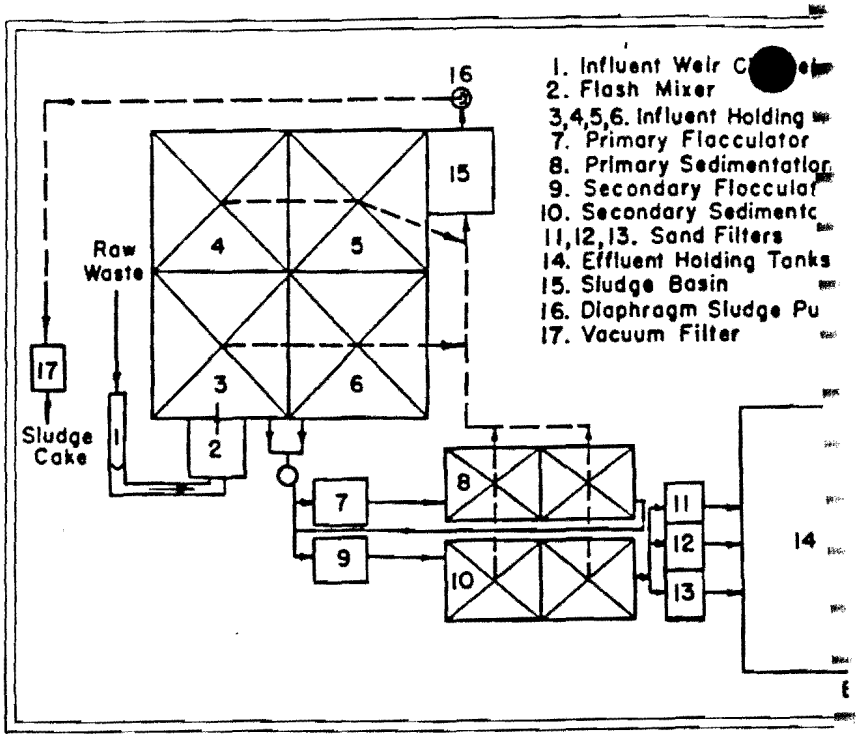


Fig. 3-1. *Flow diagram of the waste treatment plant, TA-45.*

Pilot plant studies by scientists and engineers at Los Alamos of the treatment of plutonium-contaminated wastes indicated that a physical/chemical process using an iron salt at a high pH was an effective method for concentrating the radioactivity in a precipitate [1,2]. Accordingly, the AEC contracted with a consulting engineering firm, Black & Veatch of Kansas City, to design a small plant along standard sanitary engineering lines. As designed, the plant had duplicate rapid-mix basins and settling tanks and could be operated at 35 gpm with the tanks in series or 70 gpm when operated in parallel. Based on flows recorded for January 1951 (Table 3-1), the design treatment rate was conservative. The flow for January 15-16 totaled 32,233 gal. At 35 gpm, would be required for treatment; a gpm, 7.68 h. It had been planne operate 8 hours per day, 5 days p

Figure 3-1 is a schematic of th Fig. 3-2 is a view of the exterior a and Fig. 3-3 shows the plant opera floor. The facility was constructed north side of Canyon Road, appr across from the United Church, at of $200,000 for the plant and $1 for the lab facilities. It was design TA-45, Waste Disposal (WD) site 3-4). The main building, WD-2, not only the treatment plant but al group office, administrative office chemistry laboratory, a counting r and space for research projects or p plant studies.

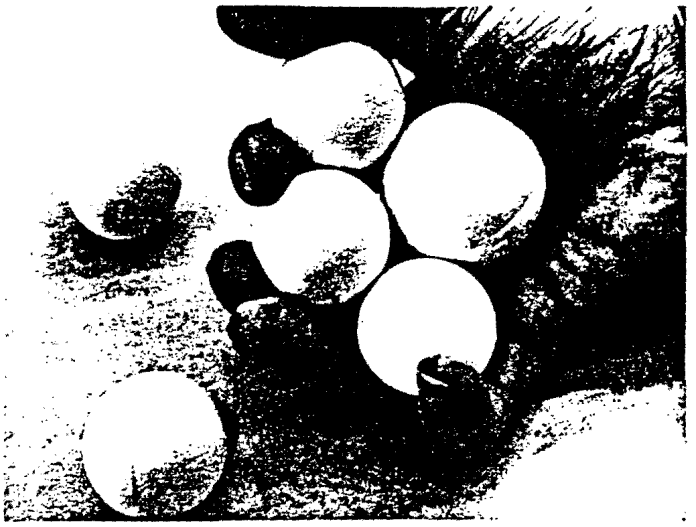


Fig. 3-8. *The optimum clay sponge.*

had professional expertise in this field. Figure 3-8 shows the relative size of the sponges developed.

Twenty-three component compositions of various earth silicates and clays were selected for a study based on low cost, homogeneity, availability, and chemical composition. Ten of the compositions produced bodies with favorable sponge characteristics, but only four of the ten had acceptable firing and fired properties. The compositions of greatest promise were those that included diatomaceous silica, kaolin, and feldspar.

A spherical shape appeared to be most advantageous, and a two-inch diameter was most economical to produce in large quantities. Therefore, studies proceeded on the basis of a two-inch spherical sponge, though preliminary tests were based on one-inch spheres.

Analysis of the condensate produced during drying revealed that less than 1% of the radionuclides soaked into the sponges was lost in the condensate with ruthenium-106 being the most volatile.

The LASL Engineering Divisio designed the tunnel kiln facility, and Christenson installed the system in I Building at TA-1 in 1961. Operatio began in early 1962. Figures 3-9 and 3-10 show parts of the operation duri a test run.

In the early 1960s, design of a replacement waste treatment facility fo TA-45 was underway. The new plant, TA-50, was to be located near the intersection of Pajarito Road and Peco Drive. To permit long-term studies of tunnel kiln concept, Christenson inclu space in the basement of the plant building, LD-1, room 24, to install the tunnel kiln process.

Thomas did preliminary soaking a drying tests with radioactive solutions i a lab kiln in the laundry lab, TA-21, DP-33. The sponges, bisque-fired to 1200°C were soaked, dried, and resoak as many as five times providing an absorption of 200% of the volume of tl sponge. This absorption converts to ter gallons of waste per cubic foot of sphere To fix the activity in the sphere permanently, it was fired to 1300°C.

The kiln constructed at Delta Building, TA-1, was designed and manufactured commercially as a 45-ft l electrically fired apparatus capable of heating to 1600°C. Small carts on rails carried the sponges and were moved through the tunnel at 45 ft per day. Several runs were made at the Delta Building location, but soon after benefic occupancy of LD-1, TA-50, was obtaine the entire system began transfer to TA-5 The last part of the equipment left Delta Building on April 8, 1964.

Though Christenson estimated the cost of the process as $0.60 per gallon of waste compared with the costs of storage of the wastes at $0.50 to $2.00 per gallon, the $0.60 per gallon did not include treating the condensate nor storing the fired spheres.

Further testing of the system at TA-50 with radioactive wastes produced major problems in controlling volatile radioisotopes during firing, severe contamination of the tunnel kiln, difficulty in controlling radioactivity in the soaking process, and unacceptable levels of leaching of the fired sponges. Attempts to resolve the problems were unsuccessful, and the studies were discontinued.

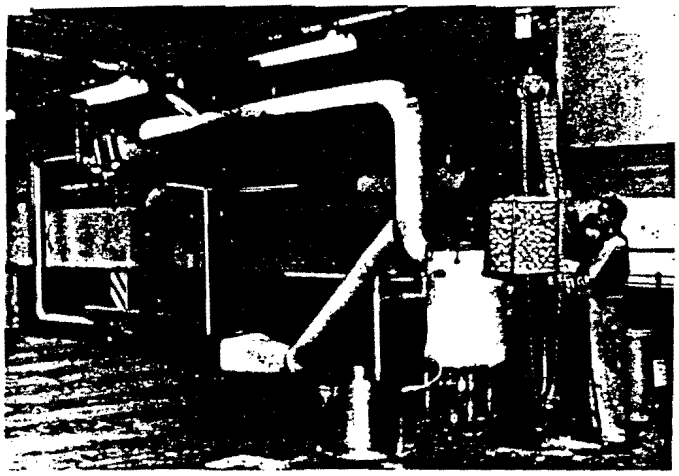


Fig. 3-9. *Tunnel kiln facility during a test run.*

Fig. 3-10. *Tunnel kiln facility during a test run.*

ROUTINE TREATMENT AT TA-45

Despite the heavy loading, TA-45 operated well and produced a satisfactory effluent (Table 3-5). Among the maintenance problems was the clogging of the sludge transfer diaphragm pumps, which was corrected by replacing them with Moyno rotor/stator units.

In January and February 1957, new equipment was installed, and certain pipe sizes were increased to increase treatment plant capacity.

When it became necessary to operate the vacuum filter through the night, a system was devised in October 1954 to move a new drum under the filter discharge chute for dewatered sludge on a time basis. The time was selected so that drums would not overfill; partly filled drums were filled during daytime operating hours on the following day.

	1951	1952	1953	1954	1955
influent flow (gal. x 1000)	4009.7	7538.9	6900.0	10,730.0	10,428.7
influent gross alpha, (dpm-L)	4760.0	3690.0	9800.0	6600.0	5340.0
effluent gross alpha (dpm-L)	191.6	85.6	210.0	444.0	334.0
dewatered sludge (ft^3)	792.0	1987.0	1830.0	4450.0	4882.0

Table 3-5. *Operating Data, TA-45, 1951-1955.*

One problem with the system was that dewatered sludge fell to the floor as the empty drums moved into place under the chute. The mess had to be cleaned up every morning. To improve this situation, a piece of galvanized sheet steel was cut to extend over five drums in line with holes cut over the drum openings. The sides were curbed and extended down about six inches. This arrangement prevented the sludge from falling to the floor and reduced cleanup considerably, but still required cleaning of the cover. This situation was not improved until the operation was closed at TA-45 and reopened at TA-50.

LASL learned that Oak Ridge National Laboratory (ORNL) was investigating the use of a centrifuge tc dewater the sludge from its lime-soda treatment plant. The unit, a large high-speed Merco, was owned by the AEC, and ORNL had completed its studies. The machine was shipped to Alamos so that its use in dewatering th H-7 sludge could be investigated. It w installed at TA-45 and several attempts were made to dewater the sludge. All v unsuccessful because the nested separat plates had little clearance, and the mac clogged almost immediately. The unit been designed to separate liquids of different viscosities and could not hand a feed containing a high level of settleat solids. The centrifuge was returned to the AEC.

One of the more important batch wastes treated at TA-45 was a cyanide solution generated by the electrochemistry section of CMB-6 at Sigma Building, SM-66, and packaged i 55-gal. drums for delivery. For treatmer one of the hopper-bottomed, mixer-equipped 3000-gal. raw waste storage tanks, partly filled with raw wastes, was set aside for treatment of the cyanide wastes. The pH was adjusted to ensure that the contents were alkaline; the cyanide solutions were added to the tank and the contents were well-mixed. A sample was taken and analyzed for cyanic concentration, and a quantity of chlorine to be added for total destruction of the

Name	Joined group	Status
J. F. Newell	1947	Transferred in 1953 to SFOO
C. W. Christenson	September 194	• Leave of absence (LOA) to International Atomic Energy Agency (IAEA) 2/14/64–9/8/64 • Retired 1979 • Deceased June 1987
J. P. Hutchinson	October 1954	Deceased December 1962
E. B. Fowler	December 1956	Transferred June 1975
R. G. Thomas	December 1954	Deceased December 1962
R. H. Harmeson	February 1957	Resigned January 1958
F. A. Guevara	December 1950	Transferred June 1956
L. A. Emelity	February 1959	• LOA to IAEA 1/20/67–2/10/69 • Retired November 1987
D. E. Slagle	August 1956	Resigned June 1961
C. G. Martinez	Before 1955	Deceased March 1985
J. P. Valdez	Before 1955	Deceased 1979
K. Schultz	June 1963	Resigned January 1964
R. Garde	June 1964	Transferred
P. Luman	September 1961	Resigned August 1965
N. W. Weeks	May 1959	Retired June 1986
J. E. Simmons	March 1960	Transferred June 1970
L. D. Williams	September 1965	Retired October 1993

Summer Temporary Employees

Name	Status	Tenure
D. K. Derr	undergraduate student (UGS)	1961, 1962
M. J. Evans	UGS	1963, 1964, 1965
R. Garde	graduate research assistant (GRA)	1963
C. L. Guerin	UGS	1956
B. Seegmiller	UGS	1968
D. Seegmiller	UGS	1966, 1967
E. M. Smith	UGS	1960
J. Trout	research assistant	1967
P. Young	casual	1963

Table 3-6. *Engineering Section FTEs in H-7, Liquid Waste Management, 1951-1968.*

cyanide was calculated. After chlorine was added, usually in the form of sodium hypochlorite, the solution was well mixed, sampled, and analyzed. This procedure was repeated until the analysis indicated total destruction of the cyanide. The tank of wastes was then treated through the plant.

In 1955, N Division was created to develop a nuclear reactor for space propulsion in the rocket program (ROVER). The first engine developed, the KIWI-B 1 B, was successfully fired at Mercury, Nevada, in 1962. Before the testing, a facility, the Mechanical Assembly and Disassembly (MAD) Building was constructed at Mercury to permit safe breakdown and decontamination of the reactor for study. H-7 was contacted for advice on waste management; H-7 recommended that a fenced tile absorption field be constructed. Soil studies indicated that the soils in the MAD Building area, caliche, had ion exchange properties. Also, the area was isolated with little danger of traffic near the absorption field. To study the effectiveness of the ion exchange, a deep pit was provided, and horizontal holes were bored several feet below the tiles. Cylindrical tubes were inserted in the holes and provisions made to pull a vacuum on the tubes and collect moisture for analysis. After the KIWI program, the Phoebus-2A was developed and tested successfully in 1968. H-7 personnel were on hand at disassembly operations to collect samples at the pit, but no liquid could be drawn from the tubes. Checks at the distribution box at the head of the field indicated that no liquid reached the absorption area. In discussing this with MAD Building personnel, it was learned that only steam cleaning was used and that very little liquid waste was generated.

Personnel changes in the Engineering and R&D sections and group office at TA-45 between 1951 and 1968 appear in Table 3-6.

During operations at TA-45, a notable incident involving the environment occurred. On May 17, 1957, a very small amount of solution contaminated with millicurie amounts of strontium-90 was dropped unknowingly on the floor of the laboratory at WD-2, TA-45. Several persons tracked through the contaminated area and carried the contamination on their shoes to personal automobiles, two Los Alamos homes, and one Albuquerque home. A major decontamination operation began on May 20, 1957, when the problem became known. Total cost of this cleanup, including labor, decontamination equipment, and claims for disposed items, was $1248.00. A report of the incident is included in Appendix H.

As the lab moved to South Mesa, new connections to the TA-45 system increased rapidly (Table 3-7).

Several of the new facilities developed such "shakedown" problems as broken water lines, discharge of cooling waters to the acid waste system, and improperly operated valves; flows to TA-45 became unmanageable at times. Activity levels were low, and much of the high-flow wastes were bypassed directly to the canyon. Operations personnel were busy tracking high flows; operating TA-45, TA-21, and TA-35; and monitoring construction at TA-50.

Data	Connection
1951–52	• SM-16, Van de Graaff • SM-29, CMR • SM-32, Cryogenics
1952–1954	• SM-39, LASL Shop • SM-40, Physics • SM-65, Source Storage
1955	• SM-34, Cryogenics
1956	• SM-102, LASL "hot" shop
1957	• RC-1, TA-48 Radiochemistry
1959	• SM-66, Sigma • SM-141, shops
1961	• SM-35, Press Building
1962	• the high-level chemistry addition to RC-1, TA-48

Table 3-7. *New connections to the TA-45 treatment system.*

One week after final acceptance of TA-50, on May 15, 1963, the laboratory section moved out of TA-45 to the new labs at TA-50, LD-1.

When the new treatment facility at TA-50 began operations in July 1963, all wastes from SM-700 were pumped to TA-50, and the only wastes to TA-45 were the very small flows from TA-1. In late 1963, with decontamination and decommissioning operations underway, plant operation of TA-45-2 was necessary only one day a week. Finally, all flows were diverted to Acid Canyon on May 27, 1964, and efforts were directed to treating all stored liquids and dewatering all sludges in preparation for decommissioning the site. Removing all sludges and sediments was a major effort and required a considerab of time. Including the media fro gravity filter, hundreds of 55- an drums were sent to TA-54 for bu

Reusable plant and laboratory equipment were scavenged and re in other areas as required, with muc it going to TA-50. In an April 7, visit and inspection, Dr. Popejoy o University of New Mexico (UNM) Drs. Crew and Critchfield (LASL) considered reusing the entire TA-45 for night lab classes, but decided no do so. On January 25, 1965, TA-45 released to ENG-3 for decommission and demolition, which was done wit considerable advice and assistance from H-1.

References

1. J. F. Newell and C. W. Christenson, "Progress of Liquid Waste Disposal Studies," Los Alamos Scientific Laboratory report LAMS 863 Series A (March 15, 1949) and, LAMS 883 Series A (May 23, 1949).
2. C.W. Christenson and M. B. Ettinger, "Progress of Liquid Waste Disposal Studies," Los Alamos Scientific Laboratory report LAMS 913 Series A (June 28, 1949) and LAMS 923 Series A (July 18, 1949).
3. C. W. Christenson, *et al.*, "The Use of Ceramic Sponges for High Level Waste Disposal," in *International Conference on Water Pollution Research, September 1962* (London: Pergamon Press 1964).
4. H. J. Longley, E. F. Gloyna, and C. W. Christenson, "Heat Generation in the Disposal of High Level Radioactive Wastes," Los Alamos Scientific Laboratory report LA-2664, TID-4500 (17th ed.), (January 1962).

CHAPTER

four

Replacement of TA-45 with TA-50: 1963 to 1975

Concern was expressed early that with the addition of planned facilities on South Mesa, TA-45 would be grossly overloaded (Fig. 4-1). Although steps were taken several times to increase plant capacity by increasing pump and pipe sizes and by remodeling equipment; a new, higher capacity facility was obviously necessary.

Early in the operation of LASL, the United States Geological Survey (USGS) was involved in soil and water sampling to monitor the effects of LASL operations on the environment. The Santa Fe USGS office operated under contract to LASL, collecting samples from the supply wells, from surface streams north and south of the county, from the canyons into which treated wastes were discharged, and from appropriate test and observation wells. Analyses included plutonium, uranium, gross alpha and beta, and various nonradioactive compounds including nitrates and fluorides. When the location of the proposed TA-50 facility was established, the USGS drilled observation wells in and across Mortandad Canyon to collect samples to establish background data on radioactivity in the canyon before waste discharged from TA-50. A two-step Parshall flume was installed in the streambed to measure flow, and a flow-monitoring station was constructed to record the head on the flume (Fig. 4-2).

Black & Veatch, architect-engineers, prepared construction drawings, and the Robert McKee Construction Company of Santa Fe, submitting a low bid of $1,450,000 on July 27 began construction of the new facility in 1961. Because all TA-3 wastes drained to SM-700, it was decided to add a pumping station to transfer the wastes to TA-50 rather tha reroute the drain lines. The facility at TA-50 included:

- a chemical–physical treatment plant with a capacity of 125 gpm with units in series and 250 gpm with units in parallel;
- an ion exchange capability;
- two large labs for H-7 chemistry;
- a large room for the tunnel kiln studies;
- a large soils lab for plant uptake studies;
- several small research labs;
- the H-1 decontamination facility:
- a conference–library room;
- H-7 group offices;
- labs and offices for Group H-6; a
- as a last-minute addition, a hot cell with heavy-duty manipulators radio-operated cart, and 8-in.-thick steel electrically operated access doors.

The contractor had considerable difficulty in sealing horizontal joints in t concrete walls of the clarifiers and filter. These were chiseled out several times an packed with fast-setting cement, and the leakage was eventually stopped. Numero other problems developed, but beneficial occupancy was accepted on December 1 1962; this permitted H-7 closer supervision of the contractor and testing of the system and its units using tap wat The project was accepted by the AEC (Cecil Bingham) on May 8, 1963. Proje cost totaled approximately $1,975,000, including LD-1, the pumping station at SM-700, the mains from SM-700 to TA-50, new storage tank pumps at

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : C. W. Christenson
THRU James R. Maddy, Health & Safety Branch, LAFO
FROM : Engineering Department, LASL

DATE: May 6, 1954

SUBJECT: CAPACITY OF WASTE DISPOSAL PLANT, TA-45

SYMBOL : ENG-3

Three additional new buildings are presently scheduled for connection to the Acid Sewer System on South Mesa, TA-3. They are Cryogenics Laboratory now under construction, a replacement facility for Sigma Building in the Construction Budget for FY 1956, and the third, a new Radio Chemistry Laboratory Building for which Basic Design Criteria are now being prepared. The new buildings are expected to have quantities of Acid Sewer effluent in excess of present loadings, hence there is concern about the capacity of the Waste Disposal Plant.

Can you inform us of the present quantities of liquid wastes being processed by the plant and the amount of reserve capacity, if any, which is available in the existing waste disposal plant?

The information is pertinent to the problem of locating the proposed Radio Chemistry Laboratory.

J. F. Cully
Contracts Group

RRR/ao

cc: ENG-DO (2)
Mail & Records (2)
File

FORM 28R 15OM 9-52

Fig. 4-1. Engineering Department memo regarding capacity of Waste Disposal Plant, TA-45.

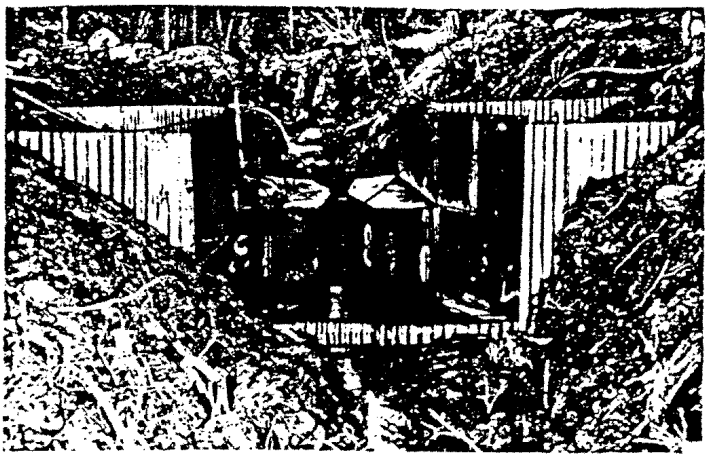


Fig. 4-2. Parshall flume in Mortandad Canyon.

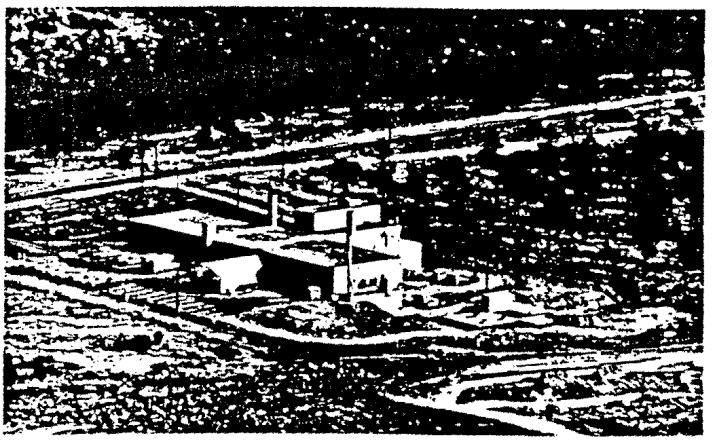


Fig. 4-3. TA-50, summer of 1963.

TA-35 with a new force main to TA-50, USGS costs for test wells and stream flow monitoring and measuring equipment, and considerable lab equipment. H-7 also spent about $100,000 in tying up loose ends after the Robert McKee Construction Co. of Santa Fe left. The first radioactive waste was pumped from SM-700 to LD-1, TA-50 on June 27, 1963. Figure 4-3 is a photo of the plant as it was in the summer of 1963, and Fig. 4-4 and 4-5 are construction drawings of the first- and second-floor interiors.

With the completion of the LD plant, it was no longer necessary to o the 50-gpm ion exchange plant in TA 7 (Chapter 6). The wastes were pum to TA-50 into either LD-2 or LD-3 a mixed with all of the other raw wastes all were treated by ion exchange follow the chemical treatment. The first trans from the TA-35 (Ten Site) storage tank TA-50 was August 20, 1963, and the TSL-7 plant was shut down.

The ion exchange columns at TA-50 were operated to strontium-90 breakthrough, then regenerated with 6N nitric acid. Spent regenerant was collect in a separate tank and treated chemically to concentrate the radioactivity. Stable strontium was used in the treatment as a carrier for the radioactive strontium.

High flows to TA-50 occurred frequently, and many hours were spent attempting to locate the sources. This entailed opening manholes by removing the covers, and, from experience, attempting to decide from which directio the influent to the manhole was greater than average. Buildings TA-48-1 and TA-3-29 were often to blame. At TA-48-1, wash water valves on basement ductwork were left on unintentionally, often on Friday afternoons, and operating the TA-50 plant on Saturday became necessary to prevent overflow of the raw waste storage tanks. The system was eventually automated, and this problem disappeared. At TA-3-29, duct washers were occasionally the problem, and it was corrected similarly—after many extra hours of TA-50-1 operation. Also, at TA-3-29, piping of water from Nash Hytor vacuum pumps to the radioactive

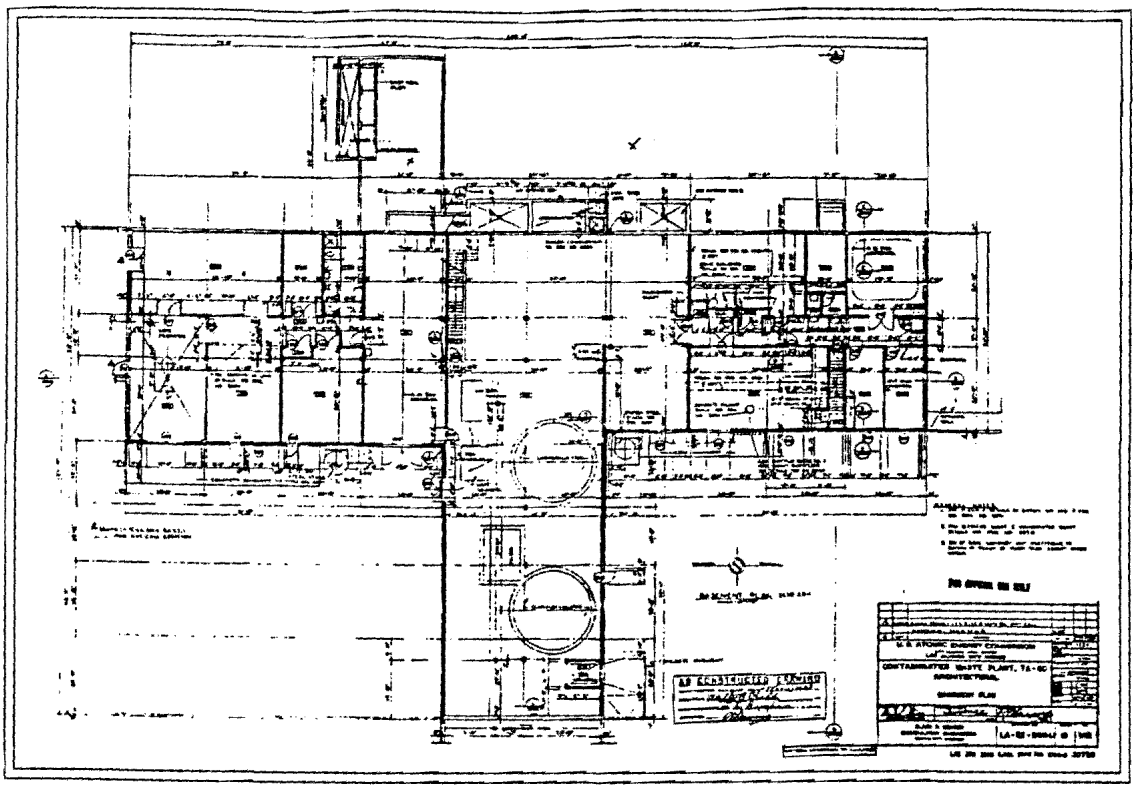


Fig. 4-4. *Construction drawing, basement of TA-50-1, 1961.*

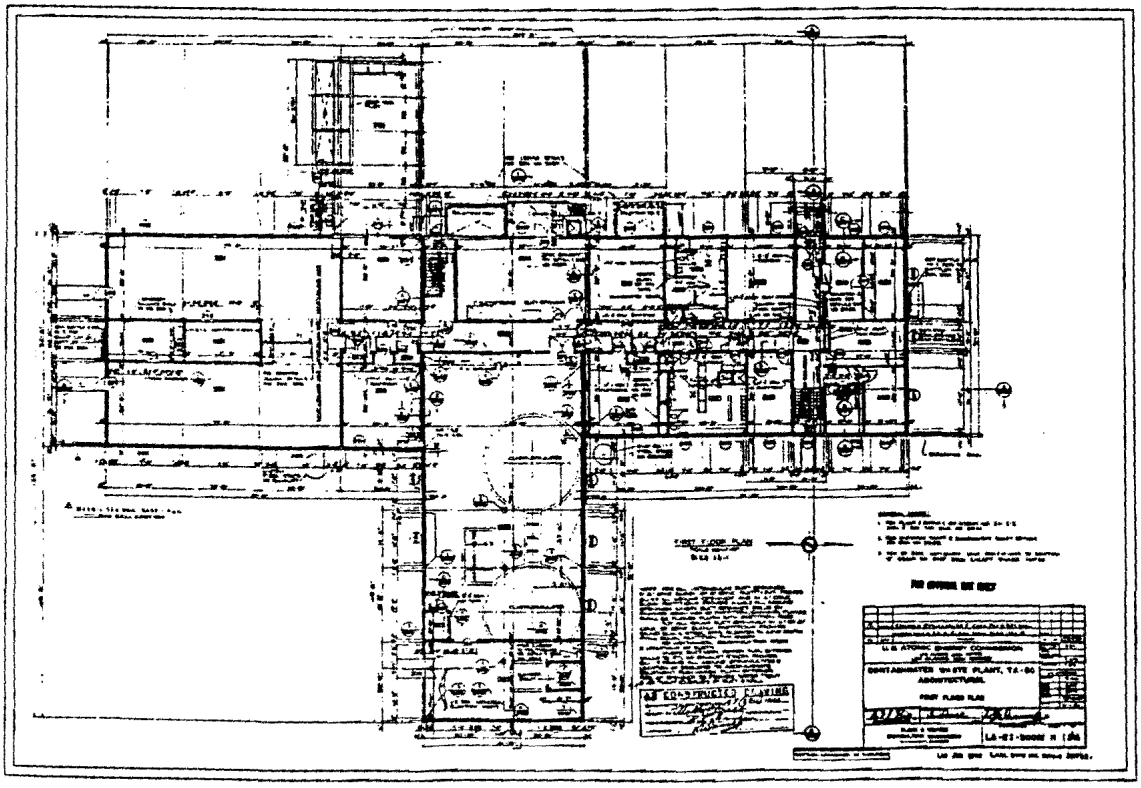


Fig. 4-5. *Construction drawing, first floor of TA-50-1, 1961.*

waste sewers created flow problems, eventually corrected by replumbing and, in some cases, changing the pumps.

High flows were only one of several serious problems. Toxic chemicals were accidentally discharged to the collection system several times, and immediate emergency measures had to be taken. A few of these instances were:

- a concentrated cyanide solution spill at SM-66 to the radioactive waste system on June 18, 1965;
- a concentrated chromium (+6) solution spill at SM-66 to the radioactive waste system on November 12, 1965;
- a chromium (+6) spill at SM-66 on January 28, 1966;
- a cyanide spill at SM-66 on August 16, 1966;
- a sulfuric acid spill at SM December 13, 1968;
- a cyanide solution spill or December 30, 1968;
- a chromium solution spill SM-30 on May 24, 1969;
- a cyanide solution spill at S on January 11, 1974.

To control the cyanide spills prevent generation of HCN, it wa necessary to assure a high pH in tl system. Operators were rushed to the SM-66 basement storage tanks and to SM-700 to add enough sod hydroxide to guarantee caustic con The influent to TA-50 was directed 25,000-gal. storage tank in LD-2 w the wastes could be treated by alkali chlorination. If wastes contaminate cyanide reached the clariflocculators chlorinator in a small room in the southeast corner of room 116 could be used. In the first year of plant operations, a chlorine residual of a fe parts per million was maintained automatically in the filter effluent as a safety measure. In the second quarter 1965, the point of automatic chlorine residual control was changed from the settling tanks to the raw feed line. Th system continued to be used until 198 Then it was totally dismantled, and the chlorinator room was converted into an office for the vacuum filter operator. Wastes contaminated by high concentrations of chromium (+6 were similarly isolated, then treated to precipitate trivalent chromium.

Table 4-1 provides operating data for the plant for the first full year of operation.

Month	Influent flow (gal. x 1000)	Influent flow, gross alpha (d/m-L)	Effluent, gross alpha (d/m-L)
January	1,078	25,400	154
February	972	18,400	148
March	1,118	14,800	96
April	998	22,800	222
May	1,146	24,800	104
June	1,121	14,000	118
July	1,231	5,400	158
August	1,385	7,200	178
September	1,424	10,800	120
October	1,199	16,600	126
November	979	14,000	200
December	962	17,000	292
TOTALS	13,613		
Monthly weighted average		15,474	156

Table 4-1. *Operating Data, TA-50, 1964.*

SIGNIFICANT PERSONNEL MATTERS

The first major personnel event was the transfer of the group from the AEC to LASL. Most of the people remained with the group, but several elected to stay on with the AEC (Table 1-1).

The usual hiring and resignations occurred through the years to 1975, and the group table of organization, including the lab personnel, indicated a staff of 18–20 people. C. W. Christenson was Group Leader this entire period and Paul Hutchinson was Alternate Group Leader and Engineering Section Leader until he passed away in December 1962. Eric B. Fowler, Laboratory Section Leader, became the Alternate Group Leader, and R. G. Thomas became Engineering Section Leader. Thomas held this position until he died. Ludgard A. Emelity was made Engineering Section Leader on February 24, 1963, and Assistant Group Leader on July 1, 1973. With major reassignments in 1975, Emelity was appointed Alternate Group Leader to Tom Keenan as Group Leader on June 1, 1975 (see Fig. 4-6). At this time, C. W. Christenson became head of special problems, and Eric B. Fowler was transferred to H-8 as Assistant Group Leader.

Ray Garde, eventually Group Leader, was hired for the Summer 1963 as a graduate student, and, upon receiving his Masters of Science, was hired as full-time equivalent (FTE) in 1964. He began work with the group on June 16, 1964.

Christenson accepted an assignment with the International Atomic Energy Agency (IAEA) in Vienna, Austria and left the Laboratory on February 14, 1964. The tour, a leave of absence, was intended to be one to two years long, but Mrs. Christenson developed health problems, and they returned to the U.S. Christenson reported back to work on September 8, 1964.

The chief chemist, Elgin Rex, was terminated on November 12, 1964, and W. Howard Adams was appointed to that position.

For seven summers, Christenson invited Dr. Ernest Gloyna, eventually Dean of Engineering at the University of Texas at Austin, to consult with the group on advances in the treatment of radioactive wastes. Dr. Gloyna had served on several AEC, Energy Research and Development Administration (ERDA), and Department of Energy (DOE) committees regarding waste management and was knowledgeable in the field.

On January 17, 1966, a US Air Force bomber was destroyed while refueling from a tanker plane and dropped four hydrogen bombs at Palomares, Spain [1]. The bombs did not detonate, but a chemical explosion of two of the units scattered plutonium and uranium over farmland in the area. Because of the incident, which AEC called "Broken Arrow," Christenson went to AEC Headquarters to describe H-7's expertise in plant uptake, then flew to Spain to consult with authorities there. The AEC asked Eric B. Fowler (who had for years studied plant uptake of radioactivity, had the soils lab in TA-50-1 constructed for that purpose, and had developed a method to assay plutonium in soils) to visit Palomares,

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87544

OFFICE MEMORANDUM

TO : Distribution

DATE: May 13, 1975

FROM : George L. Voelz, M.D., Health Division Leader

SUBJECT : ORGANIZATION OF WASTE MANAGEMENT ACTIVITIES

SYMBOL : H

MAIL STOP: 690

Effective June 1, 1975, the waste management activities in H-Division will be reorganized in line with the conversations I have had with each of you recently. This will merge the solid waste programs (H-8) with the liquid waste programs (H-7). In addition, the function of the disposal of chemicals at the burial ground (TA-54) will also be transferred from Safety, Group H-3, to the new waste management group. The group will retain the H-7 designation and I propose it be called "Industrial Waste Management". If you have any comments or suggestions for a better title, I would like it before the official Bulletin announcement on May 30.

The Group H-7 will have the following leadership:

Thomas K. Keenan, Group Leader
Ludgard A. Emelity, Alternate Group Leader
Conard W. Christenson, Assistant for Special Problems

Eric Fowler will assume a new position as Assistant Group Leader, H-8. His project, S-004, Analysis of Soil Samples (Nevada Applied Ecology Program) will transfer to Group H-8.

This notice is given limited distribution so the involved persons can begin their planning now in the hopes of promoting an orderly transition period, including consideration of space problems.

GLV/mjt

Distribution:
C. W. Christenson, H-7
E. B. Fowler, H-7
L. A. Emelity, H-7
L. J. Johnson, H-8
T. K. Keenan, H-8

Fig. 4-6. G.L. Voelz memo regarding organization of Waste Management activities, May 1975.

contact Spanish authorities, arrange to transfer analytical equipment, study the site, and make recommendations. Eric B. Fowler went over for about three weeks in June 1966, studied the problem with other US experts, and arranged to have 327 vegetation and soil samples sent to H-7. In August 1966, Spanish scientists visited H-7 to consult with Eric B. Fowler and to review the status of the study.

More than 1000 individual determinations of radioactivity in the soil and vegetation were made. Alpha activity in oven-dried soil ranged from 0 to 86,000 disintegrations per minute per gram (dpm/g) and in oven-dried vegetation ranged from 0 to 1500 dpm/g. Plutonium was the predominant alpha radionuclide.

A detailed report of the H-7 efforts was prepared and forwarded to Dr. Eduardo Ramos Rodriquez of the *Junta de Energía Nuclear* (JEN) Health Division in Madrid. The report was a guide to Spanish chemists who continued the analytical efforts.

On April 20, 1966, Emelity accepted an assignment from the IAEA to provide a booklet on ion exchange treatment of radioactive wastes. With the approval of Christenson, some of the work was done during working hours, but much of it was researched and written during off-hours at TA-50 and at home. The first draft was mailed to the IAEA for review on November 18, 1966. The IAEA waste management officer in Vienna at this time was E. R. Mathews, who had been a chemist with the AEC and LASL waste management efforts in the early days. The booklet was accepted with few corrections and was printed and distributed by the IAEA as part of a series on waste management.

Emelity accepted an offer by the AEC on October 21, 1966, to work for the IAEA and was recommended by the AEC to fill a vacancy created by the resignation of E. R. Mathews. He was approved for the position by the IAEA on December 12, 1966, and left for Austria, on a leave of absence, on January 20, 1967. The two-year assignment ended in early 1969, and he returned to H-7 on February 10, 1969.

Jeffrey J. Wanner, a graduate student in the summer graduate student (SGS) program at LASL, was employed by H-7 and H-5 from May–August 1971. In H-7, he worked in many aspects of the waste treatment program, including assisting in several research projects. While in graduate school at the University of Wisconsin, Madison, in 1974, he developed a tumor. The tumor was biopsied and diagnosed as a rare, rapidly growing cancer, primitive malignant mesenchymoma. The tumor was removed surgically, but Wanner died on December 16, 1974. His mother was concerned that the cancer was contracted during employment at LASL and wrote to her congressmen, LASL, and ERDA for assistance with answers to questions she had. In response, the Director of ERDA Division of Operational Safety, requested a full investigation by the ERDA Office of Internal Review [2]. The investigation, including Wanner's previous summer employment, which involved hazardous materials, could not pinpoint the cause of the cancer.

A MAJOR ADDITION TO TA-50-1

Groups H-1, H-6, and H-7 at TA-50-1 needed additional space in the building and in early 1965 worked with the AEC and the Engineering Division of LASL to organize funding and outline a conceptual design. H-1 required additional storage space for its decontamination operations; H-6 wanted storage space for soil samples and a soils lab with workbenches and a hood for such operations as soil separations and chemistry. H-7 needed cover for the underground tanks at the east end of LD-1 to facilitate processing spent regenerant sludge and storage room for equipment and small-volume hot wastes. Because the project was relatively small, it was combined with a project to provide additional office space at Ten Site (TA-35) in a new building, TSL-68. AEC contracted the firm of Wright and Underwood and Thomas A. Welby of Albuquerque to design the facilities. The additions were constructed in fiscal year 1965 and completed in January 1966.

The additions at TA-50 were in two locations, the north and east ends of LD-1. The north-end addition included three offices, a large storage space, and a large (15 ft, 6 in. × 26 ft, 8 in.) soils lab. The east addition provided H-1 with a large storage area, and H-7 with one room for process equipment and one room for storage. The H-7 storage had eight stainless-steel-lined 12-in.-diameter pits in one corner for highly radioactive wastes, a sump in another corner, and a monorail to transfer the wastes. The other H-7 room provided cover for the tw 5000-gal. concrete undergrounc (original construction), which w to store sludge from treating spe exchange column regenerant. T monorail was extended into the room, and a platform scale was r into the floor [3].

A FEW MAJOR MAINTENA AND CONSTRUCTION ITEN

A serious problem appeared building heat was first required in TA-50-1: a design deficiency due proximity of rooms 14 and 16. R included the space with the greate of airborne radioactivity, and roor contained building utilities—furna compressors, vacuum pumps and s tanks, hot air and hot water heatin components, and an exhaust air ple The rooms had no positive separati Combustion air was to be supplied through louvers in a double-door e room 14; a lower air pressure in roo was to be created by including a rela large louvered opening in the steel the plenum. The plenum exhaust fa continuously; the furnaces fired und thermostatic control.

A staff member was walking th room 14 on one of the first cold da when the gas-fired burners actuated. Flames covering the entire face of th boiler rose from the unit in search o combustion air. More air was being sucked from the area by the plenum was being provided through the lou outside doors. The system was shut until welders from the Zia Compan

LASL's support services subcontractor, had fixed a cover over the plenum opening.

Later in the year, when snow was falling, the breeze through the louvered outside doors carried snow into room 14, covering the air compressor motors. This problem was corrected by covering the door openings and cutting a large rectangular hole in the concrete west wall directly behind the boilers. Because this hole was below grade, a grated pit was provided on the outside of the building.

To provide a lower air pressure in room 16 than in adjoining rooms, a wall separating rooms 14 and 16 was constructed, and a separate heating and ventilating system, with high efficiency particulate air (HEPA) filtration of exhaust air, was installed in room 16.

On Friday, May 22, 1964, a break appeared in the 6-in. cast-iron force main that carried treated wastes from TA-50-2 to Mortandad Canyon. H-1 and H-8 surveyed the wetted area and found radioactivity levels at or below background. Zia Company fitters repaired the break the same day, and the system was back in operation.

The flash mixer basins, as designed, were two adjacent small pits for each clariflocculator. Chemicals were added in the first pit, and the mix was stirred by a high-speed mixer. The wastes overflowed this mixing tank to the adjoining tank, from which the wastes flowed to the flocculator. This adjoining tank was almost cubical with the exit pipe in the center of the bottom. During operation, the bottom corners of this tank would fill with the ferric hydroxide/calcium carbonate floc. Buildup of the floc would continue until flow through the line to the flocculator was pinched off. Zia Company was called to clean out the pit and to rod out the connecting line. After several of these work orders, it was decided to install a stainless steel conical bottom insert in the pit to eliminate the chemical buildup. ENG-2 designed the inserts; they were installed on February 7, 1966, and the plugging problem was resolved.

During 1967-1968, an addition, core processing (analyses of soil samples from the Nevada Test Site) was planned for the south end of RC-1, TA-48. Laboratories for analyzing soil samples from underground detonations at Mercury, Nevada Test Site, were provided. Wastes from the analyses would contain sand and gravel and would be highly radioactive. H-7 worked with the group to design a system to separate the settleable solids in the waste from the liquids and to pump the liquids automatically through a 1.5-in. stainless steel pipeline to LD-3 at TA-50. The line was constructed in the fall 1969. Separated solids would be transferred from the hopper-bottomed collector to 55-gal. drums on a batch basis by H-7 and hauled to TA-54.

When the system was operating, radioactivity levels of the waste were as high as and often higher than estimated, but accumulations of sand and gravel were less than expected. Removal of the heavy solids was necessary only a few times before the programs generating them were discontinued.

The ion exchange columns at TA-50 were usually run to treat beta-gamma wastes from TA-35 and TA-2 whenever the main plant was operated. Regeneration

was set at strontium-90 rather than hardness breakthrough, and treated effluent from TA-50-2 was used for backwash. One day in July 1969, while Jim Simmons was backwashing column 2, he heard a sharp, loud report. Investigation revealed that the dished stainless steel resin support plate in the bottom of the column had been "popped" from a concave to a convex form. The 2-in. screened openings for backwash water had become totally closed by coatings of calcium carbonate floc that had after-precipitated in the treated waste storage tanks. Pump pressure had been enough to reverse the shape of the plate. The column was removed, repaired, and replaced, and industrial water was substituted for treated waste in backwashing. The column was back in operation by September 19, 1969.

After-precipitation of calcium carbonate was not only a problem in backwashing but also in coating the gravity filter media and the ion exchange column resin in downflow processing. It was decided to recarbonate the plant filter influent and convert any calcium carbonate to the soluble calcium bicarbonate.

A surplus equipment list circulated by the Supply and Property Division indicated that several sets of carbon dioxide converters were available for the cost of transport. Two sets of two were acquired; the larger converters were installed on the plant operating floor in room 116 of TA-50-1, and the smaller set installed in the TA-21 plant, DP-257, across the settling tank with ends protruding through the north wall. Installation at TA-50-1 was com May 24, 1971. The heavy mild cylindrical tubes, jokingly referre "torpedo tubes," were loaded wit and blocks of solid carbon dioxid tubes were tapped and gaseous ca dioxide was removed and piped to distributors for recarbonation. Af loading with dry ice, pressure built rapidly in the tubes, and it became difficult to close the hatches at the of the tubes as far as necessary. Lor steel bars or sledges were increasing used as helpers.

When the tubes were first insta was more economical to use dry ice liquid carbon dioxide. However, wh price of dry ice doubled and the con became more difficult to use, it was decided to switch to liquid carbon di (see Fig. 4-7 and 4-8). The converter were removed, and a 6-ton capacity li carbon dioxide storage tank was instal outdoors along the north wall of the e wing of TA-50-1. No replacement sys was installed at the TA-21 plant.

After-precipitation of calcium carbonate was a problem at the ion exchange columns and during backwashing of the plant gravity filters in TA-50-1 and the pressure filter at th TA-21 plant. As backwashing became and less effective, an examination of th TA-50-1 filters disclosed that much of media was cemented into large lumps. Rather than acid-washing the units at TA-50, operators removed all media, placed it into 55-gal. drums, and sent them to TA-54 for burial. The underd system was repaired and new media we installed several times before recarbona

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87544

OFFICE MEMORANDUM

TO : [illegible], ENG-4
THROUGH: C. A. Reynolds, ENG-4

DATE: February 12, 1970

FROM : Safety Office

SUBJECT: CARBON DIOXIDE CONVERTERS FOR H-7

SYMBOL : H-3

H-7 will be using CO_2 to precipitate calcium in the waste treatment process. CO_2 will be generated from dry ice in converters. Two converters will be installed at TA-50. They are steel cylinders 18 feet long obtained used from the Pure Carbonic Company of Houston. One thousand pounds of dry ice is added in 50-pound blocks to each CO_2 generator. Ambient air or water from the waste line will be used to vaporize the ice. When the pressure rises above 60 psi liquid CO_2 will condense in the tank. Gaseous CO_2 will be removed from the high end of the tank at 1000 psi or so, reduced through a regulator to 0-50 psi and injected into the waste treatment system.

The tanks are dated 1948 and working pressure is 1400 psi. Two smaller tanks will be used in the same system at the DP treatment plant. ENG-4 is requested to examine the interior of each tank for rust or damage and to hydrostatically test to 2100 psi. If the tanks pass the tests a pressure relief valve at 1400 psi and a rupture disk or valve at 20 percent more will be provided. A bleed valve is also needed to reduce the pressure to zero before opening the tank. All relief lines will be piped outside the building.

Alan L. Hack
Safety Engineer

ALH:jn

cc: J. B. Weldon/A. F. Hasenbank, ENG-2
C. W. Christenson/L. A. Emility, H-7

LOS ALAMOS SCIENTIFIC LAB
FEB 18 1970

LASL-AEC-OFFICIAL

Fig. 4-7. Safety Office memo regarding carbon dioxide converters for H-7, February 1970.

Joe Weldon, Eng 2 September 27, 1972

C. W. Christenson, Group Ldr., H-7

INSTALLATION OF LIQUID CO_2 STORAGE TANK, TA-50

H7-CWC-314

At the present time, Group H-7 is recarbonating settling tank effluent at TA-50 using dry ice as the source of the gas. At the time the recarbonators were installed (see LJ4465-50), the cost of dry ice was less than half of the cost of liquid CO_2 per pound. Early this year, the price of dry ice was doubled to $0.04/lb. (vs $0.041/lb. for liquid CO_2). The $0.04/lb. for dry ice is not the full cost, however, since charges are made per 50 lb. blocks and at the time of receipt of the material, it has been determined that 20 to 25% of the CO_2 has evaporated.

Opening and closing the recarbonators has been found to be very difficult even though the doors were aligned by a machinist several times. At the present time, it is usually necessary to use a sledge hammer to begin opening the doors; normally a four foot by one inch steel bar is used to open and close the doors.

It is requested that plans be drawn and equipment be furnished to convert the system to the use of liquid CO_2. Usage has averaged about 9,600 lbs. of dry ice per month, but during several months, the demand exceeded 10,000 lbs. These figures are for dry ice "ordered" and must be reduced by 20 to 25% to obtain actual consumption figures. Liquid CO_2 storage units are furnished in 4 ton and 6 ton capacities; it would appear that the 6 ton unit would be advisable. The storage units can be rented or purchased. New and used units are available; correspondence and data on this matter are enclosed.

Desirable locations for the storage tank are adjacent to the south or north exterior walls of Wing B of LD-1. The project would require design and construction of a large concrete pad, furnishing of electrical power, piping from the storage tank to the filters in room 116 and provision of a replacement distributor constructed of Type K copper tubing. The original distributor is rusting. If the unit is rented, installation and start-up are furnished.

C. W. Christenson

CWC:gm
Encl.: 3 (a/s)

Fig. 4-8. C. W. Christenson memo regarding installation of liquid CO_2 storage tank, TA-50, September 1972.

prevented recurrences. Acid-washing of pressure filter media at the TA-21 plant became a part of routine operation.

As the plant operated, ferric hydroxide and calcium carbonate crystallized on all steel and concrete surfaces in the flocculation/sedimentation tanks, even though the surfaces had been painted with Plasite, a heavy, acid-resistant coating. The crystallization built up over time, eventually plugging all V-notches in the overflow weirs and adversely affecting the appearance of the sedimentation tanks. Bench-top efforts to design a system that would not require manual labor in scraping off the crystallization were unsuccessful, and a complete cleaning became necessary. This was a major project, requiring construction of a plastic housing over the tank for dust control, full suiting with face masks and head cover for the laborers, draining and removing all precipitate from the tank bottom, sealing the sludge draw-off opening, removing scrapings by transferring partially-filled 5-gal. containers to personnel at main floor level for loading into 55-gal. drums, removing the 55-gal. drums after sealing and checking for external contamination, and continuous, thorough monitoring by radiation control personnel of all aspects of the work.

It also required that all treatment be done through half of the plant at 125 gpm, which was likely to require some overtime operations while the other half was being cleaned. The operation was difficult, slow, messy, and expensive. It was done in October 1969 by two H-7 technicians, Jim Simmons and Dave Williams, without the housing, then again several years later by a total Zia Company crew with extensive safety preparations (see Fig. 4-9). With no means of chemical cleaning, it appears that manual scraping should be scheduled every six to eight years. The most recent effort, beginning in May and June 1995, may require more than six months because of budget problems and new regulations.

CROSS-CONNECTION ACTIVITIES

In the early days, when the group was composed of three sections—Administration, Engineering, and Lab—the staff members in the Engineering Section were degreed sanitary engineers. Christenson's primary interests were in sanitary engineering, including sanitary and radioactive waste treatment and in sewage treatment plant operation, water distribution, and cross-connection control. It became known in the Laboratory that H-7 was concerned with these matters and probably had the only expertise in the Laboratory in sanitary engineering. When various Laboratory construction plans were forwarded to H-7 for review, H-7 commented on the water systems and waste management aspects. As work grew, an article was placed in the Laboratory Bulletin recommending that any potable water taste or odor problems be referred to H-7. Christenson and Emelity were called out several times on taste problems or discovery of cross-connections, usually in new construction, and they spent many hours in investigations and corrective actions. Supporting documentation for their recommendations were US Public Health

LOS ALAMOS NATIONAL LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545
Telephone Ext: 5834

OFFICE MEMORANDUM

TO : Distribution

DATE: August 18, 1981

THRU : T. K. Keenan, H-7 Group Leader TKK

: H. S. Jordan, H-DO Associate Division Leader

FROM : J. R. Buchholz, H-7 Assoc. Group Leader JRB

SUBJECT : THANKS FOR SUCCESSFUL CLEANING OF CLARIFLOCULATOR TANKS

SYMBOL : H-7-81-426

MAIL STOP : 518

The recently completed scraping of the clarifloculator tanks at TA-50-1 was an exhausting and tedious task. The planning that preceeded the work was carefully thought out and contributed greatly to the safe and efficient operation. The structures built over the tanks, the adjacent air locks, the exhaust system and the supplied air all helped contain the contamination and contributed to worker comfort and productivity.

The support and cooperation of all concerned allowed nearly normal plant operations during the entire period. Our appreciation to all of those who helped accomplish this much needed work so successfully.

JRB:mr

Distribution:

John Lucero, H-1, MS 518
Jerry Atencio, H-1, MS 518
Larry Pacheco, H-1, MS 518
Jerry Dummer, H-1 Group Leader, MS 401
Leroy Garcia, H-5, MS 486
James Jackson, H-5 Group Leader, MS 486
Charles Chavez, Zia ADM
Don Bridgers, Zia ADM
Steve McKelvey, Zia FO
Thomas J. Cook, Zia Manager

Fig. 4-9. *J. R. Buchholz memo regarding thanks for successful cleaning of clariflocculator tanks, August 1981.*

Service booklets and American Water Works Association (AWWA) committee reports. Christenson and Emelity used a film on cross-connection control produced at Ohio State University, *What Happened to Harry*, in talks to various groups at safety meetings about the dangers of cross-connections and means for protecting potable water systems. They became aware of one of the most complete and highly organized state programs for backflow prevention from Christenson's friend Ray L. Derby, then Principal Sanitary Engineer, Department of Water and Power, City of Los Angeles. Derby was invited to visit the Laboratory to recommend establishing an effective cross-connection control program and to inspect plumbing at sites where cross-connections would be most hazardous. He arrived on January 31, 1966, and spent several days in inspections and discussions, and later preparing a brief report that was critical of Laboratory conditions. H-7 became aware of the *Manual of Cross Connection Control*, first prepared by the Southern California Water Utilities Association, but later published by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (USC), E. Kent Springer, Director. The latest edition of the manual was kept on hand. It became the primary guide in establishing a cross-connection control program at the Laboratory and helped to convince the Engineering Division and Laboratory administration that effective backflow control generally meant installing airgaps or reduced-pressure principal backflow preventers. As the number of these units increased, the Zia Company was required to establish a group of trained testers to do necessary periodic testing. The Engineering Division assigned a number of its mechanical engineers to a committee that would inspect the plumbing in all Laboratory buildings and recommend eliminating cross-connections. H-7 prepared a prioritized list of buildings that had hazardous materials. Those buildings with the most hazardous materials were addressed first. The work progressed well until engineers were pulled off for other assignments, and the task was never fully completed. Laboratory administration recommended several times that an outside consultant be used for the inspections, but funds never became available.

To make all Laboratory employees aware of cross-connection control problems and to have their cooperation in finding and correcting them, H-7 prepared a lengthy cross-connection control memo for signature by LASL Director Dr. Norris Bradbury. This memo was patterned after the recommendations in the USC manual and the program then in place at Oak Ridge National Laboratory. (The Oak Ridge program was thorough and effective and had been in force since the early days of that laboratory.) In a major accomplishment, Director's Office Memorandum (DOM) No. 31 was published over Dr. Bradbury's signature on March 7, 1966 (Fig. 4-10). Though effective, it was very brief compared with the H-7 recommendation.

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : Master Division and Group Leader List DATE: March 7, 1966

FROM : N. E. Bradbury

SUBJECT: DIRECTOR'S OFFICE MEMORANDUM NO. 31 - CONTROL OF PLUMBING AND AVOIDANCE OF CROSS-CONNECTIONS IN WATER DISTRIBUTION SYSTEMS

SYMBOL : DIR

1. POLICY

The policy of the Los Alamos Scientific Laboratory in regard to control of plumbing and water distribution system cross-connections is to protect and safeguard all potable water supplies from chemical, biological, and radioactive contamination. This will be accomplished through the use of air-gap separation or an approved mechanical device depending upon the degree of hazard.

2. TAPPING INTO POTABLE WATER LINES

a. No LASL employee will make any connection to a potable water line other than attaching a flexible hose or tubing.

b. To protect and safeguard the potable water in locations where it may be used in laboratories, all hose bibs, serrated lab cocks, or other devices designed to permit connection of hose or tubing will be provided with a proper type of vacuum breaker.

3. JOB ORDERS

All LASL job orders which involve a potable water supply line shall be approved by the ENG-4 group leader or his designated representative

4. COMPLAINTS REGARDING WATER QUALITY

Any disagreeable tastes, odors, or colors noted in the discharge of a potable water supply should be brought to the attention of Group H-5, 7-5231.

N. E. Bradbury
Director

Fig. 4-10. Cross-connection control memorandum signed by Dr. Norris Bradbury.

Major concern over possible cross-connections in Laboratory buildings and the legal and political consequences of personnel injuries and water line contamination prompted Health Division approval of a request by Christenson to staff a small H-7 Liquid Waste subsection. The subsection, one staff member and two technicians, would serve full-time to inspect Laboratory buildings, respond to complaints of bad-tasting water, recommend installation and testing of backflow preventers, and inspect new construction for proper installation of the units. For the staff member position, Christenson hired William Dunne from the US Military Academy, where he had a position with water utility responsibilities. Dunne came to the Laboratory on February 25, 1975. For the technician positions, Lawrence L. Hupke transferred from within the Laboratory on April 19, 1976, and Ralph C. Ward was reassigned within H-7. Both technicians were highly qualified senior personnel. The subsection became active in addressing its heavy workload and had major accomplishments in "curing" water distribution and plumbing problems throughout the Laboratory (see also Chapter 8).

A RECAPITULATION OF ENGINEERING AND SPECIAL STUDIES SECTIONS R&D

Until the Health Division Office directed H-7 to cease all unfunded R&D and to concentrate efforts on the support functions, Christenson and Fowler felt strongly that all staff members be involved in waste management studies. Many of the studies performed were helpful in resolving waste treatment problems and in several instances, papers describing the work were presented at national and international conferences. This paper, being a "brief" history, will not describe in detail all of the studies, but will list below some of the more important works by Engineering and Special Studies Sections personnel that involved considerable time or equipment, or both.

- Newell and Christenson: Treatment of low-level radioactive wastes containing plutonium
- Newell and Christenson: Treatment of radioactive wastes containing plutonium and citric acid
- Hutchinson, Emelity, and Christenson: Treatment of beta-gamma wastes by ion exchange
- Christenson and Thomas: Development of clay formulations with a high capacity for absorption of radioactive wastes
- Christenson and Thomas: Removal of radioactivity through local tuff—the DP West deep-pit study utilizing the SW Area T absorption bed
- Christenson and Thomas: Development of a system for encasing high-level wastes in ceramic sponges
- Hutchinson and Emelity: Incorporating acid americium wastes in cement
- Hutchinson: Treatment of cyanide solutions
- Emelity: Removal of radium-226 by clinoptilolite
- Emelity: Destruction of TNT in

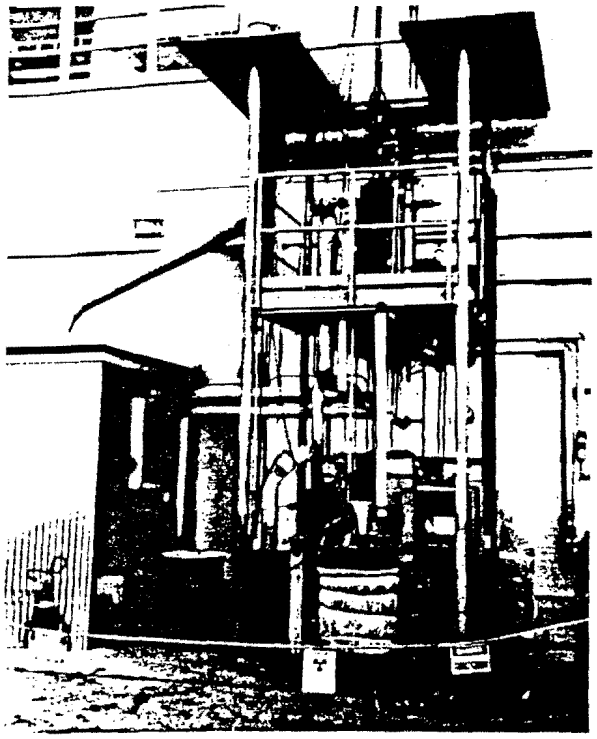


Fig. 4-11. Wiped Film Evaporator Pilot Plant.

waste waters by Pseudomonas organisms

- Christenson, Dross, Garde, Buchholz, and Rohrer: Incorporation of alpha-active ferric hydroxide/calcium carbonate precipitates in asphalt using a wiped-film evaporator (Fig. 4-11)
- Garde: Reverse osmosis for treatment of alpha radioactive wastes
- Emelity and Wanner: Tritium loss by leaching from coated cement paste blocks
- Christenson and Jones: incineration of solid radioactive wastes
- Christenson, Dietz, and Pashman: Burial of solid radioactive wastes in salt mines
- Drago and Buchholz: Precipitation of alpha-active nuclides using coagulants other than ferric sulfate

The major work was a r[illegible]t o[illegible] plant uptake of various radionuclic[illegible] Eric Fowler. Fowler is considered ar[illegible] international authority on the subj[illegible] See also the text that he edited. *Ra[illegible] Fallout, Soils, Plants, Foods, Man.*

THE ULTRA HIGH-TEMPERA[illegible] REACTOR EXPERIMENT (UHTREX)

The Ultra High-Temperature R[illegible] Experiment (UHTREX) facility was completed in February 1965 in what been TA-4, east of TA-50 along Puy[illegible] Road. The site, operated by Group K was designated TA-52.

With considerable input from F[illegible] a waste neutralization–pumping statio TA-52-2, was provided to collect, neutralize, store, and pump radi[illegible] waste solutions to TA-50. The two sto tanks, reinforced concrete of 5000-ga capacity each, were recessed into the ground on the north side of the statio Automatic pH control and depth measurement were included. Two pum were available to transfer the wastes to manhole LD-7 at TA-50, from which waste could be directed to the main influent manhole LD-6 or to one of th stainless steel lined tanks in LD-3.

Wastes during the first few years w extremely dilute, much below permissi levels for discharge to the environment. They were also limited in volume. Wa accumulated in the number one storage tank reached a depth of 37.5 in. by mid November 1966, were sampled and analyzed, then discharged directly to the canyon. Activity levels were 40 cp[illegible] gross alpha and 300 cpm/L gross beta.

By the end of January 1968, the storage tanks had each accumulated about 31 in. with activity levels of 700 cpm/L gross beta and 600 cpm/L gross gamma. On January 25, 1968, all wastes were drained to the canyon.

The reactor attained criticality in August 1967, and it operated for about one year reaching peak power of 3 MW. The AEC decided to cease funding reactor development in Los Alamos in 1970; the reactor was shut down and the site was closed. On August 25, 1970, all wastes remaining in the storage tanks, about 40 in. in one and 30 in. in the other, were pumped to TA-50. All equipment was drained, and the building became inactive. In 1989, the entire facility at TA-52-2 and its force main to TA-50-3 were decontaminated and removed [4].

THE BURIED LINES REPORT: OVERFLOW PROBLEMS

A comprehensive report by Idaho National Engineering Laboratory (INEL), "Evaluation of Hazards and Corrosion of Buried Waste Lines in NRTS Soils" [5] was circulated to H-7 in early 1973. It was evident to management that a similar report should be prepared about buried line conditions at LASL, and H Division Office assigned Emelity to the task in May 1973. The completed report stated that the buried contaminated waste lines were constructed under specifications in widespread use for sanitary waste systems. The lines were primarily short lengths (2–4 ft) of vitrified clay pipe (VCP) with asphalted joints and cast iron pipe (CIP) or duriron pipe for pressure sections and road crossings. Many of the pipe joints in the VCP were likely leaking. Manholes in the system were generally of much higher quality than the pipe lines, with most of the manholes in newer sections of reinforced concrete rather than precast or brick units. The report was completed in July 1973 with the recommendations taken under advisement.

In a recommended maintenance check of all cleanouts on the VCP line on July 9, 1974, a cleanout on the gravity VCP line along Pajarito Road opposite the Occupational Health Laboratory (OHL-1) was found to be discharging to the environment. The line just beyond the cleanout was partially blocked by root growth, and wastewater backed up through the unit. The cleanout was repaired immediately, and the line was rodded out and placed back in service.

The overflowing waste had drained north to the canyon, contaminating a wide area. Health Division Office (H-DO) was notified and H-1, with the assistance of H-8 and H-7, began a major cleanup operation. Contaminated soils were removed to levels of 20 dpm/g [5]. Six hundred cubic yards of dirt were removed, and 150 samples were collected and analyzed. The cleaned area was backfilled with 1150 yd^3 of dirt covered with 350 yd^3

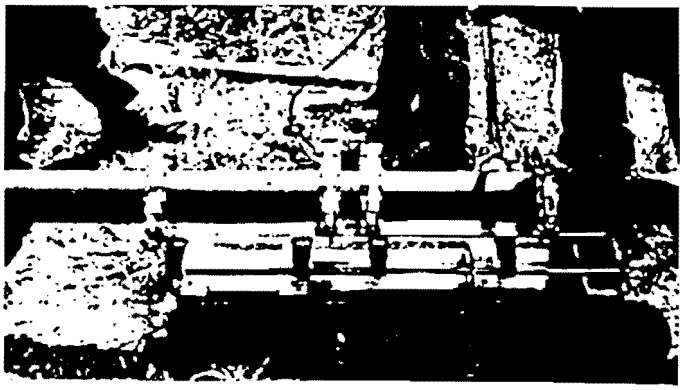


Fig. 4-12. Welding of new polyethylene piping.

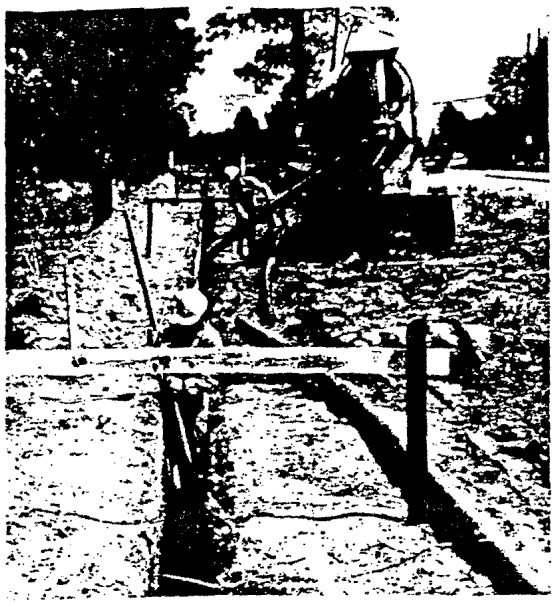


Fig. 4-13. Providing sand base for polyethylene waste line installation.

of topsoil and reseeded. Appendix I is the abstract from the report.

After several meetings with Engineering Division and Laboratory management, H-7 decided to install a welded plastic liner inside the VCP and CIP, which were primarily 8 in. in diameter, between TA-50 and the corner of Diamond Drive and Pajarito Road. Under emergency conditions, Christenson contacted a supplier and ordered enough polyethylene pipe of diameters that allowed insertion in the VCP/CIP. While this effort was underway, further discussions concluded that insertion into the existing piping would require the system to be shut down. H-7 decided, therefore, to install the new polyethylene piping in a separate trench generally 5 ft south of the VCP and CIP lines. In this case, shutdowns would involve only the time required for end-of-line hookups (Fig. 4-12 and 4-13).

A work order was given to the Engineering Design Group to [illegible]er the flow capacity of this smaller plast[illegible] line. Before the answers were availabl[illegible] installation was completed and the r[illegible] smaller line was placed in service on September 3, 1974. In a telephone c[illegible] H-7 shortly after the SM-700 pumps [illegible] turned on, Robert Klaer, a Zia Compa[illegible] engineer driving by the Diamond Dr[illegible] Pajarito Road intersection, reported th[illegible] the manhole on the northwest corner [illegible] (Manhole SM-736) was overflowing v[illegible] wastes running down the road. The pumps were shut down immediately, a[illegible] H-DO was notified. Christenson and [illegible] many others hastened to the site, and th[illegible] Fire Department was called out to wash down the curb. When H-DO, H-1, anc[illegible] H-8 representatives arrived, the wash-down had been briefly underway, and [illegible] contaminated water had flowed to [illegible]orr drain near the SM-29 guard gate, passe[illegible] under Diamond Drive through the culvert, and drained to Mortandad Canyon at its west end. The wash water was cut off almost as soon as H-DO, H-1 and H-8 arrived. Cleanup operations began immediately, and ENG-DO order[illegible] tank transport of SM-700 wastes to TA-50 until line problems could be resolved. The order was countermanded before any tank was transported; H-7 argued that by monitoring the manhole, valves at SM-700 could be adjusted to reduce the discharge so that overflow could not occur. A high-level alarm was installed in SM-736 on February 28, 1975, and an overflow line from SM-736 to SM-727 was constructed to recirculate wastes abov[illegible] overflow level to SM-700. Pumping

systems at SM-700 were modified so that a high level at SM-726 shut off the SM-700 pump; the high level also alarmed at Zia Control at SM-223.

The cleanup included removing all contaminated curbs and gutters, part of the SM-29 parking lot, and truck loads of dirt from the canyon [4].

Though very little plutonium or other radionuclides were involved in the spills, the events were reported by all major radio networks and newspapers throughout the United States. ENG-4 listed the total cost of the cleanup of both spills, including the cost and installation of the polyethylene pipe, at $124,061.

THE STUDY GROUP REPORT

Recognizing that the collection and waste treatment systems were not state of the art and that protection of the environment had become a major national concern (PL 92-500 Federal Water Pollution Control Act Amendments of 1972), Dr. George L. Voelz, Health Division Leader, organized a study group to review LASL waste management operations and to recommend improvements to meet existing standards. Appendix J is a copy of the memo establishing the Study Group and listing its objectives. In addition to Emelity as Study Group Leader, the following personnel were appointed as members of the group:

- J. R. Buchholz, H-7, Assistant Leader;
- A. M. Valentine, H-1;
- W. R. Goldsmith, H-8 (original member);
- L. C. Borduin, H-8 (replaced Goldsmith);
- M. E. Muller, ENG-6; and
- R. A. Hemphill, ENG-9.

M. Wheeler, A. Stoker, R. Garde, all of H-8, provided a hazard evaluation of possible leaks in the collection systems, and numerous others contributed their expertise to the report.

A visit to the Rocky Flats Plant (RFP), where a new collection system/treatment facility had been completed, convinced the group that state-of-the-art waste management in the nuclear industry incorporated the following basic philosophies:

- all waste collection lines must be double-contained and continuously monitored for leakage and
- all tanks containing radioactive wastes must be fully inspectable for leakage, with visual inspection preferable.

The group met frequently, reviewing conditions at all sites at which radioactive wastes were generated and considering such management options as hauling, deep-well disposal, mechanical evaporation, solar evaporation, and incineration. Recommendations for improvements, preliminary drawings, and cost estimates were provided for each of the sites. Before the Study Group Report [7] was completed, the initial steps to procure line-item funding for improvements in collection and treatment were underway. H-DO called in a rough draft of the report in mid June 1975, although work on drawings and estimates continued to completion.

References

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2. "Report of James B. Malone, Resident Investigator, ALO, Jeffrey J. Wanner (Deceased) - Alleged Radiation Incident," Los Alamos Scientific Laboratory, (44-2-371) (December 5, 1971).
3. Wright and Underwood P. A. and Thomas A. Welby, "Office Building TSL-68, Tech Area 35, and Add'n to Building LD-1, Tech Area 50," LASL Construction Plans, (1965).
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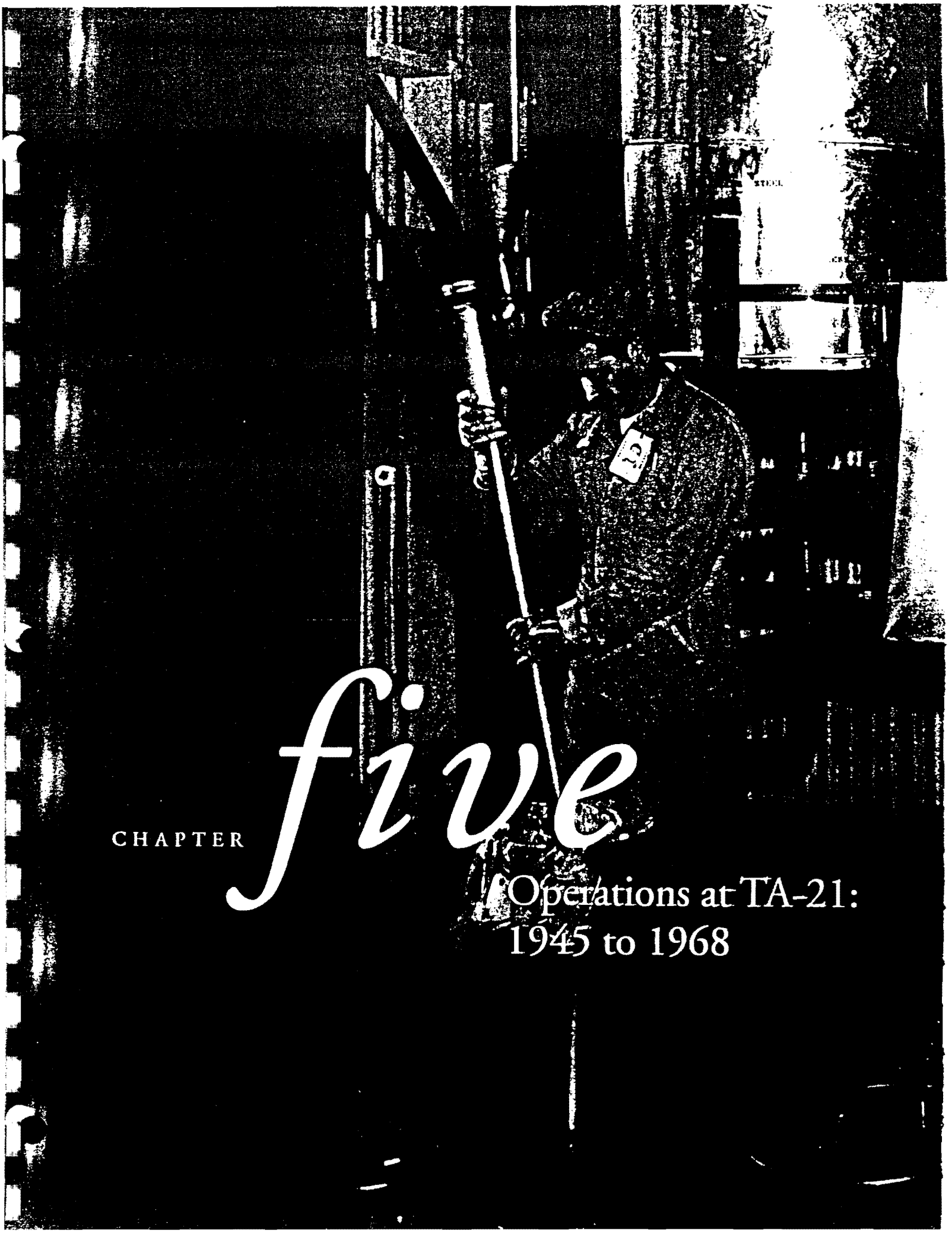
5. B. E. Paige, *et al.*, "Evaluation of Hazards and Corrosion of Buried Waste Lines in NRTS Soils," CP-1013/US AEC Idaho Operations Office, Idaho Falls, Idaho (1972).
6. Eric B. Fowler, "Report on Acid Waste Line and Diamond Drive Cleanup," LASL (December 16, 1974).
7. Liquid Waste Management Study Group (L. A. Emelity, Chair), "A Survey of Liquid Waste Management Problems at the LASL," LASL (1975).



CHAPTER *five*

Operations at TA-21: 1945 to 1968

The C-Shop fire in TA-1 was instrumental in arousing concerns about the proximity of plutonium operations to the community (Chapter 1). Immediate measures were taken to provide a new site, TA-21, for this work and for studies involving polonium-210, a short half-life alpha emitter. Plutonium work was assigned to the west end of TA-21 and polonium work to the east.

With a rapidly expanding workforce, the need for larger laundry facilities than those at TA-1 was recognized, and a new plant was provided at TA-21 to replace the smaller facility.

For an immediate resolution of concerns in 1945 about management of radioactive liquid wastes at TA-21, four interconnected absorption beds were provided for radioactive wastes from the west labs (DPW) (1945–1952); two absorption beds were provided for the wastes from DPE labs (1945–1968); and three interconnected beds were constructed for laundry wastes (1945–1961). In addition, in a fenced area between DPW and DPE, two 50,000-gal. storage tanks for more active plutonium and americium liquid wastes were installed underground and covered with a concrete slab. The tanks, known as the "General's Tanks," were provided with openings for addition of wastes (1945–1977) and for ventilation. The area, eventually called Area A, also was provided with burial pits for contaminated solid wastes (1945–1946 and 1969–1977) (absorption bed and solid waste burial areas were eventually given alphabetic designations). [1] At TA-21, H-7 was involved with the following:

- Area A—General's Ta[illegible] are
- Area T—DPW waste absor[illegible] beds;
- Area U—DPE waste absorp[illegible] beds; and
- Area V—laundry waste absorption beds.

WASTE TREATMENT AT DPW

In addition to the TA-45 waste treatment plant, Black & Veatch de[illegible] a similar but smaller facility at TA-2[illegible] wastes from DPW. It was located at t[illegible] Area T absorption beds so that the p[illegible] could be bypassed if necessary and unsatisfactory effluents could be drai[illegible] to the beds rather than to DP Canyo[illegible] small branch of Los Alamos Canyon.

The plant, designated DP-35 an[illegible] finally accepted on January 31, [illegible] Fig. 5-1), was compact with limited lab[illegible] space and no vacuum filter to dewater precipitates. The flash mixer and flocculator were at a second-story level[illegible] and the iron and lime solutions feed ta[illegible] were at ground level. Problems with pumping these solutions were constant; use of ferric sulfate was eventually abandoned in favor of ferric chloride, which is completely soluble.

The exterior of the uninsulated building was corrugated galvanized steel, and during hailstorms, the noise inside was deafening [2, 3]. Ceiling-mounted unit heaters were inadequate for keeping work spaces warm during co[illegible] winter days.

Precipitates from the sedimentation tank were drained to a storage tank from which they were transferred to a 200-[illegible]

The Zia Company
Attention: T. J. Cook

FEB 7 1952

M. W. K. Hartmayer, Acting Director, Community Management Division

FINAL ACCEPTANCE, CONTRACT NO. AT(29-1)-1202
WASTE TREATMENT PLANT, TA-21

SYMBOL: LTR-2

This office has been advised by letter from the Director, Engineering and Construction Division, that work accomplished under subject Contract has been inspected and was found to have been in accordance with the plans and specifications and that the same was finally accepted as of January 31, 1952.

The above accepted work is hereby assigned to The Zia Company and should be picked up on plant and equipment records and maintained by The Zia Company. The question of maintenance funds will be resolved at an early date and you will receive further information in regard to this matter.

The using agency of the above designated facility will be the Industrial Waste Treatment Branch of the Engineering and Construction Division (Mr. John F. Newell).

CC: John F. Newell, Chief, Industrial Waste Treatment Br

George L. Williams, LASL

Real Est Br
Com Mngmt Div
Nottrott:js Siglow Hartmayer
2-7-52

Fig. 5-1. Acceptance memo for DP-35, February 1952.

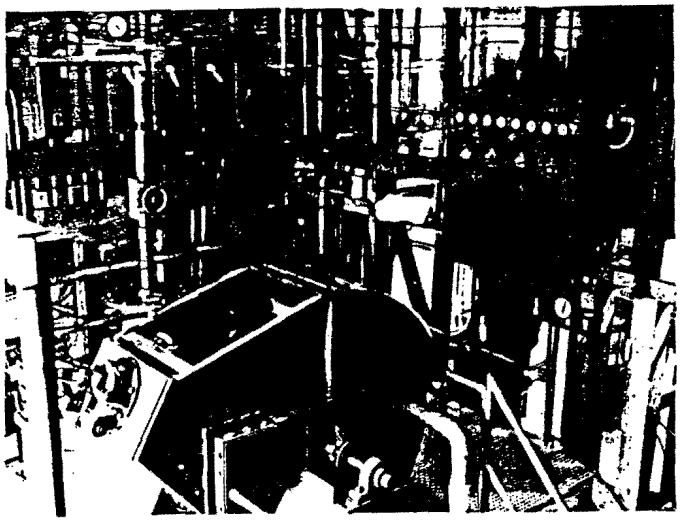


Fig. 5-2. Drum filter installation, TA-21-35.

tank trailer. The trailer was towed through commercial and residential areas to TA-45 where the precipitates were dewatered. The hazards of this operation were immediately apparent: not only was there the danger of an accident or spill on public roadways, but inclement winter weather occasionally made trailer towing inadvisable, and the DP-35 storage tank became overloaded. Pinhole leaks in the tank on the trailer became apparent when air pressure was applied to empty the tank at TA-45 (with no application of air, the pinholes did not leak during the trip from DP-35). The leak holes were sealed when they were found, and efforts to provide a vacuum filter for the DP-35 plant were intensified (Appendix K). Because there was no space within the building, an addition was constructed to house the vacuum filter (Fig. 5-2). Construction began in July 1956 and the addition, with filter installed, was completed in October 1956. The filter went into operation on October 17, 1956.

With a design treatmen[illegible]re c[illegible] gpm, it was originally believed tha[illegible] wastes received could be treated in [illegible] 8-h working days per week. This [illegible] briefly, but it became necessary ev[illegible] to operate five days per week and [illegible] occasionally to increase treatment [illegible] over 60 gpm. During periods of hig[illegible] flow, the vacuum filter could not ke[illegible] with the volume of precipitate bein[illegible] generated; and overtime operation, b[illegible] during the week and on weekends, [illegible] became necessary.

Table 5-1 provides some operati[illegible] data for alternate years from 1952 t[illegible]

BATCH WASTES

One of the major differences bet[illegible] wastes received at TA-45 and those received at TA-21-35 was the g[illegible] va[illegible] and, occasionally, the large volume of batch wastes delivered to TA-21-35. [illegible] wastes arrived in containers ranging fr[illegible] about 200 mL to 200 gal. with 9-L [illegible] bottles, and 200-gal. tank trailers bei[illegible] most common. The large volume bat[illegible] wastes that were treated separately re[illegible] designing special treatment operations [illegible] additional equipment, and additions [illegible] the building. All of these wastes were [illegible] contaminated with uranium, plutoniu[illegible] and/or americium. They included:

- highly acidic americium wastes;
- wastes with a high concentratio[illegible] of fluorides (KOH scrubbing solutions);
- a waste largely of tributyl phosphate (TBP) with possibly some tricresyl phosphate (TCP);
- alcohol;

- a lard/vegetable oil waste;
- a uranium distillate waste; and
- a "strip" waste.

Figure 5-3 shows Cornelio G. Martinez transferring a container of batch wastes into a special storage/treatment tank.

Fluoride wastes. The fluoride wastes were collected in separate batch treatment tanks equipped with mixers. Lime was added to precipitate calcium fluoride, which was then dewatered by the vacuum filter into 55-gal. drums and sent to burial at TA-54. Generally, the lime treatment was applied several times before the supernatant solution could be diverted to the raw waste.

Alcohol wastes. Alcohol wastes were mixed with cement and vermiculite in 55-gal. drums in a tumbler operation. After the cement set, the drums were taken to TA-54 for burial.

Lard/vegetable oil waste. The quantity of lard/vegetable oil waste was small, usually less than 10 gal. in a delivery. This material was mixed with a commercial gelling compound (Spillaway), packaged, and sent to TA-54.

Acidic uranium distillate waste. The acidic uranium distillate waste had relatively low radioactivity, and treatment involved neutralization and discharge to the plant main influent stream.

Acidic strip waste. The acidic strip waste resulted from processing spent uranium fuel. It was received in relatively large volumes contaminated by strontium-90 and cesium-137. See also Chapter 9.

Smaller volume wastes. The smaller volume wastes varied widely in types and levels of radioactivity.

	1952	1954	1956	1958	1960
Hours operated	2,063	1,070	1,242	1,104	1,229
Total flow x 10^3 (gal.)	2,683	3,227	3,801	2,659	2,294
Influent gross (cpm/L)*	58,200	187,000	90,000	163,000	626,000
Effluent gross (cpm/L)*	35	73	60	64	310
Fluorides (gal.)		8,485	9,052	10,323	3,370
mg plutonium		1,444	1,118	1,642	2,660
Raffinate (gal.)		12,111	12,156	17,018	4,060
Equivalent mg plutonium		2,872	3,351	10,070	344,010†
Dewatered sludge (ft^3)			264‡	3,066	1,598

Table 5-1. *Operations summary for TA-21–35 (DPW Plant).*
*Weighted averages
†Included 1.141 g plutonium-238
‡Partial year

Fig. 5-3. *Transfer of batch wastes to a special storage/treatment tank.*

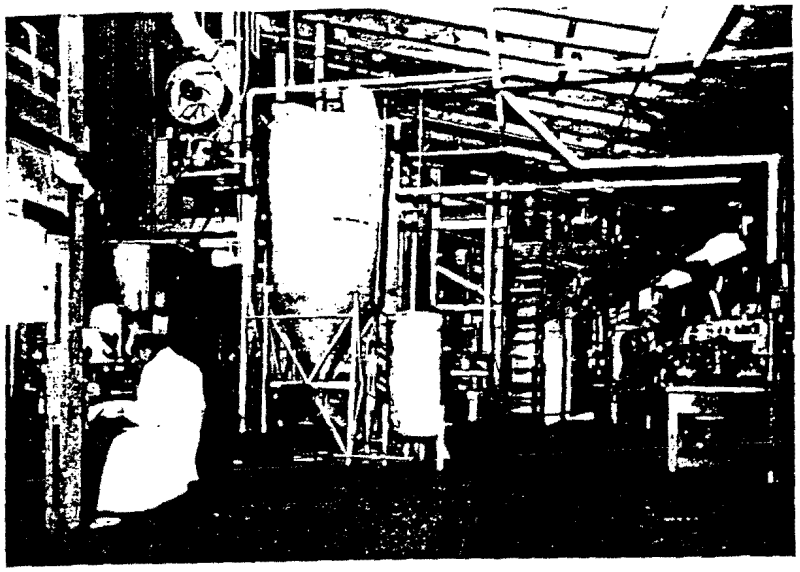


Fig. 5-4. Paul Hutchinson seated at the desk and technician Cornelio Martinez at the lab table, TA-21-35.

Some were treated to precipita e radioactivity: the solids were dewate on the vacuum filter, and the superna was directed to the main influent. O were added to the americium waste f treatment through that separate syste In a few cases, wastes with higher bet gamma levels were hauled to TA-35 (Site) and added to the wastes in one o the 50,000-gal. storage tanks.

Americium waste. After the vacuum filter and the americium wast management system were added, DP- was staffed with two to three technicia with staff member assistance as necess (Fig. 5-4). The americium treatment operation required the services of one technician full-time and two others to manage the main plant, the vacuum filt and the many batch wastes. Overtime operation was frequently necessa

Solution	Molarity
HNO_3	6 to 7
Mg^{++}	0.5 to 0.9
Ca^{++}	0.3 to 0.5
Al^{+++}	1.1
F^-	0.3
Fe^{+++}	0.1
NO_2^-	0.002

Table 5-2. *Approximate composition of americium raffinate waste solutions.*
Specific gravity: 1.35–1.40 g/mL
Plutonium: ~1 mg/L
Americium: 0.1–1.0 mg/L

THE AMERICIUM WASTES

In 1959, CMB-11 was generating acid waste averaging one milligram per liter each of plutonium and americium (Table 5-2). This level of activity was to high for treatment through the plant because of the open surface areas of man of the treatment units. Paul Hutchinso studied the problem and experimented with various approaches. He decided on neutralization with 50% sodium hydroxide and mixing with cement and vermiculite. Leaching studies indicated that immersing small blocks of the set m in water resulted in small losses of activit to the leachant.

Under emergency orders, a small addition was constructed on the southeast corner of DP-35 in September 1959, and it was equipped with a tank for preparing 50% sodium hydroxide solution from flake, a neutralization tank obtained from CMB-11 (the tank in which a plutonium solution had gone critical), and a single-drum tumbler. A vacuum pump transferred wastes from the delivery trailer to the neutralization tank, which was equipped with a mixer. Figure 5-5 is a picture of the plant, and Reference 4 is a description of the first four-and-a-half years of operation.

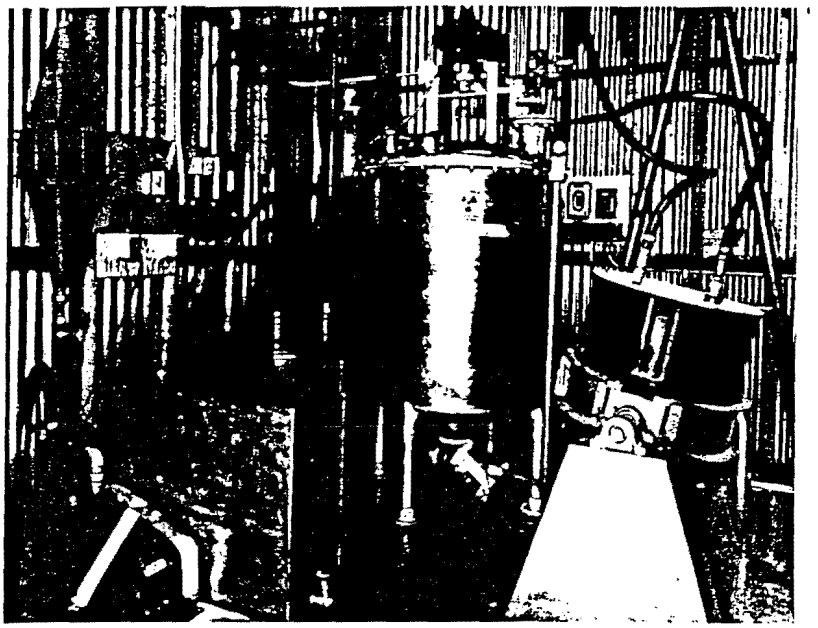


Fig. 5-5. *The original raffinate treatment system at DP-35.*

The first 270-gal. trailer load was delivered to DP-35 on November 16, 1959. Plutonium-239 concentration was 0.8 mg/L; americium-241 content was 2.98 mg /L. It was 6.9 molar in nitric acid. The facility had many shortcomings, the greatest of which was the low treatment rate, only 20 gal. of waste per drum and only one drum tumbled at a time. The americium trailers were held up because the facility had no storage capacity for wastes; neutralization was very slow due to heat build-up because the tank had no cooling system.

The problems were attacked as rapidly as time and funding would permit. With H-7 design, LASL shops fabrication and Zia Company installation, a cooling coil was added to the inside of the neutralization tank in November 1960. Other improvements were slower in coming, but an incident on April 11, 1961—in which the lid of a tumbling drum popped off and americium paste sprayed over much of the interior of the addition—focused some attention on the operation. The facility was cleaned, decontaminated, and painted while americium waste accumulated.

By May 1961, a 1000-gal. tank for storage of americium waste was in place, and a double-drum tumbler replaced the single-drum unit. Another room was added for storage of chemicals. Rollers were welded to the inside bottom of the dumpster skips to facilitate locating the heavy drums in November 1961, and in January 1962, an electric hoist was ordered to simplify loading the drums into the skip.

To ease the task of handling the 94-lb bags of cement, a 285-barrel bulk cement silo was purchased and installed

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : John Bolton, Head, Engineering Dept. DATE: December 3, 1962

FROM : Eric B. Fowler, Alternate Group Leader, H-7

SUBJECT: CEMENT SILO FOR DP TREATMENT PLANT, TA-21

SYMBOL : H-7

The amount of cement required to fix americium waste at TA-21 will reach 4500 bags this year (1962). Lifting and transport of this weight (450,000 pounds) poses a health and safety problem. Necessary storage of the monthly shipment, in bags, at the warehouse, contributes to the overall cost of the operation.

A storage silo for bulk cement will allow for an annual savings of about $2,000 in cost. Present usage is at the rate of 110 barrels per month; the savings on bulk cement at this rate are about $675 per year. Storage at SM-30 is calculated at $3.00 per square foot per year. The 450 square feet required cost a total of $1,350 per year. The Supply and Property cost for salaries and transportation is unknown. Since bulk cement can be delivered to the site, a further savings will be realized in Supply and Property salary and handling costs.

In light of these advantages, viz, improved materials handling with much greater safety at a cost recoverable in less than three years, we are requesting a review of the work order (Lab Job No. 2556-21) initiated May 26, 1961, with the goal of installation of the necessary facilities.

ORIGINAL SIGNED BY
ERIC B. FOWLER
ERIC B. FOWLER

EBF:lbg

CC: H-7 File (2)

Fig. 5-6. Request for cement silo for DP treatment plant.

in 1964 for a cost of $6,050 (Fig. 5-6, 5-7). The first load of general purpose Portland cement, 160 barrels, was delivered to DP-35 on March 23, 1964. A second neutralization tank was added, and in late 1964, a storage system to provide 50% liquid sodium hydroxide for neutralization replaced the use of the 50-lb bags of flake. Table 5-3 lists the plutonium and americium activity in the cemented wastes for much of 1959 to 1964 and the number of 55-gal. drums used. A typical treatment log, June 1962, appears in Table 5-4.

In early 1964, Dr. Shipman and representatives of the Engineering Division decided to take immediate steps to replace the DP-35 plant with a larger facility, partly on the basis of predicted waste volumes from DP East. A force main from DP East to DP-35 and a storage tank for these wastes at DP-35 were planned for construction late in the year.

In line with a new facility, Christenson deliberated on means to improve the americium waste treatment rate and to make it more of a continuous process. He consulted with Steve Stoddard, section leader of the Ceramics Section, CMB Division, at SM-66, and they decided that a pug mill, the type used in the clay industry, would probably be an effective approach. Christenson considered that this device, in addition to mixing americium waste with cement, would also mix treatment plant precipitate with cement, making a vacuum filter unnecessary in the new facility. The new plant, labeled DP-257, was about half of the facility requested because of a decision to fund the project under the general plant

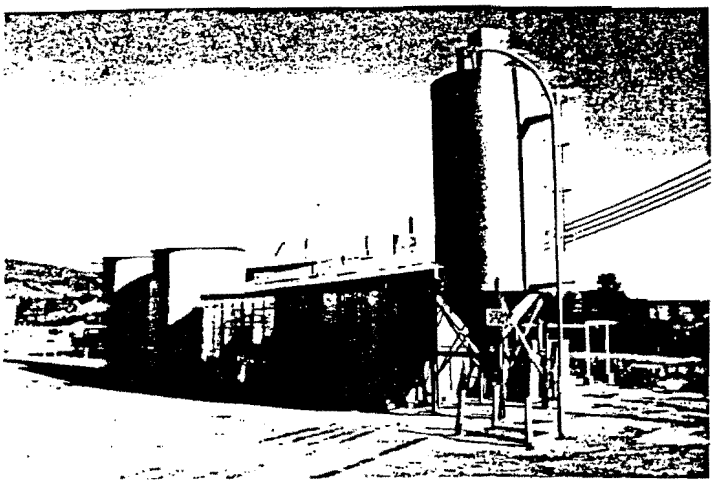


Fig. 5-7. Cement silo at DP treatment.

Year	Total plutonium-239 (g)	Total americium-241 (g)	Total equivalent plutonium-239 (g)	Total number of drums
1959*	11.39	24.83	1,163.50	123
1960	59.83	88.25	4,154.63	741
1961	58.59	98.43	4,625.74	1,105
1962	92.85	61.54	2,948.31	1,566
1963	99.43	47.27	2,292.76	1,830
1964†	39.32	23.83	1,145.03	717
Totals	361.41	344.15	16,329.97	6,082

Table 5-3. *Summery of radionuclide disposal by cement fixation: americium raffinate waste treatment.*

*2 months

†6 months

Date	Volume (gal.)	Ave. acid mol.	Pu (g)	Am (g)	Drums to TA-54	Cement (lb.)	Vermic (lb.)	Caustic (lb.)	Coolir water (gal.)
1	115	6.51	0.492	0.730	8	2256	72	275	3000
5	115	6.44	0.493	0.379	8	2256	72	271	1130
6	115	6.44	0.493	0.379	8	2820	72	271	1210
7	165	6.48	0.685	0.563	10	2820	90	393	1350
8	115	6.48	0.477	0.392	8	2256	72	273	1040
11	115	6.48	0.477	0.392	8	2256	72	273	1030
13	115	6.41	0.454	0.267	8	2256	72	270	1295
13	115	6.41	0.454	0.267	6	1692	54	270	1295
14	43	6.41	0.170	0.099	5	1410	40	101	1020
15	115	6.20	0.275	0.206	8	2256	72	261	480
18	115	6.20	0.275	0.206	8	2256	72	261	870
22	115	6.37	0.449	0.227	8	2256	72	270	1520
22	115	6.37	0.449	0.227	8	2250	72	270	468
25	49	6.37	0.191	0.097	3	828	27	115	1170
27	115	6.30	0.473	0.350	8	2256	72	266	490
28	115	6.30	0.473	0.350	8	2256	72	266	1230
Total	1752		6.780	5.131	120	34380	1075	4106	18598

Table 5-4. *Americium waste treatment at TA-21-35, June 1962.*

project (GPP) program rather than as a line item. Total cost had to be less than $500K. It was designed by Behrent Engineering Co. of Denver (contract signed February 18, 1966) and bid on June 21, 1966; the award went to Modern Construction Company of Santa Fe for $328,990. The notice to proceed was issued on June 28, 1966. By the end of June 1967, construction was completed except for a few minor items.

With the advice of Stoddard, Christenson awarded a contract for the 90-day rental of a double-shaft pug mill used in the ceramics industry to the Fate-Root-Heath Company for $450 on May 16, 1967.

The pug mill was received and installed at DP-35 to allow time to work out the design of the system and to experiment with it while mixing plant precipitates with cement. A stainless-steel hopper section was fabricated by Laboratory shops, and CMB-6 provided a urethane transition piece to connect the hopper to the pump. The waste–cement mixtures were pumped to 2-ft-diameter, 20-ft-deep pits in Area T. Though DP-257 was completed and in operation and much of DP-35 had been decommissioned, drum tumbler treatment of the americium waste at DP-35 continued until the pug mill system was installed at DP-257 and made operational

during the first quarter of 1968. Successful testing of the pug mill system persuaded Christenson to purchase the unit, and, with some credit for rental funds, it was obtained for $4800 in late 1967. For maximum use of Area T, the receiving pits were drilled at least 8 ft in diameter and, if possible, 65 ft deep. The 65-ft depth was not always possible because of a gravel stratum about 3 ft thick at a depth averaging about 28 ft that passed through Area T.

Feed to the pug mill included Portland cement at about 130 lb./min. and liquid waste at 6–9 gpm.

In operations in the second quarter of 1968, the following wastes were processed through the pug mill:

- 1665 L of neutralized americium waste;
- 1094 L of treated strip waste;
- 23,724 L of plant precipitate; and
- 82 L of miscellaneous batch wastes.

In the third quarter, neutralized americium waste volumes increased to 14,710 L and in the last quarter to 27,238 L.

The history of operations at DP-257 appears in Chapter 9.

THE ERDLATOR

In February 1959, a small group representing the Research Section, Sanitary Engineering Branch, Corps of Engineers, Research and Development Laboratory at Fort Belvoir, Virginia, moved into Area T with a large trailer containing a water purification unit called the Erdlator and a small laboratory. A large black rubber circular tank about 20 ft. in diameter and 4 ft deep was set up near the trailer.

The purification unit was a small water treatment plant including a flash mixer, flocculator, and upflow clarifier. The rubber tank was the settling tank. The study would determine the type and quantity of chemicals that most efficiently remove plutonium from drinking water. This information would be necessary in the event of a nuclear war.

The first tests used industrial tap water spiked with plutonium. Iron–lime treatment maintained a satisfactory sludge level in the clarifier, and plutonium removals were very good.

For the next tests, raw waste from one DP-35 influent storage tank would be treated in the Erdlator and discharged to the other. The group immediately experienced difficulties in maintaining the sludge blanket. Various adjustments in chemicals, feed rates, flow rates, etc., were unsuccessful, and the group eventually declared that the unit could not treat the wastes from DP West (DPW). Surface tension measurements indicated a waste surface tension about 60% of that of distilled water. Army personnel concluded their experiments in March 1959 and returned to Fort Belvoir in early April. The Erdlator trailer was hauled away, but the black rubber tank was abandoned in place. A formal report was written on the studies performed at DPW, and copies were forwarded to H-7 [3].

INCINERATION BY SALAMANDER

In late 1960, 900 gal. in 15-gal. drums of what was called tributyl phosphate (TBP) contaminated with alpha activity were delivered to DP-35 for treatment. It appeared to contain some oil, and later deliveries were thought to contain tricresyl phosphate (TCP). Studies began immediately on ways to manage this waste; the first ideas pointed toward fixing it in some material from which water would not leach the radioactivity. Celite, cement, lime, and vermiculite were tried in various combinations, and the cement–vermiculite mix or vermiculite only appeared to be the most effective. This system was used for several years, when it was found that the gelling compound, Spillaway, was also effective. During these early years of receiving of TBP and TCP wastes, Christenson believed that the optimum treatment of organics was incineration, and several staff members investigated the subject. It was suggested that a contractor's salamander—an inexpensive steel pot for about ten gallons of fuel—might serve as a basic incinerator and on July 23, 1964, a salamander was obtained from the Zia Company. The salamander had a chimney about three feet high and was normally used by contractors to prevent recently poured concrete from freezing. The fuel is usually kerosene; adjusting combustion air inlets permits a practically smoke-free operation. After a test period, the salamander was put into operation in August 1964 burning a mixture of organic waste and kerosene, which was add[illegible] operator. Health physics and safety personnel reviewed the operation, sampled and tested exhaust gases, an found the performance satisfactory. Additional units were purchased, an many as three at a time were in use. In August 1964, 58 gal. of waste we incinerated. This volume increased t 136 gal. in September and 137 gal. October. These operations removed much of the backlog, and subsequent burning decreased to the range of 25 per month over the next several monti

Though exhaust gases were routin sampled and analyzed for radioactivit which was always found within accept limits, health physics personnel were concerned that an accidental discharge might occur. Several staff members of H-7 were therefore assigned to d[illegible] a higher capacity unit with HEPA filtration of the exhaust gases. In May 1965, an improved unit was tested. The temperatures developed were too high for the structural integrities of the salamander and filter units. Work order were placed to construct a heavier-gage stainless steel unit and to purchase a ceramic air filter. The new unit (Fig 5-8) with prefiltration of exhaust gases was completed. Major difficulties in adjust the combustion air were eventually resolved, and the unit was used to incinerate the TBP/TCP; vacuum pump oil; lubricating oil; and in brief tests, surgical gloves, PVC gloves, and pieces c old tires. Generation of the TCP/TBP was phased out in the late 1960s, but other organics continued to be received for incineration.

In the early 1970s, vacuum pump oil was the main waste incinerated. Records indicate that this effort continued through September 1972, after which the salamander operations were at a standstill. Design efforts continued.

COTTON PLUG FILTERS

An article by Baylis of Chicago water treatment described using cotton plug filters to indicate turbidity in filter effluents. The cotton plugs filtered a small stream of the filter effluent, then were ashed to obtain the weight of solids entrapped. Baylis had figures as low as 0.03 ppm on his filter runs. The units were installed on the DP-35 filters in October 1961, and the first month's results indicated a level of 0.65 ppm in the east filter and 0.771 ppm in the west. Over the next five months, during which the two filters treated about 1,000,000 gallons and were backwashed several times, these values varied from 0.65 to 1.778 ppm for the east filter and 0.377 to 1.815 for the west. Tests at the end of the first year of using the cotton plugs seemed to indicate no permanent degradation of the filter beds.

ADDITION OF A GRIT CHAMBER

In the first years of operation of the DP-35 plant, Christenson expressed the need for an effective grit chamber (see Fig. 5-9). As proposed, the chamber required several modifications to make it safe and efficient. Construction began in April 1960, and it began operation on October 14, 1960. Numerous shortcomings were corrected into November 1960. Using the grit chamber reduced sand and grit accumulations in such operating units as the raw waste sump and storage tanks.

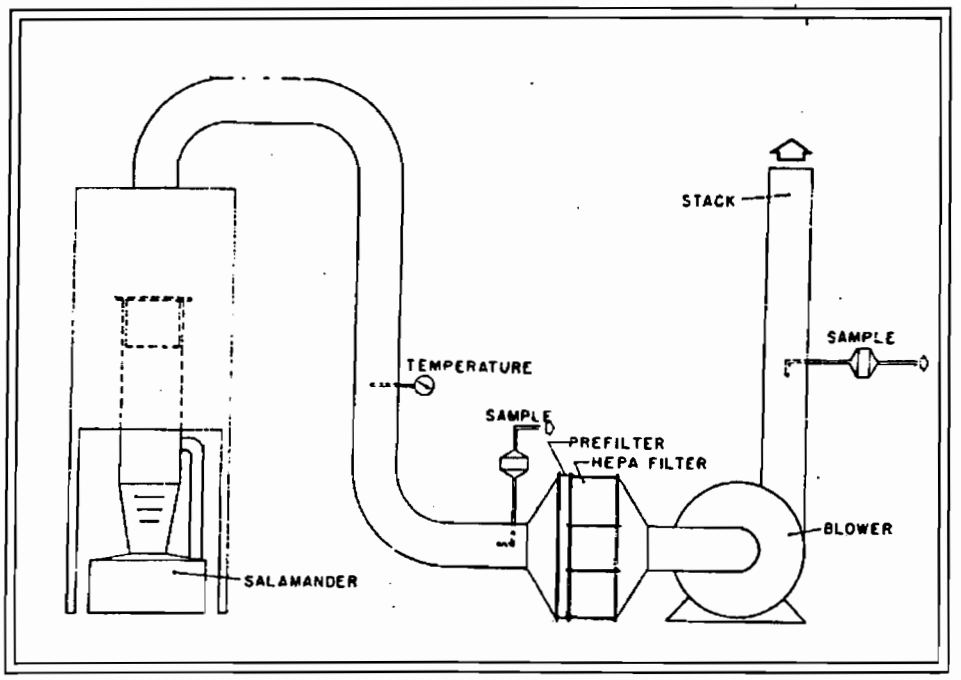


Fig. 5-8. Improved salamander incinerator.

THE SNAKE PIT—TUFF PERMEABILITY STUDY

Christenson, Thomas, and Fowler were interested in the filtering ability and ion exchange capacity of volcanic tuff. The Deep Pit Permeability Study was initiated for the Area T location just west of DP-35. For this study, a pit 6 ft wide × 12 ft long × 30 ft deep was excavated at the northeast corner of absorption bed number one, the southwest bed of the four (Fig 5-10). Excavation of the pit, which became known as the

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : John Bolton, Engineering Department DATE: February 1, 1960

FROM : C. W. Christenson, Group Leader, H-7

SUBJECT: GRIT CHAMBER AT BLDG. 35, TA-21

SYMBOL : H-7

The installation of the grit chamber has been kicked around for some time. First it was delayed for lack of money, then we installed some new equipment which looked like it would eliminate the need for the grit chamber. Not it appears that we must have this job reactivated. The accumulation of grit at several points in the plant presents many operating difficulties.

It is requested, therefore, that Lab. Job No. 2169, Print No. Eng-C-22002 be accomplished as soon as possible.

Original Signed by
C. W. CHRISTENSON
C. W. CHRISTENSON

CWC:lbg

cc: T. L. Shipman, H-DO
H-7 Files

APPROVED:

T. L. SHIPMAN, M.D.
Health Division Leader

Date: 2-1-60

Fig. 5-9. Christenson memo regarding grit chamber need, February 1960.

"Snake Pit" because of visits by a few uninvited crawlers, was completed in December 1959. Horizontal test holes were drilled in February and March 1960 at several levels in the south face of the pit extending under the absorption bed. The cores were taken for study, and in June 1960, porous cups were installed in the holes (Fig 5–11). The study was meant to determine the rate of movement of moisture through the tuff and the ability of the tuff to remove radioactivity. A vacuum applied to the porous cups would permit collection of liquid samples. Lab section personnel did bench studies of the tuff core by using 6-in. diameter × 12-in. tuff cores for over a year. They investigated removing various radioisotopes and nonradioactive metal ions and methods to remove the accumulated radioactivity from the core.

Trial runs were made on the porous-cup vacuum systems in June 1960, and about half of them collected ground water with gross alpha activity varying from 3–1600 cpm/mL, much higher than anticipated. On July 6, 1960, all DPW raw waste was diverted to the southwest absorption bed, and after fifteen days, some 100,000 gal. had been applied. Alpha activity of the applied waste was about 50 cpm/mL, but some samples had activities of about 2000 cpm/mL. Plutonium was being moved through the tuff, and previously bound plutonium was being released. Apparently some sample cups intersected fissures in the tuff providing results that in no way confirmed the lab tuff-core studies.

On August 1, 1960, tap water—instead of raw waste—was discharged to

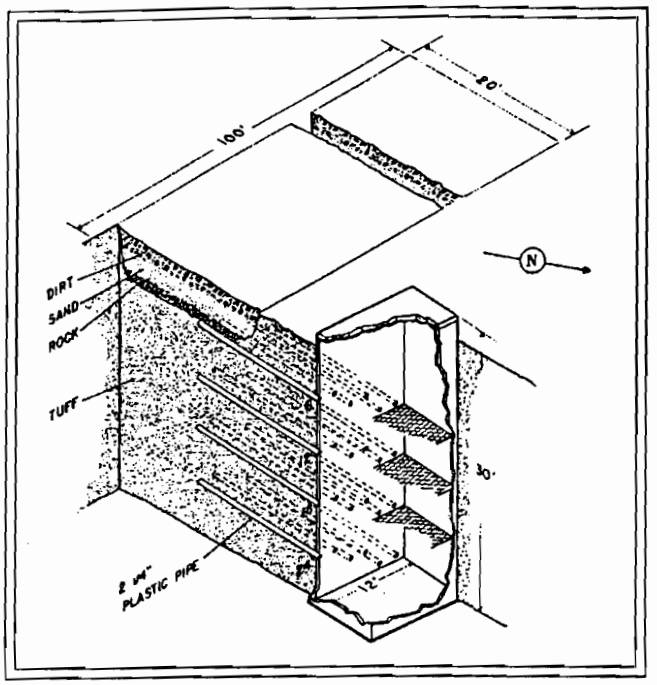


Fig. 5-10. A pit for the Deep Pit Permeability Study.

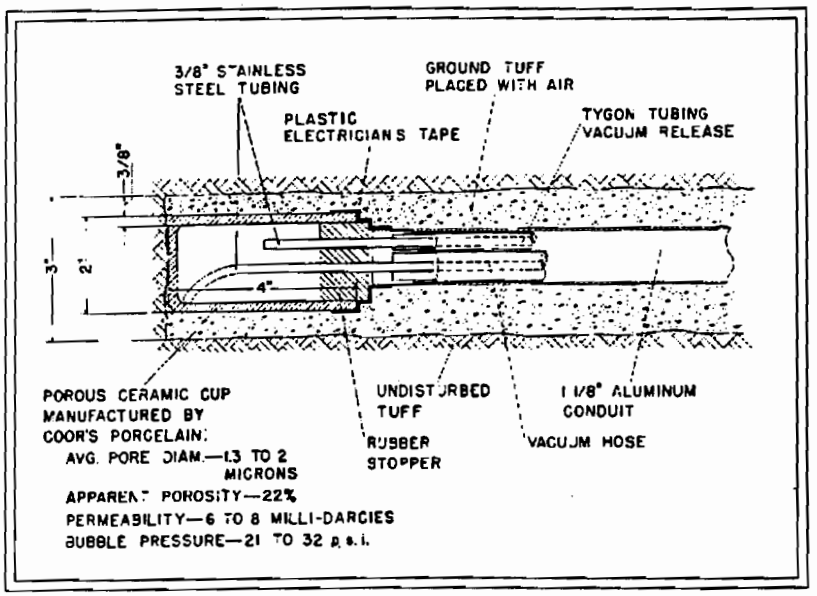


Fig. 5-11. Installation of porous cups.

VACUUM EXTRACTION IN TUFF:

As a follow-up on the Deep Pit Tuff Permeability Study, a series of laboratory experiments were run using the same type porous ceramic cups now placed at levels from 6 ft to 28 ft in the pit at DP West.

The results of these experiments, in which both raw DP waste and plutonium-spiked tap water were used, indicate that a high percentage of plutonium-239 is being retained in the ground tuff and the cup surfaces at high pH values. At pH levels of 2.0 and less, about 50% of total activity passes through the filter media. This suggests that the plutonium valence changes from +4 to +6 with lowering pH. The higher valence plutonium has been demonstrated here and elsewhere to be less susceptible to absorption, adsorption, and ion exchange than the +4 state. As this valence change is a reversible reaction, with the plutonium +4 more stable, the retention of plutonium in tuff may be dependent on the acidity of applied waste.

the absorption bed until 135,000 gal. had been applied. Moisture readings indicated 48.5% moisture at the 6-ft level decreasing to 22% at the 28-ft level; activity and solids were being moved downward. USGS personnel believe that all movement was mainly through cracks or fissures. Because of the disappointing data, weekly composite samples were discontinued on October 5, 1960, and testing was suspended while deeper test holes were considered. Personnel believed that if the pit was deeper, cracks and fissures might not play as major a role in water transfer. A plan was drawn to deepen the pit another 45 ft, but the work was never done.

In December 1960, 27 samples of tuff from the pit indicated an ion exchange capacity for cesium-137 removal that ranged from 0 to 3.4 milliequivalents per 100 g of tuff. If plutonium exchange capacities were similarly low, pluton would likely readily migrate through the tuff.

In January 1961, five 100-ft dee vertical holes cased with 2.5-in. plasti pipe were drilled along the edge of th absorption bed, four on the north fac one on the south, for a study of moist travel in the tuff.

The lab staff attempted to resolve some of the erratic results of the field study. A few paragraphs from the Ma 27, 1961, progress report to Dr. Shipm are quoted in the gray box on this page.

In July 1961, raw waste was again diverted to the southwest absorption b and in August 1961, tap water was add at 5 gpm. Moisture readings verified that cracks and fissures were the d factor in water travel. Christenson assembled the data on the analyses of the pit samples (>900 analyses, chemical and radiochemical) for discussion at the Second AEC Working Meeting on Ground Disposal of Radioactive Wastes at Chalk River, Canada, September 26– 1961. Daily sampling at the pit was discontinued in September because of maintenance problems, but subsequently no further samples were collected.

ADDITION OF DPE WASTES

In the 1940s and 1950s, wastes from DPE were routed to the two absorption beds in Area U. The primary contaminan in the waste to the beds was polonium-210, but some actinium-227 waste was discharged to the beds in 1953. In

DPE personnel prepared DP-209 for high-temperature chemistry research, and H-7 had an automatic pH neutralization system installed. To handle the liquid wastes, a pumping station, DP-223, was constructed at DPE with a 3-in. diameter steel line extending to DP-35. H-7 installed a storage tank for these wastes at DP-35 with piping to permit discharge for treatment or for disposal to the canyon. On January 26, 1965, the first wastes from DPE were received at DP-35. The wastes were generally low in radioactivity, and a high percentage of them were discharged untreated to the tile field until August 1967, when they were diverted directly to DP Canyon.

References

1. E. S. Merrill, "A History of Waste Disposal at Technical Area 21: 1943-1978, (March 1990) in *TA-21 Operable Unit RFI Work Plan for Environmental Restoration*, Chapter 14, p. 14-117 (May 1991).
2. L. A. Emelity, C. W. Christenson, and W. H. Kline, "Operational Practices in the Treatment of Low-and - Intermediate-Level Radioactive Wastes," Argonne National Laboratory and Los Alamos Scientific Laboratory report LADC-7249 (1966).
3. L. A. Emelity, and C.W. Christenson, "Replacement of an Old Treatment Plant, a Design Based on Experience," Proceedings of a Symposium on Management of Low and Intermediate Level Radioactive Wastes, Vienna, Austria, 1970, LASL document LADC-11333.
4. L. A. Emelity, C. W. Christenson, and E. B. Fowler, "Disposal of Am-241 and Pu-239 Raffinate Solutions by Fixation with Cement," Los Alamos Scientific Laboratory report LA-3150-MS (August 1964).
5. M. Pressman, and D. C. Lindsten, "Decontamination of Water Contaminated with Plutonium." US Army Research and Development Laboratory, Fort Belvoir, Virginia (January 12, 1960).
6. Plans for Grit Chamber Installation, DPW Waste Disposal Plant, Bldg. DP-35, TA-21, ENG-C22002 (January 23, 1959).
7. "TA-21 Operable Unit, RFI, Work Plan for Environmental Restoration (OU1106)," Vol. II. Los Alamos National Laboratory report LA-UR-91-962 (May 1991).

CHAPTER SIX

Beta-Gamma Wastes: Operations at TA-35

Improved source preparation facilities were constructed for CMR-10 at the east end of Pecos Drive; the first building/laboratory was completed in 1951. The site was labeled TA-35, Ten Site Laboratory (from CMR-10). CMR-10 was dissolved in January 1955, and K Division reactor development moved into the site.

One of CMR-10's early projects at Ten Site was preparing kilocurie gamma sources of lanthanum-140. The group, under John W. Schulte, provided four 50,000+ gal. concrete storage tanks, TSL-10, to contain the wastes from the processing while the major sources of radioactivity, barium-140 and lanthanum-140 (Appendix L) decayed to a level permitting release to the environment. However, it soon became evident that as the barium-140 and lanthanum-140 decayed, the content of the much longer-lived strontium increased (Fig. 6-1). Wastes with excessive levels of strontium-90 were discharged to the environment with the expected undesirable effects (Fig 6-2). To correct this situation, Group H-7 studied methods to remove radiostrontium from the waste. Bench-scale tests of a phosphate coagulation process and a lime-soda treatment were made. Personnel decided that a small water-softening plant using an Infilco Corporation 2-gpm Accelator™—which had originally been purchased for studies of treatment of DP wastes—would be adequate to treat Ten Site wastes (Fig. 6-3). However, as waste volumes and activity levels increased beyond estimates and as laboratory bench studies of ion exchange indicated that this process using high-capacity nuclear cation resins would be more efficient, the group decided to abandon chemical softening and s ion exchange treatment. One fact favor of this decision was the low c of the Accelator™; it would have replaced with a much larger unit. Problems with ion exchange were unresolved:

- the single valence phase of the resins in which to opera sodium⁺ or hydrogen⁺;
- whether to operate the colum to hardness or strontium breakthrough;
- whether to discard resins afte breakthrough or regenerate;
- the process of regeneration, if this option is selected; and
- how to treat or dispose of the highly radioactive regenerant.

Bench-scale studies by Pa Hutchinson and the H-7 laboratory personnel (W. M. Webster) were in He determined that the ion exchang process would be used and that a trea rate of 10 gpm would be adequate. result, a mild steel column of high-c cation exchange resins was installed i southeast corner of the filter buildin TSL-7. These resins were to be regen with sodium chloride. However, du construction and early operation of system, continuing bench work indic that higher efficiencies were obtaina operating in the acid phase using six r nitric acid to reduce pH of the raw w to about 3.0.

The carbon steel column and appurtenances were replaced with st steel units within a few months, and t new plant, after shakedown im em beginning March 1955, went into

Charles Reynolds, ENG-4 June 1, 1954

John W. Schulte, CMR-10

INSTALLATION OF WASTE TREATMENT EQUIPMENT AT TEN SITE

CMR-10-407

I have looked over the design which should be submitted to you this week by the AEC Industrial Waste Treatment section. Although the proposal is more elaborate than we had considered earlier, I believe this equipment will be adequate for a variety of uses in justifying the expense.

The history of this problem is briefly as follows:

The storage system at Ten Site was planned for holding up waste water until the Ba^{140} and La^{140} activity had decayed to below tolerance level. The quantities of Sr^{89} and Sr^{90}, with half-lives of 54 days and 20 years respectively, are of insignificant concentration initially but are substantially more than we had anticipated in the Ba^{140} shipments. However in six months to a year, the activity contributed by the strontium isotopes may be as much as 50% of the total; this is explained by the relatively short half-life of 12.8 days for the Ba^{140}-La^{140} chain and the longer half-lives for the strontium isotopes. Consequently, at times, the water dumped on the basis of the Ba^{140} tolerance actually exceeded the $Sr^{89,90}$ tolerance. If this practice is continued, there would be a hazardous concentration accumulated in Mortandad Canyon. The installation of the DTR-P reactor at Ten Site also means that activities with lower tolerances than Ba^{140} will be accumulating and for which some disposal system will have to be provided. The proposed plan could also be used for processing such wastes.

To acquaint you with the relative permissible concentrations, I have included the following table as a means of pointing out our problem.

	Tolerances		
	Ba^{140}	Sr^{89}	Sr^{90}
Total Body Burden	5 μ curies	2 μ curies	1 μ curie
Air (average intake)	1.3×10^{5} d/m/m^3	4.4×10^{4} d/m/m^3	4.4×10^{2} d/m/m^3
Water (assume 2.2 liters/day)	4.4×10^{6} d/m/l	1.5×10^{5} d/m/l	1.3×10^{3} d/m/l

I would like to see this job concluded satisfactorily, since this storage problem has plagued us for some time. We would appreciate whatever you can do to get this going. There will be no Ba^{140} shipments due at Ten Site before July 15.

Original Signed by
John W. Schulte

John W. Schulte

JWS:ec

cc: C. W. Christenson

Fig. 6-1. Schulte memo regarding waste treatment equipment installation at Ten Site, June 1954.

5-28-54

TO: DEAN MEYER

FROM: Jack W. Aeby and Tony Garcia

SUBJECT: More digging in canon Mortandad.

Measured by pocket pedometer, while following the wanderings of the stream, it was found that the first hole we dug was approximately 200 yd from the backside of the fence. In our previous digging, we never struc water, but this time we struck water at about 30 inches and hit rock-bottom at about 37.5 inches. We took a sample from the bottom of the hole, which of course had to be brought up through the water, which by this time had risen to a depth of about 12 inches. Also we found out later that this was highly contaminated water that had been dumped the day before inadvertantly and without our knowledge. We are not sure of the accuracy of this sample #9 on account of this, but it does seem in line with our other results reading 169.9 c/m/g. This then would be the bottom most sample and should be added to the other series. It was of hard clay and consisted of about a 2 inch layer just above the rock bottom.

The second hole we dug was about 550 yds. from the fence, just 50 yds. before the Ten-site stream joins the main stream coming from the canon between the contaminated dump and Ten-site mesa. At this point we were able to dig down only about 12 inches, before stricking a rock bottom. Again, just above the rock bottom was a layer of clay, from which we took a sample. This sample, #11 reads 770.3 c/m/g, and was taken about 10 in down. Sample #12, at a depth of 5 inches, read 419 c/m/g and a surfa sample #13 read 198.2 c/m/g. The surface was sand and the 5 inch sa a mixture of humas and sand.

The water which was dumped came from tank T-4 on which we have several samples, and the water samples that we took from our hole agree with the findings on the T-4 samples. T-4 contained very old material and halflife studies are being continued on the samples of water taken in the canon. Present results seem to confirm the suspision of rather long halflife material being present, approaching some combination of the halflives of Sr 89 and 90.

We followed the main stream down toward the rio Grande for about 1 mile only to discouver that for all of this distance the stream travels over rock. Also there is no evidence that the water entering this main strear comes from the Ten-site stream. And it would appear, that unless sudden and rapid runoff occurs, to carry surface contamination into the main stream, that all the contamination from Ten-site dumping is trapped in the soil before it reaches the main stream about 600 yds from the fence.

It seems then, that in the light of the future reactor program, and the possible necessity of fencing in most of this area, that a small amount of bulldozer work, to stop surface contamination entering the main strear during heavy runoff, would be considerably cheeper than the present proposed sump.

Jack W. Aeby
Tony H. Garcia

Fig. 6-2. Memo from J. Aeby and A. Garcia.

operation. It consisted of one 16-in.-diameter column, 8 ft high and containing 5 ft³ of high-capacity cation exchange resin (Nalcite HCR). A dilute acid feed tank, a spent regenerant tank and a sludge storage tank were included (Fig. 6-4). The first official run (a run is the treatment cycle done between regenerations of the resin) of about 6,000 gal. was completed by June 10, 1955. Gross beta–gamma activity in the raw waste varied from 3350 to 12,700 dpm/mL and in the treated effluent from 61 to 203 dpm/mL.

Flow to the raw waste storage tanks increased significantly at this time, permitting inadequate decay time. Wastes were treated that were 10 to 20 times more active than that for which the plant was designed. Lead-brick shielding of the column and the spent regenerant tank was constructed, but operation of the system, requiring nearness to the equipment, resulted in operators accumulating excessive radiation exposures (Appendix M).

Various methods of operating and regenerating the column, various concentrations of HNO_3, for both acidifying raw waste and regeneration, and various methods for treatment of spent regenerant were attempted. Because of high flows of raw waste to the storage tanks, overnight operations began as early as Run 2 (Fig. 6-5). Nine runs were completed in 1955 by Hutchinson, generating the following data.

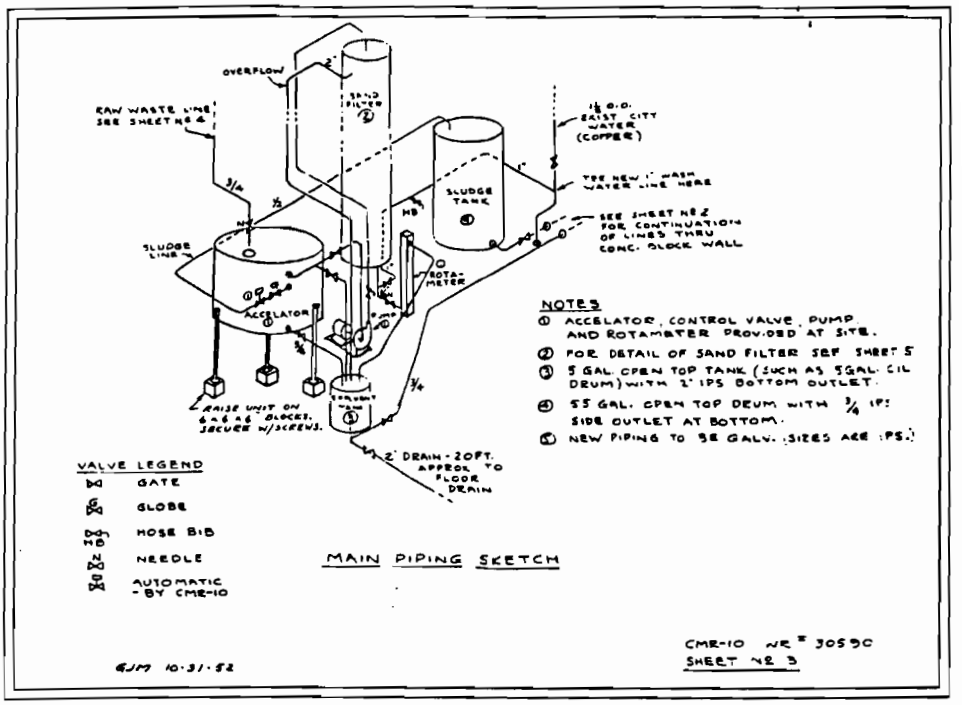


Fig. 6-3. Early plan, waste treatment, T-35-7.

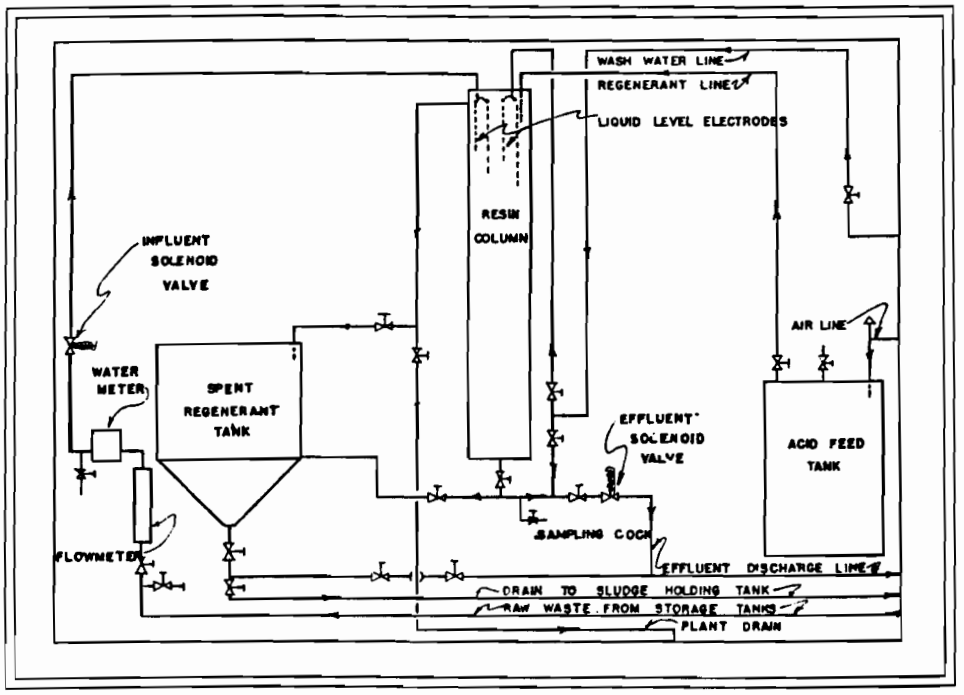


Fig. 6-4. The ion exchange process, TA-35-7.

Average treatment rate	~1 to 6 gpm
Total treated	2560 to 12,350 gal./run
Raw waste strontium-90	560 to 32,700 + dpm/mL
Treated waste strontium-90	1.5 to 965 dpm/mL

Surface area 1.4

July 1, 1955

Run No. 2.

Date started - July 1

Date completed - July 15

Final Meter Reading 13840

Initial " " 2630

Total Treated (gal) 11,210

Date July	Time	Meter Read	Gallons Treated	Rate GPM	Rate Gal/ft²/M	Raw pH	Raw Gross β+γ d/min/l	Raw TH	Raw Sr d/min/l	Effluent pH	Effluent Gross β+γ d/min/l	Effluent TH	Effluent Sr d/min/l	% β+γ
1	0830		100	3.8	2.7	6.8	10,000	194		1.8	103	14		1.5
1	1330		500	4.0	2.9	6.6	5430	230		1.8	5	5		2.9
5	1630		2700	3.3	2.4	7.2	3250	215		2.3	111	8		1.7
6	1130		3350	5.5	3.9	7.0	3360	196	1180	2.5	166	10		1.8
6	1630		4480	3.8	2.7	7.1	3340	189	932	2.9	173	8		2.1
7	1130		5000	2.5*	1.8	7.0	3080	192	1105	3.1	160	11		1.9
7	1630		5770	4.3	3.1	7.0	3360	188	Sr 90	3.3	?	8		2.3
			JULY 8-11 SHUT-DOWN. TRANSFERRING AT 10 SITE											
12	1040		5880	3.7	2.6	6.8	8400	200		3.4	184	12		2.3
12	1100		6000	6.0	4.3	6.8	7560	210		3.4	183	12		2.6
12	1630		6700	2.3	1.7	6.6	7420	201	3178	3.5	159	11		3.6
			OVERNIGHT RUN											
13	0830		8320	1.7	1.2	6.6	7320	201	445 Sr 90	3.6	101	14		1.6
13	1530		9150	2.0	1.4	6.8	7080	200		3.6	101	13		1.9
			OVERNIGHT RUN*											
14	0830		9450*											
14	1100		10070	4.1	2.9	6.8	5780	196	3040 189	3.9	163	23		7.0
14	1400		10720	3.6	2.6	6.8	6620	197	560	4.0	153	22		11.6
14	1630		11210	6.8	4.9	6.8	6720	196	1000	4.0	184	37		9.5
15			SHUT-DOWN. TRANSFERRING AT 10 SITE											

* PUMP LOST PRIME.

Fig. 6-5. *Page from record book for Run 2.*

The four storage tanks of TSL-10 (Fig. 6-6) were designed as T-3, T-4, T-5, and T-6, north to south. T-3, -4, and -5 received the raw waste as determined by valve status. The waste was pumped to TSL-7 for treatment, and treated wastes were discharged to T-6 or to Ten-Site Canyon, a branch of Mortandad Canyon. The T-6 water was also used in the large air filters of TSL-7, and evaporation from these units was a significant waste disposal operation. On the weekend of February 11–12, 1956, the entire contents of T-6 were discharged to the canyon because of a line break, and in early October, T-3 and T-4 were full and overflowing.

In late 1956, K Division, the operators of TA-35, decided to switch to tap water for the filters to reduce maintenance problems, and all treated wastes had to be discharged to the canyon, requiring a higher level of treatment than had been necessary for using the waste in the air filters. The tank farm, which K Division had operated, was turned over to H-7 in February 1956.

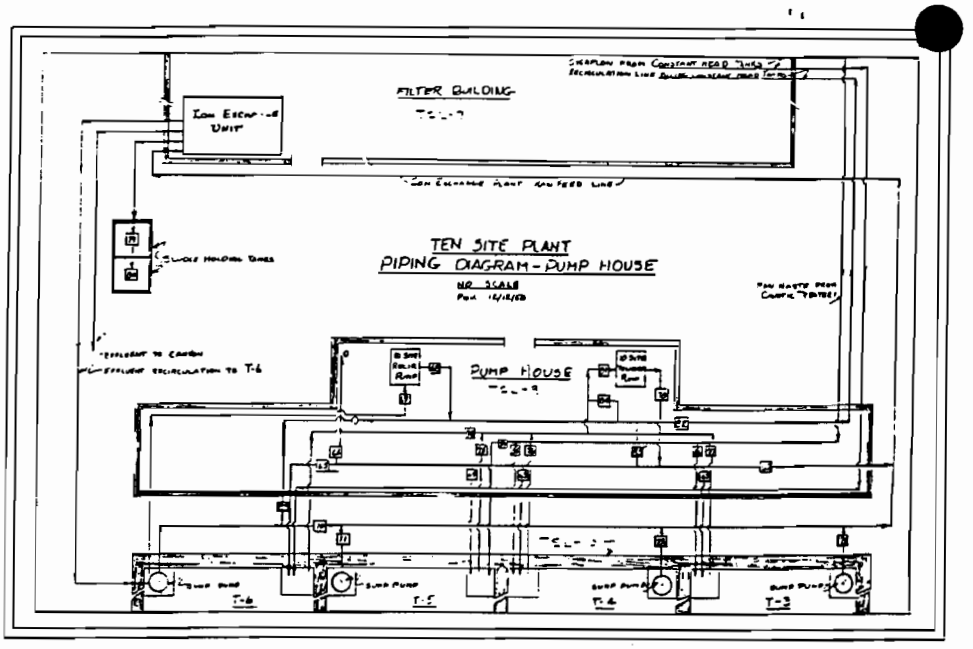


Fig. 6-6. Ten Site Plant pump house.

A SECOND COLUMN IS ADDED

In August 1956, Christenson requested construction of a second ion exchange column (Fig. 6-7) to improve the effluent from the plant, and the division leader, Dr. T. L. Shipman, approved the request. In 69 runs (with 69 regenerations), about 504, 600 gal. had been treated through the single column.

The new column was added in early 1957, lead shielding was provided, and a concrete platform with a heavy-steel stirring device and crane were constructed outdoors on the southeast corner of TSL-7 to mix the precipitated spent regenerant sludge with cement (Fig. 6-8–6-10). Beginning with Run 70 in early 1957, the columns were operated in series. Octyl alcohol was added daily to the tops of the columns to control foaming.

Because of the high gamma radiation at the columns, even with the lead-brick shielding, a system of chemical treatment within the storage tanks was developed. Ferric sulfate ($Fe_2(SO_4)_3$), sodium carbonate (Na_2CO_3), sodium hydroxide (NaOH), and calcium chloride ($CaCl_2$) were added to a tank and the contents for mixing and were recirculated with the feed pumps. The process was successful as a pretreatment method in reducing radioactivity, but large volumes of sludge accumulated in the bottom of the tanks. In the last quarter of 1957, 100,000 gal. were treated in this manner. Results for the year appear in Table 6-1, and a brief

John Bolton, Engineering Department — August 7, 1956

THRU : T. L. Shipman, M.D., Health Division Leader
C. W. Christenson, Group Leader, H-7

INSTALLATION OF ADDITIONAL ION EXCHANGE COLUMN AT TA-35 LIQUID WASTE DISPOSAL FACILITY
H-7

Because of the increase in activity of the wastes produced at TA-35, it has become necessary to install a second ion exchange column in order to decrease activity in the effluent to the level recommended by the AEC. Recent experimental work at TA-45 indicates that the addition of stable strontium to the effluent from the present column and subsequent passage through a second column produces an effluent which meets the AEC requirements.

The second column will be essentially the same as the first with similar piping connections to the acid tank and spent regenerant tank. For purposes of economy in operation, I recommend that it be 18" in diameter as compared to the present 14" diameter column. I will be happy to furnish further details when needed.

Original Signed by
C. W. CHRISTENSON

C. W. Christenson

CWC/lbg

CC: T. L. Shipman, H-DO
H-7 File

Fig. 6-7. Request for second ion exchange column for TA-35, August 1956.

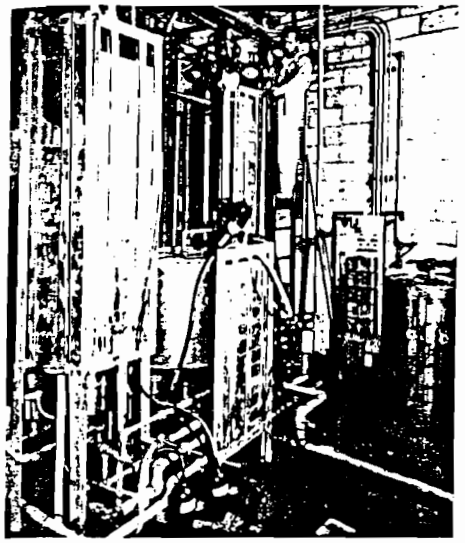


Fig. 6-8. A second column at TA-35.

Fig. 6-9. N. W. Weeks at the Plant Controls.

Fig. 6-10. Mixing sludge with cement, TA-35-7.

history through early 1958 is provided in Appendix N. Appendix O, a memo from R. G. Thomas, shows the high activity levels in the area.

A few items of interest that occurred with the two small-column shielded plant were the following.

- Manually controlled acidification of raw feed began on November 23, 1956, in Run 63. At Run 68, February 10, 1957, the system was automated.
- Series operation of the two columns was first used for Run 70 on February 27, 1957.
- The maximum radiation on contact with the outer surface of a column (unshielded) at 1 ft from the top was 15 rem/h.
- On August 11, 1958, a break in a force main from the pump building to the filter building was discovered. Thousands of gallons of wastes from T-5 and T-6 were lost to Ten Site

Total gallons treated	465,850
gallons recirculated	35,460
gallons discharged	430,390
Operating cycles	16
average volume (gal.)	29,100
maximum volume (gal.)	61,500
minimum volume (gal.)	7,900
Raw gross beta (total curies)	32.08
average per cycle (c/m-mL)	9,620
maximum per cycle (c/m-mL)	22,567
minimum per cycle (c/m-mL)	1,870
Raw strontium-89 + strontium-90 (total curies)	2.55
average per cycle (c/m-mL)	765
maximum per cycle (c/m-mL)	2,100
minimum per cycle (c/m-mL)	251
Final gross beta (total curies)	2.33
average per cycle (c/m-mL)	580
maximum per cycle (c/m-mL)	2,713
minimum per cycle (c/m-mL)	133
Final strontium-89 + strontium-90 (total curies)	0.24
average per cycle (c/m-mL)	71
maximum per cycle (c/m-mL)	377
minimum per cycle (c/m-mL)	6
% gross beta removed	93.1
% strontium-89 + strontium-90 beta removed	92.9
% strontium-90 of strontium-89 + strontium-90 in raw. From intermittent sampling	10 to 25
strontium-89 - MPC in drinking water (c/m-mL)	34.8
strontium-90 - MPC in drinking water (c/m-mL)	0.4
final strontium-89 c/m-mL avg.	58.5
ratio with maximum permissible concentration (MPC)	1.65
final strontium-90 c/m-mL ave.	12.9
ratio with MPC	31.1

Table 6-1. Ten Site operation summary, 1957.

Canyon through a storm drain before the break was discovered.

- During transfer by air pressure of nitric acid from a 13-gal. glass carboy to the acid holding tank used for column regeneration, the carboy split open and spilled about 6 gal. of acid on the floor. Sodium and calcium carbonates were used to neutralize it before the area was washed down.
- Through 1957 and 1958, the two columns operating in series treated 815,000 gal. Average treatment rate was 3.1 gpm with runs ranging from 10,000 to 80,900 gal. The total volume treated by the two columns from February 1957 to June 1960 was 1,454,000 gal.
- A sump pump rated at 10 gpm was added to each of the 50,000 gal. storage tanks to permit discharge from any tank to the treatment plant or the air filter washing system.
- An air diffuser was installed in the bottom of Column 1 in June 1958 to improve backwashing and displace entrapped air.
- On May 22, 1959, because Column 1 had become too radioactive, all of the resin in the column was removed and replaced with new resin.
- Extremely heavy waste flows to the storage tanks began in July 1959 and the plant operated seven days a week. After weeks of searching, operators discovered an open tap on a water line under a lab bench in TSL-2 on August 21, 1959.

During the first five years of the ion exchange treatment, Paul Hutchinson and several chemists of the lab section operated hundreds of bench-scale tests to reso many of the unknowns. These quest included the following:

- the possibility of the use of clinoptilolite or other clays for ion exchange;
- the most efficient nuclear resin the market;
- the relative efficiencies of upflow versus downflow throu the columns;
- whether parallel or series opera would be most advantageous;
- the optimum pH of waste fed to the columns;
- the best method for controlling foaming of the columns; and
- the optimum method for chem treatment of spent regenerant.

Some of the resolutions of Hutchinson's studies were that

- column influent should be adjusted to a pH of 2.5 to 3.0 using nitric acid;
- series operation of the columns was necessary for the decontamination required;
- stable strontium (nitrate) should be used in chemical treatment of spent regenerant to improve precipitation of the radioactive strontium;
- octyl alcohol should be poured in a thin layer on top of the columns to control foaming;
- ion exchange capacity of clays t was too low to warrant its use;
- the nuclear resins sold by Nalci Dow, and Rohm and Haas had high capacities and adequate physical properties.

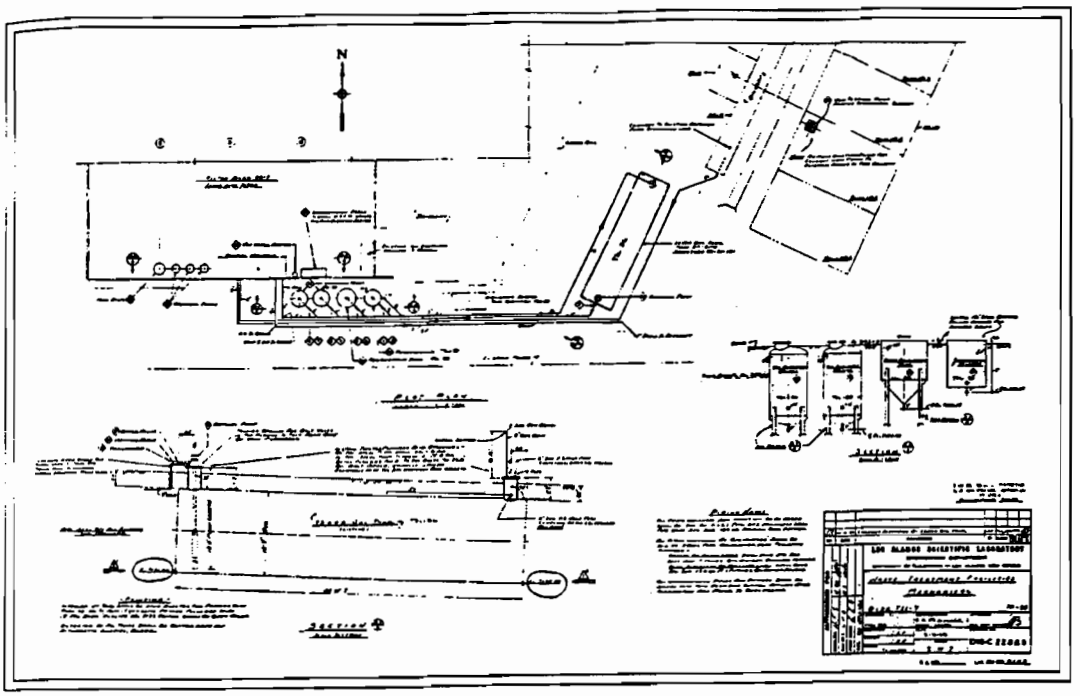


Fig. 6-11. Proposed waste treatment facilities at TA-35.

THE NEW 50-GPM PLANT

In early 1958, larger ion exchange columns preceded by a continuous chemical precipitation system were evidently necessary to improve safety and reduce discharge radioactivity levels. Christenson and Hutchinson worked with ENG-2 on preliminary plans for the new plant estimated to cost about $66,000, and Christenson reported their completion in a memo to Dr. Shipman on January 13, 1958.

Among the considerations in the design of the new plant was K Division's construction of a new plutonium facility in TSL-2. Also, the new molten plutonium reactor, LAMPRE I, was nearing operational status. Processing of its cores could result in some plutonium and mixed fission products in waste streams. As demonstrated at WD-2 and DP-35, plutonium wastes are most efficiently removed by a physical–chemical process. The question arose as to whether the alpha wastes should be kept separate in storage and treatment from the beta–gamma wastes, but cost considerations prevailed, and no attempts were made to keep the wastes separate. The group also assumed that a building would be necessary to house some equipment and a lab, and a survey of unused LASL facilities produced a building at TA-16. An engineering estimate on April 24, 1959, revealed an increased cost of $107,525 (Laboratory Job #2102). This level of expenditure was unacceptable, and efforts began to find avenues to reduce it. No additional buildings were included. The system (Fig. 6-11) was composed of three chemical feed tanks and an acid feed tank

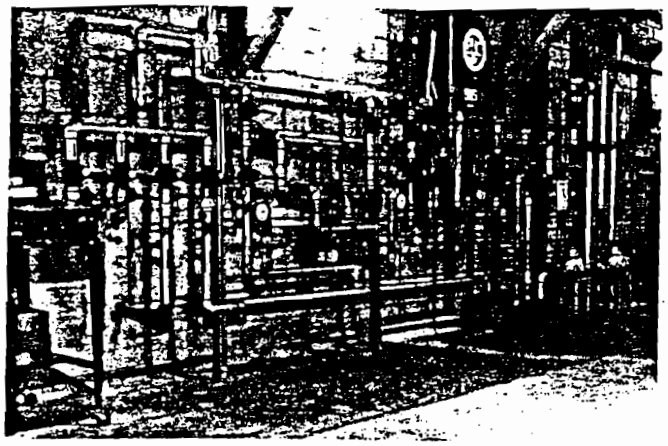


Fig. 6-12. *Stainless steel piping at the new TSL-7 physical-chemical waste treatment plant.*

	Raw Feed		
	Maximum	Minimum	Weighted average
pH*	9.8	0.9	3.9
Conductivity	3500	43	573
Total Hardness (ppm) (as $CaCo_3$)	160	56	113
Calcium (ppm) (as $CaCo_3$)	90	25	62.7
Magnesium (ppm) (as $CaCo_3$)	99	0	47
Sodium (ppm) (as $CaCo_3$)	3120	890	1530
Gross beta (c/m-mL)	10.624	2764	7100
Radiostrontium (c/m-mL)	271	53	137

	Column 1 Effluent			Column 2 Effluent		
	Max.	Min.	Wt. ave.	Max.	Min.	Wt. ave.
pH	7.2	2.0	4.2	3.0	1.7	2.6
Conductivity	165	40	92	225	50	97
Total hardness (ppm) (as $CaCO_3$)	90	27	56.3	60	14	46
Calcium (ppm) (as $CaCO_3$)	50	10	37	40	0	24
Magnesium (ppm) (as $CaCO_3$)	40	8	20	29	4	21
Sodium (as $CaCO_3$)	2800	860	1490	2640	82.5	1320
Gross beta (c/m-mL)	2734	442	900	1936	392	685
Radiostrontium (c/m-mL)	40	1	13.7	21	1	2.7

Table 6-2. *Ion Exchange Treatment - New Ten Site Plant (50 gpm): Composite Analysis (6/13/60–1/1/61).*
Total ion exchange treatment (gal.) 719,357
Total operating hours 218.
**Raw feed pH is adjusted to 2.5–3.5 before application to the columns.*

inside TSL-7; a flocculator tank; tv
50-gpm ion exchange columns anc
regenerant tank buried outside alo
east end of the south wall of the bu
and a 25,000-gal. sedimentation ta
obtained from TA-21, buried abou
halfway between TSL-7 and TSL-1
existing sludge storage tanks. 1,000
total capacity, were incorporated int
plan, and the old two-column plant
southeast corner was abandoned in
save decommissioning dollars. All a
piping and tanks in contact with aci
stainless steel (Fig. 6-12).

Through May and early June 19
various units of the plant were check
with tap water. Actual waste treatme
through the ion exchange columns b
on June 13, 1960, using supernatant
the 25,000-gal. tank as feed. Treatm
satisfactory. The method generally us
involved chemically treating wastes fr
50,000-gal. storage tank with discharg
the 25,000-gal. settling tank; treating
settling tank supernatant through the
columns; and discharging to the canyo
To permit close control of operations,
chemical treatment and ion exchange
usually done in separate sessions. Som
typical early data appear in Table 6-2.

Many breaking-in problems were encountered and remedied as soon as possible. Three of the more serious we the following.

- Leakage around the bolted tops o the ion exchange columns, which corrected by replacing the 0.25-i thick Teflon cover gaskets with 0.125-in.-thick gaskets.
- Failure of the vertical, submerged discharge pump on the 25,000-g

buried tank. The impeller was completely plugged with ferric hydroxide/calcium carbonate precipitate. Cleaning restored the full capacity of the pump.

- Development of pinhole leaks in the ferric chloride chemical feed tank. The tank was emptied and cleaned, and the holes were welded shut.

With the new plant, overflow concerns and overtime operation requirements disappeared.

Because of the limited capacity, 1000 gal., of the spent regenerant tank and the need to prevent diluting the regenerant, air pressure—rather than movement by tap water—was used to empty the columns and transfer the acid regenerant.

By the end of March 1961, all the storage tank wastes were treated, and tank levels were at a minimum. LAMPRE I would soon start up, and large waste volumes were expected. Flows increased for a few months, but no problems developed in treating it, and by the middle of August, the storage tanks were again empty. Flows then decreased to low levels, and treatment did not become necessary until April 1962, when

- 110,100 gal. of waste were treated chemically and
- 90,150 gal. were treated by ion exchange.

Flow volumes remained much lower than usual except for a few instances of TSL-2 cleanup operations and system malfunctions. Raw wastes were generally much lower in radioactivity, and unintentional flows of tap water reduced these levels further.

On July 26, 1963, 40,800 gal. of a dilute waste were pumped to TA-50 from T-5, the first Ten Site waste not treated at Ten Site, and the 50-gpm plant was put into a stand-by status. During its three years of operation, it treated 1,533,000 gal. of waste by physical–chemical and ion exchange systems. Table 6-3 provides data on its first few months of operation.

Date	Type	Volume (gal.)	Composition of raw feed (cpm/mL)		Composition of treated waste (cpm/mL)	
			gross beta	strontium-90	gross beta	strontium-90
6/13/60	chemical	25,300	22,540	304	21,456	280
6/15/60	ion exchange	22,740	9,400	216	488	1
6/16/60	chemical	22,740	40,285		4,415	245
6/21/60	ion exchange	48,450	10,624	245	642	5
6/24/60	ion exchange	95,560	13,960	252	545	5
8/23/60	ion exchange	76,260	52,480	384	2,356	192
8/24/60	ion exchange	120,963	5,126	220	392	5

Table 6-3. *Early operating data, 50-gpm plant at TA-35-7.*

TRANSFER TO TA-50

From 1962 to 1963, the new plant at TA-50 was under construction. It included a complete ion exchange facility with:

- two cation resin columns containing 50 ft^3 of high-capacity nuclear resin in each;
- a 5,000-gal. storage tank for concentrated nitric acid;
- an 800-gal. dilute (6M) nitric acid storage tank;
- a large spent regenerant treatment tank;

Month	Volume (gal.)	Treatment method
July	40,800	chemical
August	55,600	chemical
September	0	
October	0	
November	54,000	physical-chemical systems and ion exchange

Table 6-4. *First waste pumped to TA-50 from Ten Site.*

- two 5,000-gal. storage tanks for sludges from chemical treatment of spent regenerant;
- storage tanks for 50% and dilute sodium hydroxide; and
- the necessary pumps, meters and controls.

At Ten Site, pumps were installed in T-3, -4, -5, and -6, and a force main to TA-50 was provided. Depths in these tanks were transmitted to recorders on the control panel in TA-50, Building 1, Room 116.

Tests were run on pumps, valves, and control systems to determine whether they were functional. To check the nitric acid storage tanks, both for the concentrated and the dilute acid, acid from 13-gal. carboys was pumped into the tanks. Both tanks, the 5,000-gal. concentrated acid storage tank and the 800-gal. dilute (6N) storage tank were constructed of mild steel with complete polyvinyl chloride (PVC) lining. Both tanks soon developed leaks, and the supplier, Alpha Engineering, attempted to repair them. Additional cracks developed in the linings later and both tanks were replaced with unlined stainless steel units during the third quarter of 1966; the 5,000-gal. tank was replaced with a 4,000-gal. unit.

The first wastes pumped to TA-50 from Ten Site were so low in beta–gamma activity that they were given chemical treatment only (Table 6-4).

The transfer of wastes to TA-50 continued until June 1981 when decommissioning of the entire waste storage and treatment complex at Ten Site was scheduled to begin. This work was part of a contract to remove abando lines and structures funded under th construction contract "Radioactive l Waste Collection System Improvem From the first pumping of wastes to TA-50 in 1963 to the last transfer in 1981, 3,840,000 gal. of untreated Ten Site discharges were transferred. The radioactivity of the waste had decreased significantly through the ye and by 1981, it was unlikely that treatment was required.

In 1961, a small reactor test pit v provided in a new building, TSL-29. manage the expected radioactive liqui wastes, a neutralization station, TSL-4 and a set of storage tanks, TSL-31 (1,(and 5,000 gal.) were constructed to th south of TSL-29. The storage tanks h pumps to transfer the wastes to the inl header along TSL-10.

In 1968, the Fast Reactor Core Te Building, TSL-27, was provided to the east of TSL-29 for the LAMPRE II reactor, and its radioactive waste lines were tied into TSL-41. The test facility was never completed. Waste flows fron both buildings were minimal with little radioactivity.

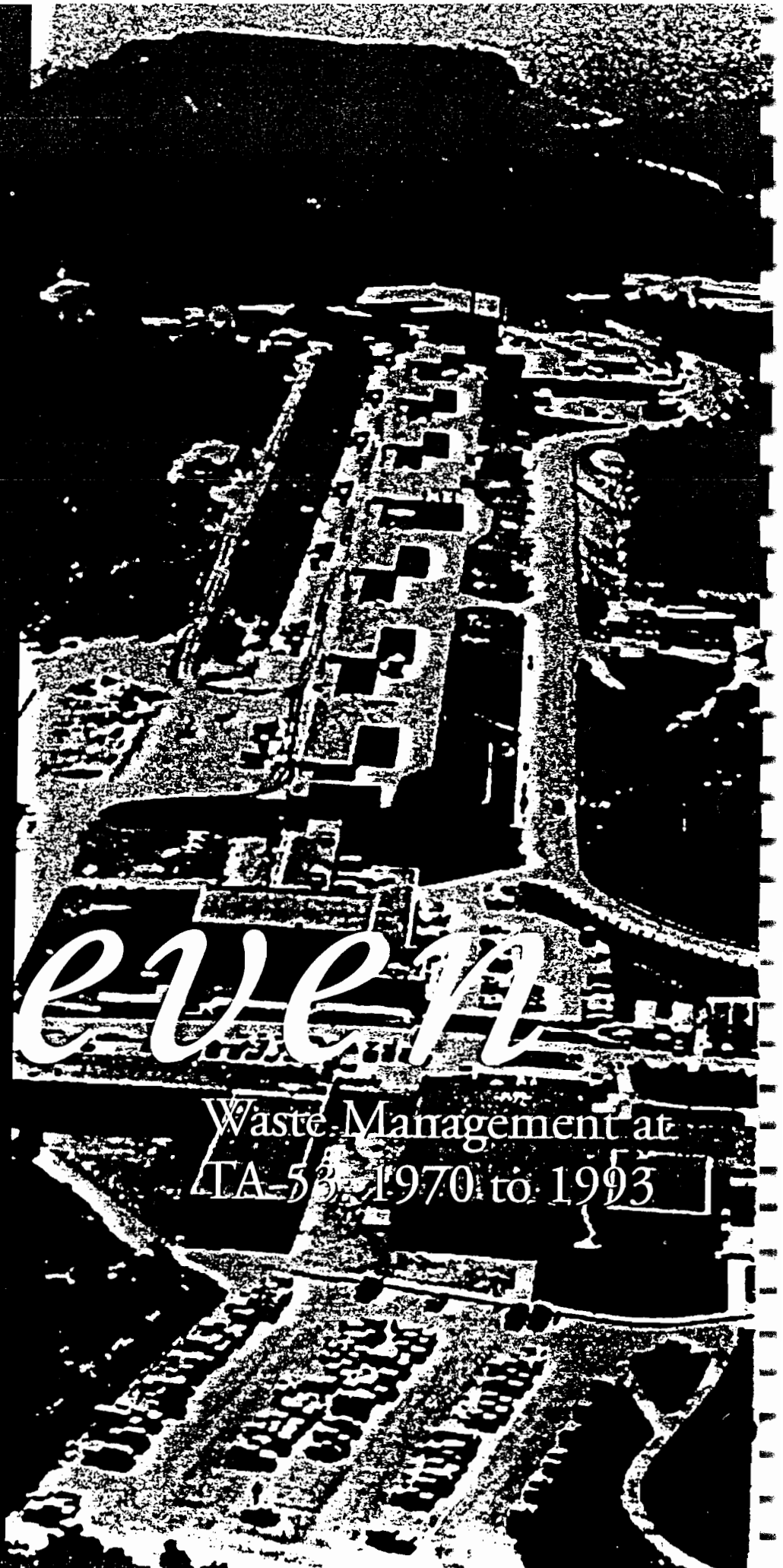
In February 1985, both TSL-31 and TSL-41 were removed as being unnecessary. TSL-27 is now the Nuclea Safeguards Research Building, and TSL- is the Gas Laser Building.

The force main from the TSL-10 storage tanks to TA-50, originally 3 in. i internal diameter, had two sections rerouted around new construction durin the period of its use, and in one instance because of the difficulty of obtaining

3-in. pipe, the rerouted section was replaced with 4-in. pipe. In the first decommissioning activity at TA-35, 305 ft of the force main were removed, denying any further transfers. Several other lines were removed in 1981, but most of the decommissioning—lines and structures—occurred in 1984 and 1985. Because of cover by pavement or structures, intersections with utilities and significant depth of burial, approximately 2,100 ft of the line were left in place.

References

1. J. P. Hutchinson, *et al.*, "Treatment of Wastes Containing Radioactive Barium, Lanthanum, Strontium and Yttrium," Proceedings of a Seminar at the Taft Engineering Center, Sanitary Aspects of the Atomic Energy Industry, Cincinnati, OH, December 6-9, 1955.
2. J. C. Elder, *et al.*, "Radioactive Liquid Waste Lines Removal Project at Los Alamos (1981–1986)," Los Alamos National Laboratory report LA-10821-MS (September 1986).
3. "RFI Work Plan for Operable Unit 1129," LA-UR-92-800 (May 1992).



CHAPTER *seven*

Waste Management at TA-53, 1970 to 1993

154 1963–1983: RECENT

Many of Los Alamos' Major Scientific Achievements Come from its World Renowned Meson Physics Facility

LAMPF provided an exciting new facility for the expansion of knowledge and application to human needs.

It was named in honor of the late Senator Clinton P. Anderson of New Mexico, a staunch friend of Los Alamos.

First Beam Achieved At LA Meson Facility

The first beam of the Los Alamos Meson Physics Facility (LAMPF) was achieved at 11:55 p.m. last night, June 10.

The 5 MeV (million electron volts) proton beam was a test of the 750 keV (thousand electron volts) Cockcroft-Walton injector, the beam transport system and the first drift-tube Alvarez accelerator tank. A graphite beam stop was used to halt the beam after it had traveled a few yards. Health monitors in the area reported a reading of approximately one million neutrons per second in the beam.

Dr. Louis Rosen, head of the Medium Energy Physics division at LASL, labeled the test "a real milestone" so that his crew is now able to produce a beam through the first section of the three-section accelerator. Dr. Rosen's division is charged with the overall responsibility for the LAMPF project.

Los Alamos Monitor 6/12/70

Cancer Patient Tests Begin

Tests on cancer patients began at LAMPF Monday evening, according to an announcement made by the UNM medical department.

The great, half-mile long particle accelerator was used to bombard skin tumors in two patients during the evening and well into the night.

It will be six to 12 months before long term effects of the current radiation tests can be assessed.

The Clinton P. Anderson Meson Physics Facility, as it is formally labelled, can be used to create a tremendous stream of negative pi mesons (pions). It is hoped that the beam can be so carefully tuned that the pions will release their energy precisely within a deep-seated inoperable tumor and without injuring surrounding healthy tissue.

The studies are being conducted by the University of New Mexico Cancer Research and Treatment Center under a grant from the National Cancer Institute division of Research resources and centers. Cancer Center physicians have been assisted by LASL scientists operating the Meson facility.

LAMPF is the only facility producing pions in sufficient quantities for medical testing. Initial studies are designed to compare the effects of conventional x-rays with those of pions, using low dose levels. The tests are designed so that no ill effects in normal tissue are expected.

Actual studies to determine the curative potential of pions with cancer in humans are not expected to begin for about a year, after the results of the current series and later tests

Fig. 7-1. *The proton linear accelerator, LAMPF.*

In the late 1960s, the Medium Energy Physics Division received funding to construct a half-mile-long beam channel for an 8-MeV proton linear accelerator (Fig. 7-1). The facility is known as the Los Alamos Meson Physics Facility (LAMPF) or, formally, Clinton P. Anderson Meson Physics Facility, in honor of Senator Anderson who was instrumental in obtaining the funding. The facility was designed by Giffels and Rossetti, Inc., of Detroit, MI, [1] and constructed by Rutherford (injector building), Hensel Phelps (beam channel), and Brennan (Area A, Area B, dor switchyard) among others. The fi run at 5 MeV was successfully con on June 10, 1970.

Floor drains were provided alo beam channels, at target areas, and cooling water recirculation pumps. Cooling water was continually deio by ion exchangers to limit the build radioactivity. Cooling water system to be drained infrequently, perhaps annually, ensuring that waste manag would be a minor problem.

For waste management, all floor drains in operating areas were piped t buried 2,500-gal. tanks at the end of t beam channel just southwest of Beam A. The tanks were provided with abo 17 ft of cover to ensure that radioactiv at the surface was at background levels. Depth indicators, interconnecting pipi and vertical pumps were included (Fig. 7-2). The wastes were to be pump into tank trucks and hauled to TA-50 for treatment. In practice, however, when the beam was in operation, waste flow quantities were high and waste radioactivity was low. The high volume resulted from leaks in pumps, valves, an target areas; H-7 personnel attended ma evening and weekend callouts. When h levels were indicated, H-1 personnel at the site would call H-7. The H-7 perso would report to the site and collect a sample from the filled tank using a samp tap on the pump. From the beginning of operations and because of the low level of radioactivity, the H-7 and H-1 representatives and the ENG Division coordinator at the site would connect a hose to the pump on the filled tank and

transfer its contents to the nearest manhole on the sanitary waste sewer system. This system ended in two lagoons with surface areas of 1 acre each east of the site [3]. The lagoons had been designed to be sufficiently large to contain all sanitary wastes from the site without ever overflowing. However, because of numerous problems with the circulating cooling water system and the discharge of uncontaminated water to the sanitary system, the lagoons overflowed frequently, particularly in winter when evaporation rates were lower. Table 7-1 provides data for the years 1985-1992.

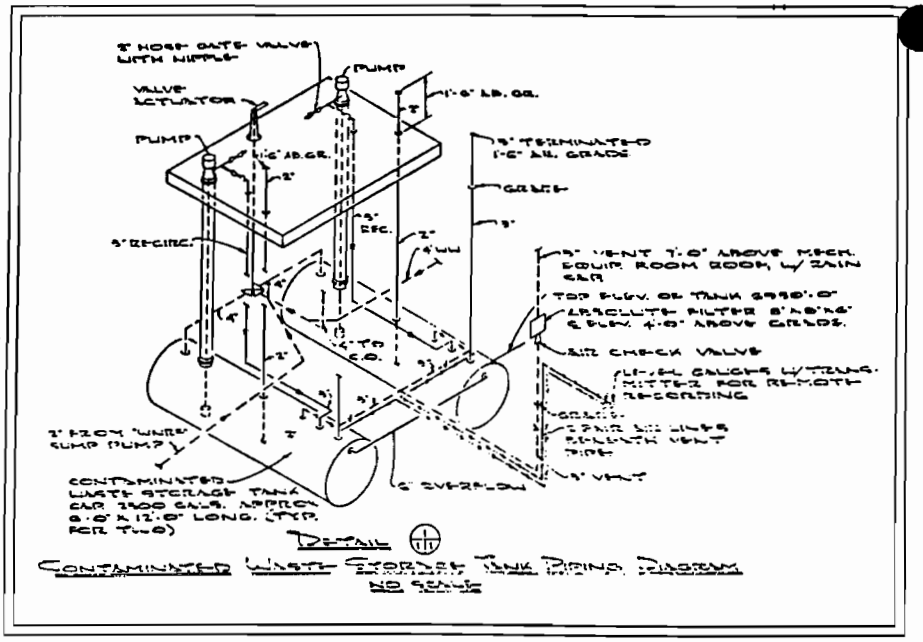


Fig. 7-2. LAMPF waste storage tanks.

THE NUCLEAR CHEMISTRY WING OF MPF-1

While beam problems were being studied and resolved, W. C. Kruger and Associates, Architects and Engineers, Santa Fe, was designing a nuclear chemistry wing to be attached to the Administration Building. The structure was primarily offices, but it also contained four chemistry labs. A pneumatic tube from the accelerator to a chemistry lab was provided to safely transfer irradiated targets or "rabbits." The highly radioactive liquid wastes from analyses of the rabbits were drained to a 250-gal. neutralization tank in the basement where a sodium hydroxide solution from a 200-gal. steel dilution tank would automatically neutralize the waste before it overflowed to storage. The dilution tank was fed from a 100-gal. steel storage tank for 50% sodium hydroxide near the ceiling and from an industrial water line. The neutralization tank and the 3,000-gal. storage tank were

Year	Discharge from MPF 68 and 69 to lagoons (L)	Beryllium-7 (Ci)	Hydrogen-3 (Ci)	Discharge from lagoons to environment (L)	Beryllium-7 (Ci)	Hydrogen-3 (Ci)
1985	1,600,000	9.5	86.5	9,520,000	0.1	6.7
1986	1,160,000	38.1	103.0	5,640,000	0.8	17.2
1987	759,000	90.6	89.9	4,109,000	0.3	10.9
1988	840,000	18.0	88.0	2,360,000		4.9
1989*	912,000	2.5	82.2	12,700,000	0.07	25.0
1990	1,618,000	83.4	0.6	0		
1991	1,158,000	4.4	0.1	0		
1992	287,740	1.0E-4	1.2E-4	0		

Table 7-1. *Operating Data: TA-53 Waste Lagoons, 1985-1992.*
**Last year in which there were overflows to the environment.*

of concrete construction recessed in the basement floor. High- and low-level alarms and a depth indicator were provided. Vertical wet pit pumps were installed to transfer the waste to an H-7 tank truck in a loading area on the east side of the building, or to a floor drain in the basement that was connected to the sanitary waste system for use when radioactivity was very low. The liquid caustic tank was filled as necessary from a delivery truck at the loading pad. A tank truck and the plastic 200-gal. Tuff Tanks™ were used to transfer waste to the TA-53 lagoons or to TA-50-2, but the service was infrequently needed.

THE ION EXCHANGE RESINS PROBLEM

The tap water used for beam and target cooling was passed through ion exchange columns to deionize it to keep the cooling water radioactivity as low as possible. In the beginning of operations, Meson Physics (MP) Division contracted with an outside company to replace the resin cartridge. It was decided in late 1971, however, to flush the exhausted resins into the radioactive waste collection system. A three-way valve was installed in the line near the two 2,500-gal. storage tanks to divert all flow to a new resin storage tank. This tank [2] was a vertical cylinder 65 ft long, 28 in. in diameter, with the 28-in. section about 15 ft below grade. It is designated TA-53-59. A 12-in. steel pipe extended from the 28-in. section to grade. A 0.5-in. compressed air line within a 2.5-in. resin removal line was provided to lift the resin from the tank to H-7 containers. H-7 engineer designed a system of truck-mounted drums to separate v and resin, retain the resin in the dr and recirculate the water back to th storage tank, but the system was never constructed.

After analysis to ensure that wa radioactivity was low, the resin remo system was tested and determined to effective. Resins were blown beyond the collection devices into parking ar (C. R. King, J. C. Casados). Since that test and probably because a resin separation system for unloading was r constructed, the resin collection tank has likely never been emptied.

THE MERRIMAC AREA CHEMISTRY LABS

In early 1972, plans were complete for managing relatively hot wastes from a chemistry lab in the Merrimac Area. The lab, including a hot cell, was locate in the shop and storage area on the southwest corner of Beam Area A at Building MPF-3. The wastes would be produced from chemical analyses of irradiated targets. H-7 worked with Bruce Dropesky, the principal chemist involved in designing the facility. The facility included the following:

- a 100-gal. capacity, horizontal cylindrical storage tank for 50% sodium hydroxide,
- a 185-gal. tank for diluting the sodium hydroxide,
- a 300-gal. neutralization tank with mixer,
- a pH control system, and

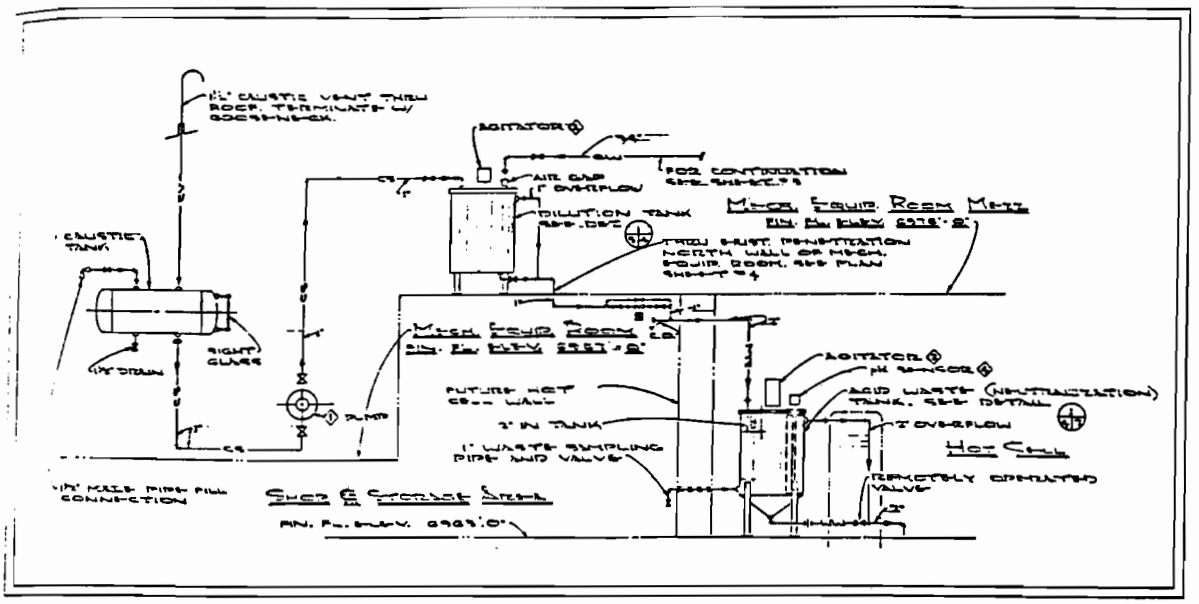


Fig. 7-3. Planned facility to treat wastes from the Merrimac Area.

- a remotely operated valve on the 2-in. drain line from the neutralization tank (Fig. 7-3).

The valve permitted directing flow to a pump for discharge to a tank truck or to the floor drain on the collection system of MPF-68 and -69. The system was installed and put into operation in 1972.

As programs developed, however, most of the analytical chemistry work was completed at the labs in MPF-1 or at TA-48. Tank-truck transfer of the waste never became necessary.

THE WEAPONS NEUTRON RESEARCH FACILITY

In 1972, 1973, and early 1974, H-7 worked closely with personnel of MP Division on plans to manage radioactive liquid wastes from new construction, the Weapons Neutron Research (WNR) Facility. This Department of Defense (DoD) laboratory was constructed at the south end of a beam line running south from the beam switchyard at the east end of the experimental area. Waste storage facilities were to the east of the building along the access road. Waste volumes were expected to be low, and truck transfer to TA-50 would be the primary disposal mode. A hose connection on the pump discharge piping was provided to permit pumping low-level radioactive wastes through a temporary fire hose connection to a sanitary sewer manhole. Original plans by the LASL Engineering Division and MP Division called for duplicate 4,000-gal. steel tanks, 10 ft long and 8 ft in diameter. As finally designed by the Architect-Engineer Bernard Johnson, Inc., however, the tanks became duplicate adjoining

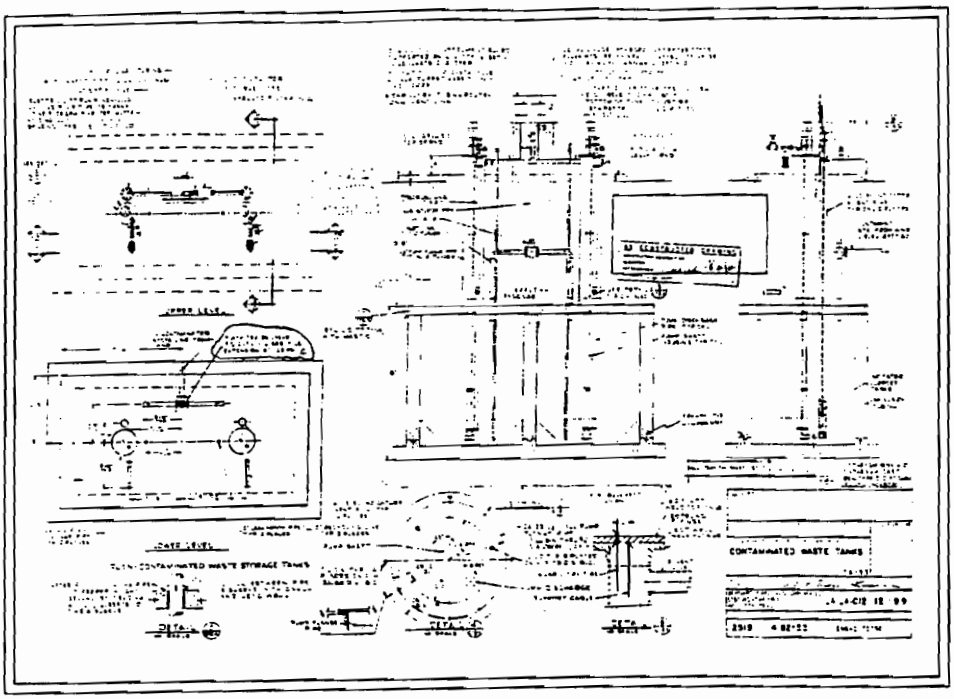


Fig. 7-4. Waste tank proposed for the Weapons Neutron Research Facility.

reinforced concrete units with an overflow connection. Wastes from the 4-in. line could be diverted to either tank; a vertical wet pit pump was installed in each tank with provisions to recirculate, mix, and sample; and level gauges monitored the depth (Fig. 7-4).

As in the waste management practices at the storage facilities, wastes to the WNR tanks were generally of low-level radioactivity, and hauling was deemed unnecessary. Instead, a fire hose was attached to the pump discharge line and extended to the nearest manhole on the sanitary sewer system. In this way, all WNR radioactive liquid wastes were transferred to the sewage lagoons.

During 1983 and 1984, the Proton Storage Ring (PSR) was constructed just south of the main east–west road through the site, La Mesita Road, and due north of the WNR. For beam purposes, it was along the west edge and connected WNR beam line. Numerous floor for radioactive liquids were provide within the ring and connected to a line that drained to the WNR storag tanks. This new connecting line wa constructed in accordance with a ne philosophy, adopted under the 1979 Radioactive Liquid Waste Collection System Improvements (RLWCSI) Pr requiring encasement and continuou monitoring for leakage of all buried radioactive waste lines. (See also Ch 8.) Waste volumes and radioactivity from the PSR had also been very low.

During 1986 and 1987, the Neu Scattering Experimental Halls, part o country's effort to intercept incoming missiles ("Star Wars"), were construct adjoining and to the east of the WNR facilities. The radioactive waste systen serving the new facilities drained to th WNR storage tanks through an encase pipe-within-a-pipe, fiberglass-reinforc pipe (FRP) line. Assembling the FRP system was difficult, but use of FRP w required by the expected high tempera of the wastes.

RLWCSI AT TA-53

The 1979 major improvements project for the collection system includ changes at the TA-53 waste storage tan Drained concrete loading stations were provided at MPF-1; MPF-68 and -69; MPF-144 and -145. Instrumentation added to measure tank levels in all was storage tanks, and wiring was installed transfer this data to an intelligent multiplexer (MUX), designated "MUX

H." From MUX H, the information was transferred over telephone pairs to a computer in room 114 at TA-50-1 where the data were recorded. Existing piping was not replaced with double-contained pipe, and remote operation of storage tank pumps was not included in the project. Between 1993 and 1994, a program to replace all MUXs with programmable logic controllers (PLCs) was underway, and MUX H was scheduled to be replaced with PLC-16.

A NEW RADIOACTIVE WASTE LAGOON

From the first construction of TA-53, expansion of the facilities was almost continuous. New target areas with new cooling systems were developed, new office facilities were added, and the operating and maintenance staffs grew. The volume of sanitary and industrial liquid wastes could not be contained in the two lagoons and overflow occurred very early in the history of the site, in large part due to leaks in cooling water systems.

When the Federal Water Pollution Control Act of 1972 and amendments were promulgated and regulations under the National Pollutant Discharge Elimination System (NPDES) were established, it became necessary to identify all liquid discharges to navigable streams—basically all discharges to the environment. Each discharge was given a numerical designation, and the required chemical quality was established in negotiation with State of New Mexico and Environmental Protection Agency (EPA) representatives. Because the TA-53 waste lagoons almost continuously overflowed, their outfall was included in the program. Effluent sampling, analyses, and reporting requirements were a continuing expense, so H-7 and H-8 studied ways to return the system to the original concept of total evaporation. The eventual resolution was construction of a third lagoon [3], about 1.3 times as large as either of the originals, adjoining the original system on the south side. The new lagoon had 6-in. sand cushioning and was lined with welded, reinforced hypalon sheets. Even with this large additional surface area, however, the third lagoon overflowed as soon as it filled.

During this same period, H-7 and H-8 planned to improve managing the radioactive liquid wastes and perhaps prevent their discharge to the environment. They eventually resolved to use the newest (south) lagoon only for radioactive wastes. This decision entailed constructing new waste lines from MPF-68 and -69 and from MPF-144 and -145 to the south lagoon using double-contained lines and continuously monitoring for leakage. Merrick and Company completed the plans, and the changes were constructed in 1989 [4]. For the main leg from MPF-68 and -69 to a junction box at the head of the south lagoon, 2170 ft of 4-in. gravity line were required. For the leg from MPF-144 and -145, 689 ft of 4-in. pressure main were necessary. The branch line for MPF-144 and -145 joins the main line at main line station 8 plus 61, where station 0+00 is at MPF-68 and -69. Three new manholes (vaults) were provided in the main line and one in the branch; all

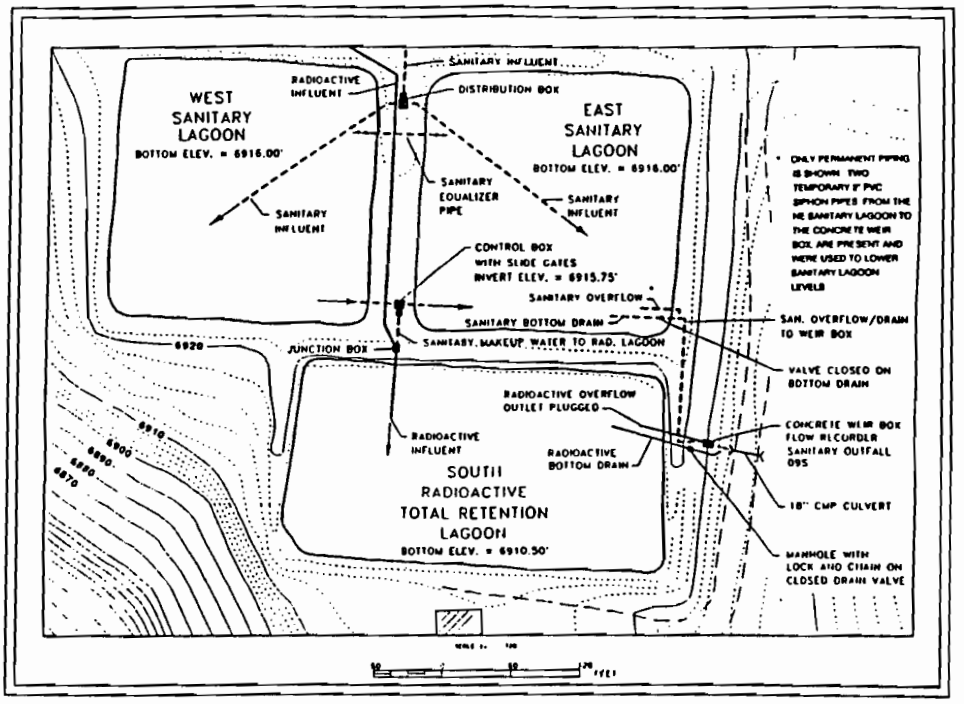


Fig. 7-5. *The lagoon system at TA-53.*

Month	Flow (L)	^{3}H (Ci)	^{7}Be (Ci)	^{22}Na (Ci)	^{54}Mn (Ci)	^{57}Co (Ci)	^{60}Co (Ci)	^{134}Cs (Ci)
Jan.	6.28E+6	14.44	6.9E-2	2.6E-2	1.1E-1	3.7E-2	1.0E-2	0
Feb.	5.19E+6	8.15	0	8.8E-2	2.2E-2	1.0E-2	2.9E-3	0
Mar.	1.25E+6	2.39	0	1.3E-2	9.6E-3	6.3E-3	1.9E-3	0
Apr.	No effluent discharged after March 1989							
Total	1.27E+7	24.98	6.9E-2	0.13	0.14	5.4E-2	1.5E-2	0
Mo. Ave. (12 mo.)	1.06E+6	2.08	5.8E-3	1.1E-2	1.2E-2	4.5E-3	1.2E-3	0

Table 7-2. *Lagoon effluent at TA -53 for calendar year 1989.*

were equipped with liquid-level alarm tied into MUX H. Also connected to MUX H, and therefore to the TA-50 computer, were the following:

- percentage depths in storage tanks in MPF-1; MPF-68 and MPF-144 and -145; and MPF- (Merrimac);
- overflow alarms at all waste storage tanks; and
- pH in wastes at the MPF-1 storage tank.

Although discharges to the environment could reach 1,000,000 ga per month when all liquid wastes were directed to the three lagoons, discharge from the radioactive waste lagoon drop to zero when the new system began operating (Table 7-2). Figure 7-5 show the lagoon system.

The two original lagoons were bypassed in early 1993 by a new waste l that conveyed the sanitary wastes to a n consolidated sewage treatment facility ju east of TA-46 [5, 6]. The TA-53 lagoon operation no longer discharges to the environment.

Although H-7 (CST-7 in late 1993 and CST-13 in late 1994) continues to monitor much of the radioactive liquid waste operations at TA-53, responsibility for these operations was transferred in the early 1990s to ENG-5 (FSS-9 in late 1994).

References

1. Plans and Specifications, Phase II. Site Utilities, Los Alamos Meson Physics Facility, Giffels & Rossetti, Inc.; Detroit, Michigan.; AEC Contract AT (29-2), (April 1968).
2. Plan, Los Alamos Meson Physics Facility, Mechanical Systems Additions, Contaminated Waste Settlement Tank, Bldg. MPF-3, TA-53, No. ENG C-50636 (AEC No. LA-KQ-2), sheet 2 of 8, (January 14, 1972).
3. Construction drawings, TA-53 Lagoon Upgrade, ENG C-44772, Zia Company.
4. LAMPF Wastewater Modifications, Merrick and Company, ENG-C 45523 (1989).
5. Plans and Specifications, TA-53 Sanitary Wastewater System, ICF Kaiser Engineers, Inc., ENG C-45995 (October 1990).
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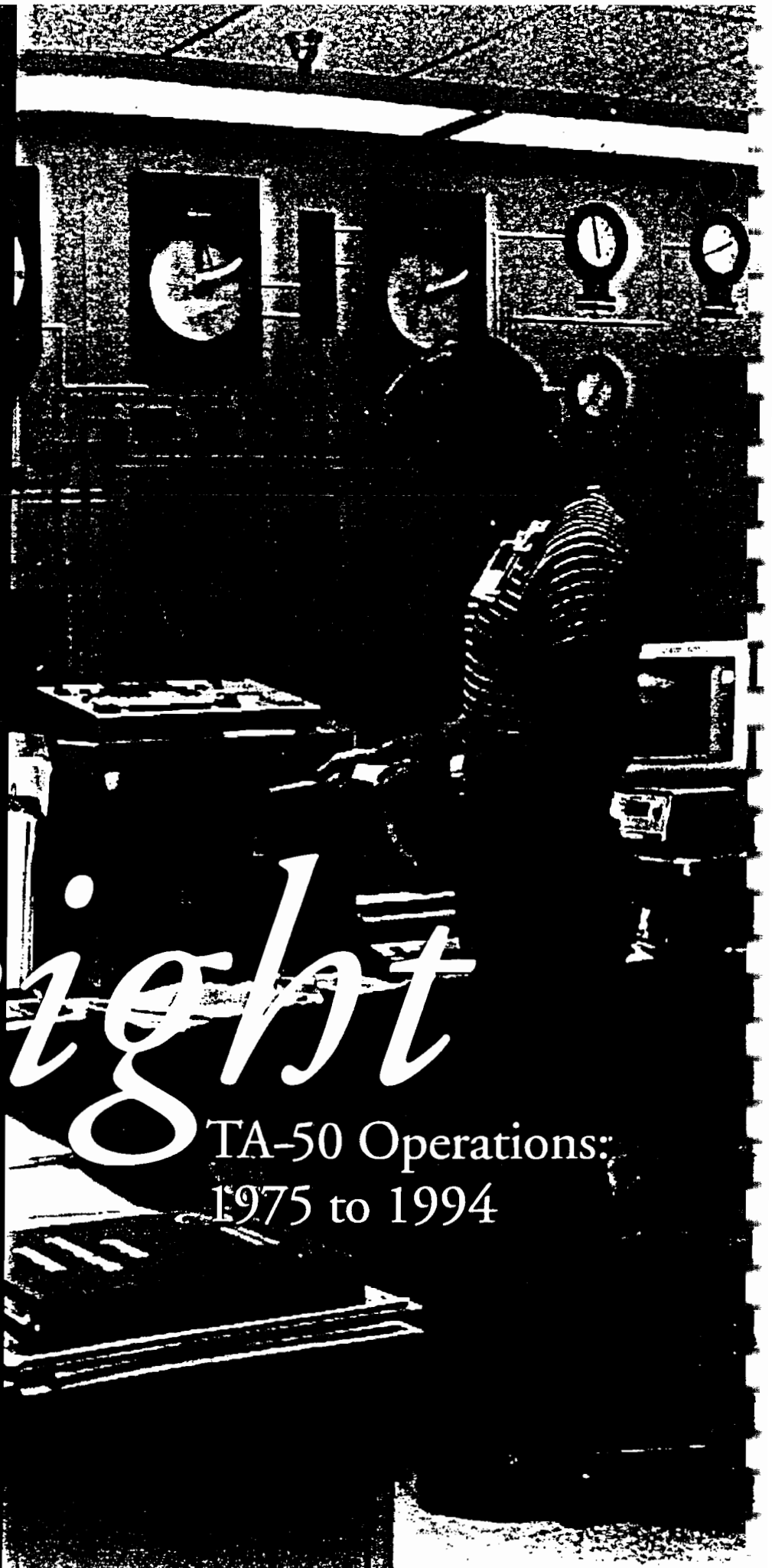

CHAPTER *eight*

TA-50 Operations: 1975 to 1994

Division	Division Leader	Tenure	Group	Group Leader*	Tenure	Section Leader	Tenure
Health (H)	T. L. Shipman, M.D.	1955-69	H-7	C.W. Christenson	1953-75	J. P. Hutchinson	1954-62
	D. D. Meyer, Acting	1969–70				R. G. Thomas	1963-62
	H. O. Whipple, Acting	1970–70				L. A. Emelity	1963–75
	G. L. Voelz, M.D.	1970–82		T. K. Keenan	1975-81	J. R. Buchholz	1975–92
Health, Safety, and Environment (HSE)	J. Aragon	1982–87	HSE-7	L. C. Borduin	1982–84		
	J. M. Puckett	1987–91		R. Garde	1984–87		
				R. A. Koenig	1987–89		
Environmental Management (EM)	T. C. Gunderson	1991–93	EM-7	A. F. Drypolcher	1989–94	S. W. Hanson	1992–94
Chemical Science and Technology	A. J. Gancarz	1993–present	CST-7				
			CST-13	S. W. Hanson**	1994–		

Table 8-1. *Administration of the division, waste groups, and liquid waste sections, 1955 to 1994.*
** John F. Newell was the first Group Leader, 1948 - 1953. The group during this time was part of the Industrial Waste Branch, LAAO AEC until transferred to LASL in 1955.*
***The Liquid Waste Section became Group CST-13 in October 1994.*

Name	Pay status	Series*	Title
J. R. Buchholz	full-time	SM	Section Leader
C. W. Christenson	full-time	SM	Special Problems
J. A. Drago	TTLT	SM	University of California graduate student
W. M. Dunne	full-time	SM	
L. A. Emelity	full-time	SM	Alternate Leader
T. E. Kain	full-time	GR	
T. K. Keenan	full-time	SM	Group Leader
C. Martinez	full-time	GR	
P. E. McGinnis	full-time	SM	
D. M. Rohrer	full-time	SM	Special Problems
J. P. Valdez	full-time	GR	TA-21 Plant Operator
R. C. Ward	full-time	GR	Special Problems
N. W. Weeks	full-time	GR	Chief Plant Operator
L. D. Williams	full-time	GR	TA-50 Plant Operator

Table 8-2. *Liquid Waste Section personnel in HSE-7, June 1975.*
**SM (staff member); GR (Graded Series)*

Leadership of the Liquid Dispc (LD) Group was changed in J 1975. Thomas K. Keenan, a l chemist from H-8 (and earlier, CMB- was appointed Group Leader; Ludgard Emelity was made alternate; and Jerry Buchholz, leader of the Special Studies Section, became the leader of the Liqui Waste Section. Table 8-1 is a list of Grc Leaders and Liquid Waste Section leade from the first organization of the group 1948 to 1994. Table 8-2 is a list of the Liquid Waste Section personnel at the time Keenan became Group Leader.

Also at this time, group responsibiliti included solid waste (low-level, transuran [TRU], and high-level wastes), chemical waste management, and development of incineration of radioactive wastes.

The TA-45 and TA-50 sites were known as the "Liquid Disposal (LD)" site originally because their primary function was treatment and disposal of radioactive liquid wastes. With the addition of other responsibilities, a name change was indicated and in a late 1976 memo (Fig. 8-1), Thomas Keenan requested that TA-50 be known as the Waste Management (WM) Site. The name was changed in early 1977.

THE IMPROVEMENTS PROJECT FOR THE RADIOACTIVE LIQUID WASTE COLLECTION SYSTEM

Because of the adverse national radio and television publicity about the two waste line spills in 1974 and the recommendations of the Buried Lines and Study Group reports, LASL management placed a high priority on line-item funding

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545
Telephone Ext: 4301

OFFICE MEMORANDUM

TO : Robert Bradshaw, ENG-DO, MS 610 DATE: December 28, 1976

THRU : G. L. Voelz, M.D., H-DO, MS 690

FROM : T. K. Keenan, H-7 Group Leader TK

SUBJECT : TA-50 SITE NAME CHANGE

SYMBOL : H7-76-595

MAIL STOP: 518

For many years, TA-50 has been named the Liquid Disposal Site. Indeed, the historical aspects of the work performed here made that a proper title.

However, with the completion and imminent operation of the TDF facility, and the 6/75 reorganization of H-7 and H-8, the expanded activities of H-7 suggest a more appropriate designation for TA-50.

I request that action be taken to rename TA-50 the WASTE MANAGEMENT (WM) Site and that the necessary signs and building I.D. numbers be changed.

TKK:bh

xc: L. A. Emelity, H-7
L. C. Borduin, H-7

Fig. 8-1. Request for the TA-50 site name change.

Phase	Description	FY	Cost ($M)
1	Radioactive Liquid Waste Collection System Improvements	78	12.50
2	Upgrading of Industrial Liquid Waste Treatment Plants	78	8.65
3	Radioactive Liquid Waste Solar Evaporation Ponds	82	8.10

Table 8-3. *The three phases for the waste treatment improvements.*

Phase	Cost ($)
engineering, design, and inspection	891,000
construction of new system	5,650,000
lab procurement and direct project support-new system	1,246,000
removal of abandoned system (Zia/Los Alamos Construction, Inc. [LACI])	2,845,000
lab direct project support, decommissioning, and removal	1,300,000
contingency	523,000
Total project cost	12,500,000

Table 8-4. *Funding for Improvements to the Radioactive Liquid Waste Collection System Project.*

for waste line and treatment plant improvements. Based on the total waste evaporation at Rocky Flats, labeled "zero discharge," a similar concept was explored for LASL wastes, and the method recommended was solar evaporation from large ponds on the east end of South Mesa. The project package developed and accepted for funding by the DOE consisted of three phases [1], Table 8-3.

A breakdown of the $12.5M funding for the Collection System Project is in Table 8-4. A large portion of this funding, about $4.1M, was provided to remove the old lines and appurtenances and related costs. New line construction was designated "Subproject A" and line removal was "Subproject "B."

THE NEW CONTINUOUSLY MONITORED COLLECTION SYSTEM, PHASE A

The design criteria for the new sy included the following:

- a double-encased, pipe-within-a system;
- continuous monitoring for leaka lines or manholes;
- acid-resistant pipe material;
- preference for welded pipe joints
- gravity flow where possible;
- flow monitoring of all discharges the system with transmittal of th data to TA-50;
- a computer control center at TA-
- improved loading stations for tan trucks hauling from specific sites:
- storage tanks that would be fully inspectable for leakage;
- a requirement that no flow throug manholes would be open-channel:
- a requirement for high-quality reinforced concrete manholes sealed internally and externally against leakage.

The DOE, with some assistance fro H-7, selected the firm of Daniel, Mann, Johnson, and Mendenhall of Los Angeles CA, to design the new system, and the plans and specifications were completed i May 1980. Bids were taken on July 31, 1980, from eight firms, and a constructic contract for $5,592,700 was awarded to Davis and Associates, Inc., of Santa Fe, NM, on September 29, 1980. The Notic to Proceed was issued on September 29, 1980, with a completion time of 730 calendar days. A copy of the first page of tl construction contract is shown in Fig. 8-2.

STANDARD FORM 23
JANUARY 1961 EDITION
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.401

CONSTRUCTION CONTRACT
(See instructions on reverse)

CONTRACT NO
DE-AC32-80AL12245

DATE OF CONTRACT
September 26, 1980

NAME AND ADDRESS OF CONTRACTOR

Davis & Associates, Inc.
P. O. Box 2184
Santa Fe, New Mexico 87501

CHECK APPROPRIATE BOX

- [ ] Individual
- [ ] Partnership
- [ ] Joint Venture
- [x] Corporation, incorporated in the State of New Mexico

DEPARTMENT OR AGENCY

U. S. Department of Energy

CONTRACT FOR (*Work to be performed*)

Radioactive Liquid Waste Collection System Improvements, Base Bid.

PLACE

Los Alamos, New Mexico

CONTRACT PRICE (*Express in words and figures*) Five Million Five Hundred Ninety-two Thousand Seven Hundred Dollars and No Cents ($5,592,700.00)

ADMINISTRATIVE DATA (*Optional*)

Budget Project No.: GB00-78016G000L72
Appropriation No. : 89X0221
Allotment No. : AL-01-40 (112)

The United States of America (hereinafter called the Government), represented by the Contracting Officer executing this contract, and the individual, partnership, joint venture, or corporation named above (hereinafter called the Contractor), mutually agree to perform this contract in strict accordance with the General Provisions (Standard Form 23-A), Labor Standards Provisions Applicable to Contracts in Excess of $2,000 (Standard Form 19-A), and the following designated specifications, schedules, drawings, and conditions:

Specification booklet entitled "RADIOACTIVE LIQUID WASTE COLLECTION SYSTEM IMPROVEMENTS FOR LOS ALAMOS SCIENTIFIC LABORATORY, LOS ALAMOS, NEW MEXICO" including Invitation No. DE-FB32-80AL12245, documents and drawings listed therein and Amendments 1, 2, 3, 4, 5, 6 and 7.

ADP Vouchered
Date 9/26/80
By CJ
Date 9/26/80

PRIORITY RATING DO-E-1 CERTIFIED FOR NATIONAL DEFENSE USE UNDER DMS REG. X

YOU ARE REQUIRED TO FOLLOW THE PROVI. OF DMS REG. X AND OF ALL OTHER APPLICABLE REGULATIONS AND ORDERS OF DMSA IN OBTAINING CONTROLLED MATERIALS AND OTHER PRODUCTS AND MATERIALS NEEDED TO PERFORM THIS CONTRACT

WORK SHALL BE STARTED Within twenty (20) calendar days after date of receipt by the Contractor of Notice to Proceed.

WORK SHALL BE COMPLETED Within seven hundred thirty (730) calendar days after the date of receipt of Notice to Proceed by the Contractor.

33-103

Fig. 8-2. Construction contract awarded to Davis and Associates, Inc.

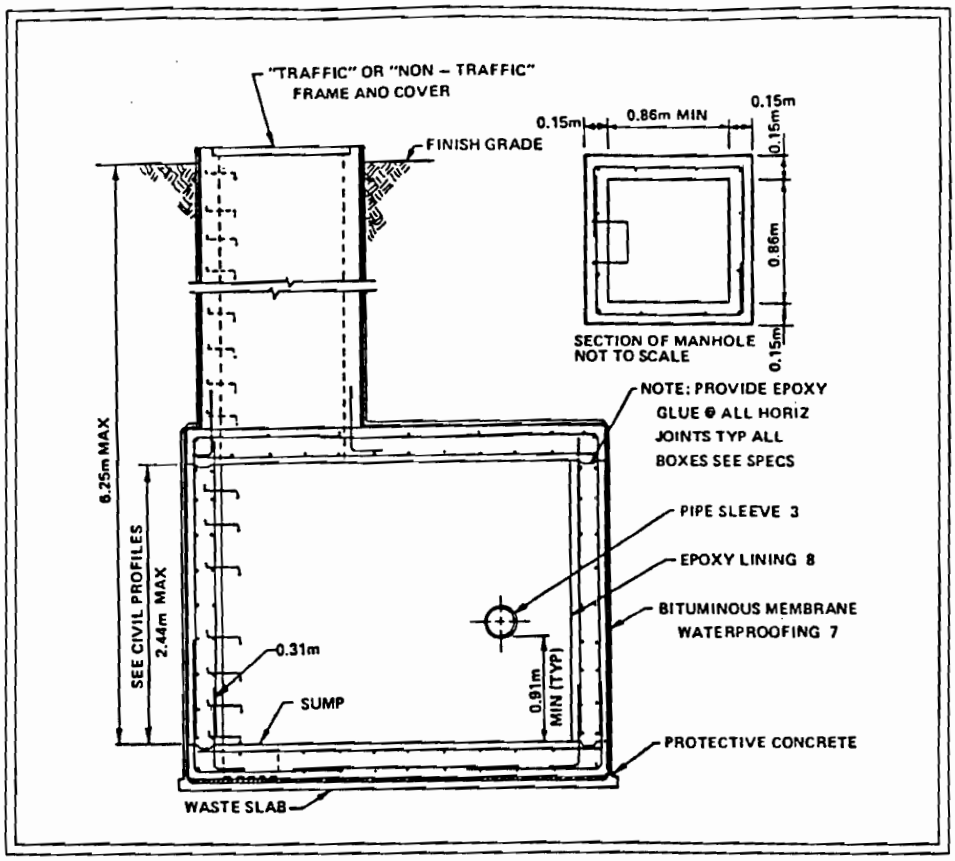

Fig. 8-3. *Typical manhole design.*

Nominal pipe size		Minimum wall thickness	
mm	in.	mm	in.
76.2	3	5.49	0.216
101.6	4	7.37	0.290
152.4	6	10.85	0.427
203.2	8	14.15	0.557
254.0	10	17.63	0.694
304.8	12	20.90	0.823

Table 8-5. *Polyethylene pipe specifications. Minimum design working pressure: 689.5 kPa (100 psi) Minimum length: 6.09 m (20 ft)*

The specifications called for

- 22,000 ft of double-encased polyethylene line;
- 34 tie-ins to existing buildings and vaults;
- 78 new manholes;
- 4 new lift stations;
- 3 new storage tanks;
- repair and sealing of eight existing storage tanks; and
- an electronic monitoring, measuring, and controlling system operated from a computer in a remodeled lab in TA-50-1.

The Laboratory purchased the electronics computer, multiplexers, wiring, etc. A diagram of the typical manhole designed for the system is shown in Fig. 8-3, and a schematic of the con based monitoring system is shown i Fig. 8-4. Table 8-5 lists some of the specifications for the polyethylene p

Alarms for liquids in manholes, measurements of flow from waste generators, indication of pH and dep and status and control of pumps and valves were hardwired to multiplexers where the information was transmitte the computer at TA-50-1 over telephc pairs. High-level alarms were also transmitted to the Central Alarm Stat (CAS), TA-3-440, where they were forwarded to TA-3-223, the utility cor facility, which is manned continuously If the computer fails, an automatic telephone system dialed a name on a call-out list of operators and, with a vo synthesizer, informed the operator of th computer problem.

Mort Sanders was hired by the gro in 1981 to oversee the installation and operation of the computer system, and Bob Payne joined the group then to maintain the system, particularly the field units.

The computer was the Digital Equipment Corp. PDP-11/44; the entir electronics system was purchased from Schlumberger, Sangamo Weston, Inc., on the basis of the lowest bid of four technically responsive bidders and the on with the highest technical evaluation. A memo of September 13, 1979, from E-5 to SP-DO requested that the system be purchased for $354,333. With assistance from summer employees and from undergraduate and graduate college computer students, Sanders designed 80 diagrams of various aspects of the

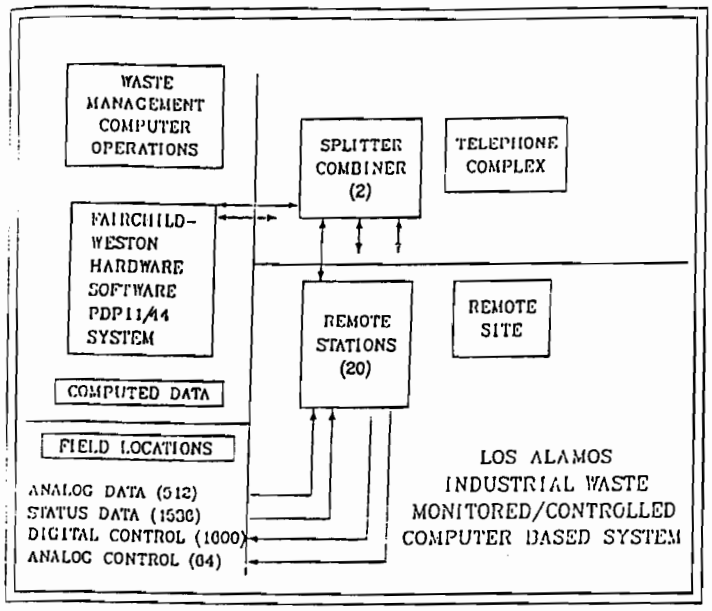

Fig. 8-4. *Schematic of the computer-based monitoring system.*

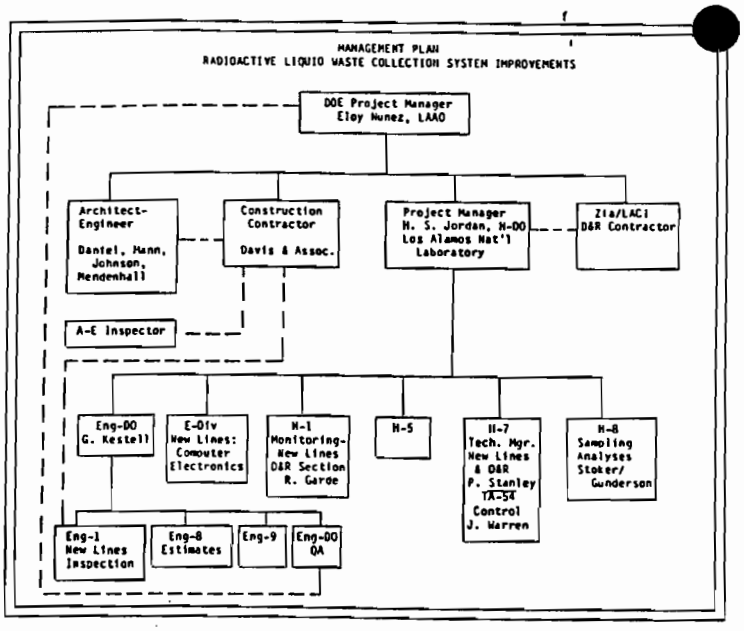

Fig. 8-5. *Management plan.*

collection system for cathode ray tube (CRT) displays. Seventeen summary displays (flow, level, pH, etc.) were also provided.

Some of the personnel involved in ensuring successful completion of the project were the following.

Position	Name
LAAO, DOE construction project manager (CPM)	E. M. Nunez
LASL CPM	H. S. Jordan
Assistant CPM	L. A. Emelity
Technical Manager, H-7	R. Garde, P. Stanley
Engineering Manager, ENG-DO	G. Kestell
LASL Field Inspector, ENG-1	M. R. Vigil
Daniel, Mann, Johnson, and Mendenhall (DMJM) Chief Engineer	W. Weinstock
DMJM Field Inspector	F. Bowling
Davis and Associates Project Manager	W. D. Junge

A diagram of the management plan is shown in Fig. 8-5.

Davis and Associates provided all of the reinforced concrete construction. The major subcontractors for Davis and Associates were as follows.

Area	Subcontractor
grading	Law Construction
mechanical	Meyer-Hinds
electrical	Beatty Electrical

By final acceptance of the Davis and Associates contract, more than 28 modifications were made, including eliminating monitoring wells at TSL-10. Final contract price was $5,562,835.

The invitation for bids included three additive alternates:

- truck-loading station at TA-2 (Omega);
- truck-loading station at TA-43 (HRL); and
- radioactive waste line connection to TA-3-40, Physics Building.

Because the Davis and Associates bid exceeded government estimates, none of the alternates were included in the contract. During the bidding and early construction period, H-7 personnel determined that several of the alternates as designed were unnecessary or had more appropriate solutions. A plan to upgrade waste treatment facilities was being completed; it included a cross-country force main to transfer treated DP-257 effluents to TA-50. The plans included injecting TA-2 wastes into this line as it crossed the site to eliminate the need for a loading station.

At TA-43, flow measurements by H-7 found that large volumes of cooling water were being discharged to the radioactive waste drains in the building, making truck transfer too time consuming and relatively unsafe. Consultation with Zia Utilities uncovered an abandoned depressed sewer (inverted siphon) crossing Los Alamos Canyon and extending from a point near HRL to a manhole on a line to the TA-3 sewage treatment plant. A line carrying all HRL liquid wastes, other than the small volumes containing a higher level of radioactivity, was connected to the depressed sewer; the arrangement eliminated the need for the loading station and any connections to municipal sewers. Und administrative controls, H-7 would pic up radioactive solutions from HRL abc certain levels of radioactivity. The line constructed under a separate contract awarded to Western States Mechanical Contractors, Inc., Albuquerque, NM, August 24, 1981, for $112,400.

The third alternate was resolved b interviewing management personnel at SM-40 and consulting the Long-Range Facilities Planning Task Force. P Divis assured H-7 that no radioactive liquids would be generated within SM-40; the Task Force felt the extension to be in tl best interests of LASL. This connectio would be added if sufficient project fur became available. The design was completed and on hand, and the line could be added in the future if SM-40 programs changed and radioactive liqu wastes were generated.

The entire $12.5M contract was funded under Budget Authorization (B 2530 with sub-BA290 covering the ne system and sub-BA291 funding remov of the old lines and appurtenances.

The completed new system was st of the art. L. A. Emelity, *et al.*, wrote a paper entitled "A New Continuously Monitored Collection System for Liqu Industrial Wastes" and presented it at t 1983 56th Annual Conference of the Water Pollution Control Federation, Atlanta, Georgia [2]. Numerous individuals and groups from througho the DOE complex visited TA-50 in th ensuing years to inspect the computer facility and its capabilities.

A surprisingly small number of problems became evident as the new system began operating, and most of them were resolved. They included the following.

- Interruption of computer monitoring because of large transient surges in the power supply during storms. A surge suppressor was installed.
- Groundwater seepage into manholes where lines entered and exited through the walls. Thunderline Corporation link-seals were used to control the problem. However, because the polyethylene (PE) lines are plastic and the material will "flow" under pressure, the seals must be tightened uniformly and under considerable stress. The problem was corrected, and alarm levels dropped considerably.
- Snow-removal equipment cracking the manhole rings. This problem pertained only to the "nontraffic" manholes whose covers project a short height above grade.

  The covers were much lighter than the "traffic" manhole covers, and operating personnel stopped replacing the brass screws that normally fasten the cover to the ring. To prevent water seeping through the screw holes, sheet steel covers were designed and used. For traffic manholes, the screws are replaced each time the manhole cover is reinstalled and a mastic is injected around the screw head to prevent seepage.

  The broken ring problem still existed in early 1994, but the group considered marking or flagging the manholes to alert Johnson Controls, Inc. (JCI) personnel of their presence and the need for caution.
- Leakage around the manhole cover gasket. Using the sheet steel covers for the nontraffic manholes corrected the problem for these units, and improved gaskets and applying mastic to the space between ring and cover for the traffic manholes resolved the problem.
- Deposition of settleable solids in the flow meters interfered with accurate measurements. This problem was corrected by improving the measuring units and replacing the electronic control and transmission equipment.
- Deposition of settleable solids in the Manning flow meters interfered with accurate measurements because the solids covered a probe in a depressed section of the tube. This problem was corrected where necessary by shielding the probe from solids deposition and in a few cases, by replacing the meter with a new Sparling unit that did not have the problem.

The buildings served by the new lines originally included the following:

- TA-3, SM-16, -29, -34, -35, -39, -65, -66, -102, -141, -154, -216, and -1264;
- TA-35, TSL-213;
- TA-48, RC-1;
- TA-50, WM-1, -37, -69; and
- TA-59, OH-1.

TSL-213, constructed as the Target Fabrication Facility, was a new addition to the collection system at the time of its construction, and TA-48-45 was added in 1988. Buildings previously served that were not included in the new system were the following:

- TA-3, SM-32, -40;
- TA-35, TSL-2, -27, -29; and
- TA-52, RD-1.

The system has operated remarkably well. In particular, flow graphs of flow measurements have permitted immediate pinpointing of unusually high discharges, eliminating the lengthy searches required previously. Data archival capacity of the PDP-11/44 was increased early in its service life by interfacing it with a Hewlett-Packard (HP) 3000 series computer located in the same room. Some of the flowmeters have been replaced, and in 1992, a program to replace all MUXs with the more advanced programmable logic controllers (PLCs) was underway. Also in 1992, funds became available to replace the entire Sangamo/Fairchild/Weston system. Replacement was desirable because of the difficulty to obtain maintenance parts. The staff of CST-7 began designing the new system, "Gensym," in 1992. All of the software required redesign; all work stations were changed to HP-9000 (models 715, 735, and 755) in the UNIX system; all MUXs were replaced by Allen Bradley PLCs; and all electronics were replaced. Most of the software, diagrams of site liquid waste lines, and appurtenances and equipment were completed and in use by early 1994, and PLCs were installed in the summer of 1994.

PHASE B OF IMPROVEMENT TO THE RADIOACTIVE LIQUI WASTE COLLECTION SYSTEM LINE REMOVAL [4]

As indicated in Table 8-4, Zia/L work in removal of abandoned lines a appurtenances was funded at a level of $2.845M with lab support at $1.3M. Some contingency funds were availabl if not used up in Phase A. All work w to be done by organizations on site. Laboratory support would involve ENG-1, H-1, H-3, H-5, H-7, and H-8. Harry Jordan, H-DO, would serve as project manager, and H-1 was designat "prime contractor;" Al Valentine was senior H-1 representative and technical manager. After organizational meetings, H-1 prepared a project plan for LAAO that was signed in May 1979. Trailers were provided for a full-time Zia draftsman and ENG-1 representatives (Manny Vigil and Darrell "Bosco" Hohner) and for H-1 operations. All lines and sections of lines to be removed were given numbers and described fully (Appendix P). Drawings were prepared showing the lines and structures for removal and all utilities in the area. Utility representatives were required to sign off on the drawings to attest to the accuracy of utility locations. Because of the depth of some lines that could not be reached by Zia equipment on hand, a $250,000 Liebherr backhoe that could dig to 25 ft was purchased by the project.

Because of contract work to be done at TA-50 under the "upgrading" project, the first work began on July 13, 1981, with removal of lines on the east and

south sides of TA-50. The original project schedule is shown in Fig. 8-6.

In November of 1981, the Laboratory was advised by DOE that $3.5M would be taken from the line removal project for use elsewhere and it was questionable whether it would be returned. With only partial completion at TA-50 and TA-35 and substantial completion along Pajarito Road and at TA-48/55, the project closed on December 2, 1981. However, with some remaining funds from both Phases A and B, the neutralization-pumping station SM-700 was removed in 1982, and line and appurtenances near Diamond Drive and Eniwetok Drive were removed in 1983.

Eventually, DOE advised the Laboratory that the $3.5M would be returned to the project, and removal operations were resumed in 1984. The project was completed in 1986, having removed over 34,500 ft of abandoned lines and 49 structures ranging in size from a small manhole to a neutralization-storage-pumping station. In 46 instances, sections of lines were left in place because of depth, the vicinity of other utilities, traffic interference by removal operations, overlying structures, etc. Five abandoned manholes were also left in place. This information was detailed on engineering drawings. The ends of "left" lines were sealed with concrete, and manhole covers were tack-welded closed.

The final report (November 12, 1986) of costs incurred by LANL during this project, 2530, under subprojects 290, 291, and 292, was $5,766,672.

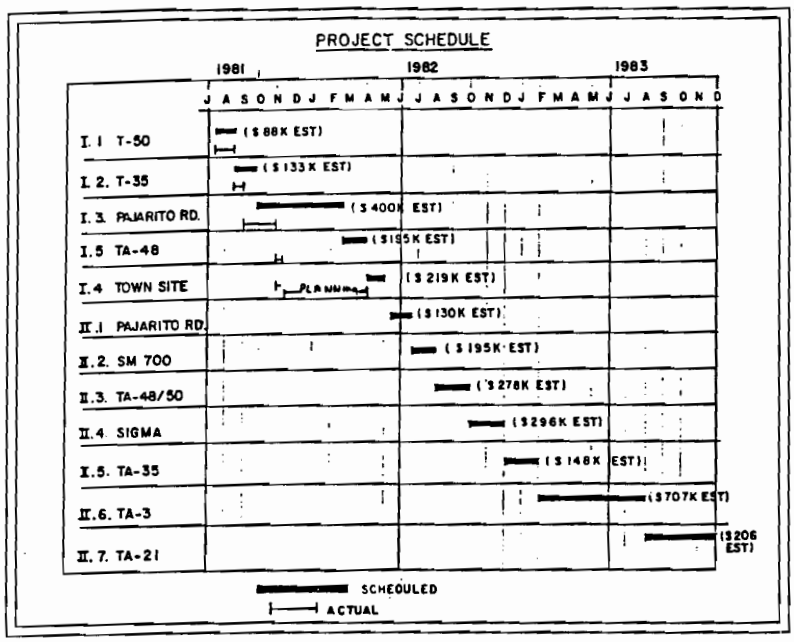

Fig. 8-6. *Phase B of improvements to the Radioactive Liquid Waste Collection System project schedule: line removal.*

UPGRADING THE INDUSTRIAL WASTE TREATMENT PLANT

In 1976 and 1977, work began on plans to upgrade the waste treatment facilities at TA-50 incorporating solar evaporation ponds on Sigma Mesa for "zero discharge" of treated wastes. The projects—plant upgrading and solar ponds—were included in a package entitled "Radioactive Liquid Waste Treatment Plant Improvements" with a total estimated cost (TEC) of $13.6M. At this time, however, the DOE realized a need for $24M for other work and decided to obtain much of it from these projects and the Proton Storage Ring work. Los Alamos was offered either the plant upgrade or the solar ponds for FY80 construction; construction of the remaining work would follow at a later date [Appendix Q]. After some

deliberation, the Laboratory chose to proceed first with the plant upgrade, and the project was retitled "Upgrading of Industrial Waste Treatment Plant" with a TEC of $7.2M, later increased to $8.0M.

A committee of DOE and LASL personnel interviewed a number of architect-engineering (A-E) firms at their offices in March 1977 and awarded a contract for Title I design to the Ralph M. Parsons Company of Pasadena, California. For this work, $200K of FY77 construction planning and design (CP&D) funds (ERDA) and $450K of FY79 Plant Engineering and Design (PE&D) funds (DOE) were used. Title II efforts were awarded to the Ralph M. Parsons Company on May 1, 1980, and Title III on September 21, 1981. E. E. Fisher of the Ralph M. Parsons Company was principal project manager for the Ralph M. Parsons Company, but R. H. Wilkinson, project engineer, was the most frequent contact for the Laboratory, which changed its name to Los Alamos National Laboratory (LANL) on January 1, 1981. When Title III was awarded, the Ralph M. Parsons Company provided a full-time inspector, Jay Colvin.

LAAO support for the project was as follows (including management succession):

- Acting LAAO Manager—G. M. Granere and
- LAAO Project Manager—D. F. Trujillo, A. L. Gonzales, R. I. Ferran.

LANL support for the project was as follows (including management succession):

- Construction Project Manager—H. S. Jordan, J. Allen,
- Assistant CPM—L. A. Emel
- Technical Manager—P. M. St R. Garde, I. L. Suazo,
- Engineering Manager—D. Ki G. Kestell, and
- Field Inspector, ENG-1—M.

Funds for the project were to be provided in FY81 at $5.0M and FY8. $3.0M. The required Ralph M. Parsc Company 70% Title II construction estimate, however, was $10.99M. Ra M. Parsons Company, LANL, LAAO. Albuquerque Operations Office (ALO personnel eventually reduced the scope work and estimates to $8.0M. Howeve because a possibility existed that some funds might be withdrawn from the project before its completion, the proje was set up in two phases with a bid required for each phase. Four items we removed from the work and set out as alternates to be constructed if funds remained from Phases I and II. An invitation for bids was issued on May 1. 1981, and bids were opened on June 16. 1981. Brown-Olds Corporation of El Paso, Texas, was the successful bidder. an a contract was awarded on September 4. 1981. Phase I was bid at $3,907,600 anc Phase II at $673,000. Phase I included four alternates:

- the new storage building;
- the new restroom addition on the northwest corner, lower level, WM-1;
- the vehicle decontamination enclosure; and
- the waste transfer pipeline with pumping stations at TA-2 and TA-21.

In June 1982, the Ralph M. Parsons

Company submitted a proposal for additional design work to incorporate the following in the project:

- modifying perimeter roads and fences;
- upgrading the vacuum filter system;
- upgrading the batch waste treatment system;
- upgrading the process exhaust air filtration;
- relocating the spectroscopy lab and lunchroom; and
- upgrading the pH control system at TA-50-1 and TA-21-257.

An emergency power supply for TA-50 was also a requested, but H-DO and LAAO did not approve it. After some negotiation, the Ralph M. Parsons Company proposal was accepted, and the six project modifications were included in the construction contract. Project records (memos, notes, letters, plans, etc.) are available in files at TA-50-1. A schematic of the upgraded plant is shown in Fig. 8-7. Figure 8-8 shows David Salazar and Robin Reynolds at the plant operations center.

Few incidents or accidents occurred during construction, but one was significant enough to become the subject of a major lawsuit. On February 17, 1984, an employee of Brown-Olds Corporation was attempting to cut a steel bolt in the floor of the south filter exhaust plenum (FE-2) with an electric grinder, and the sparks ignited some bag filters about 3 ft away. The fire caused first- and second-degree burns to his head, face, and neck. DOE and HSE-3 investigated the incident [5], and the DOE safety engineer recommended several changes in plenum work to prevent similar incidents. The

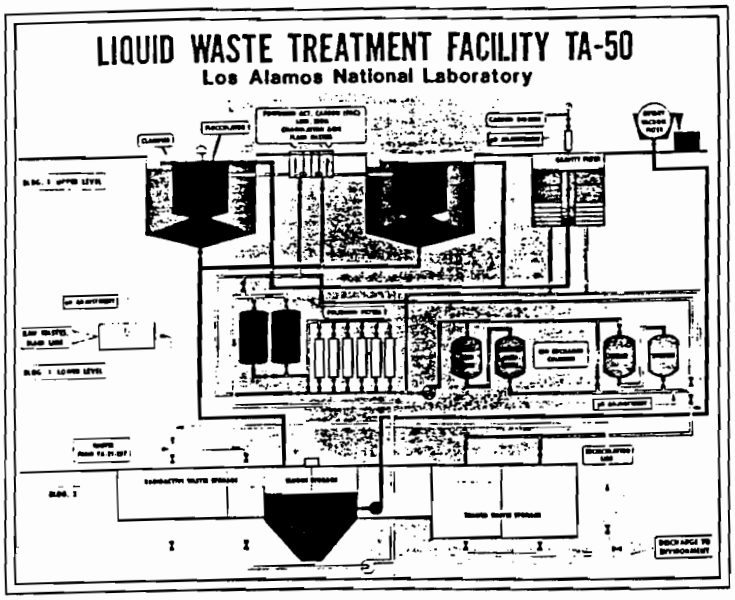

Fig. 8-7. *Schematic diagram, upgraded Waste Treatment Facility, TA-50-1.*

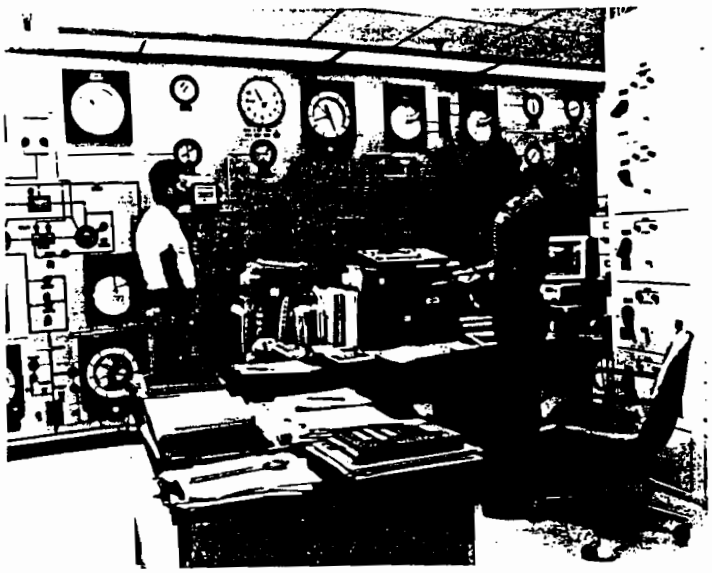

Fig. 8-8. *The plant operations control center, TA-50-1.*

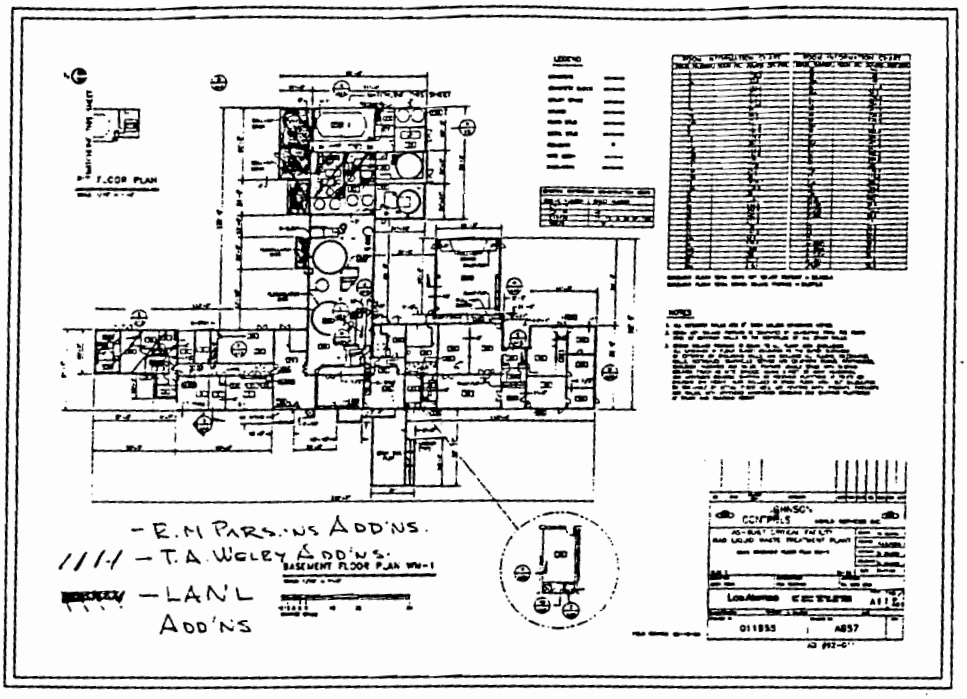

Fig. 8-9. TA-50-1 as-built facility, basement.

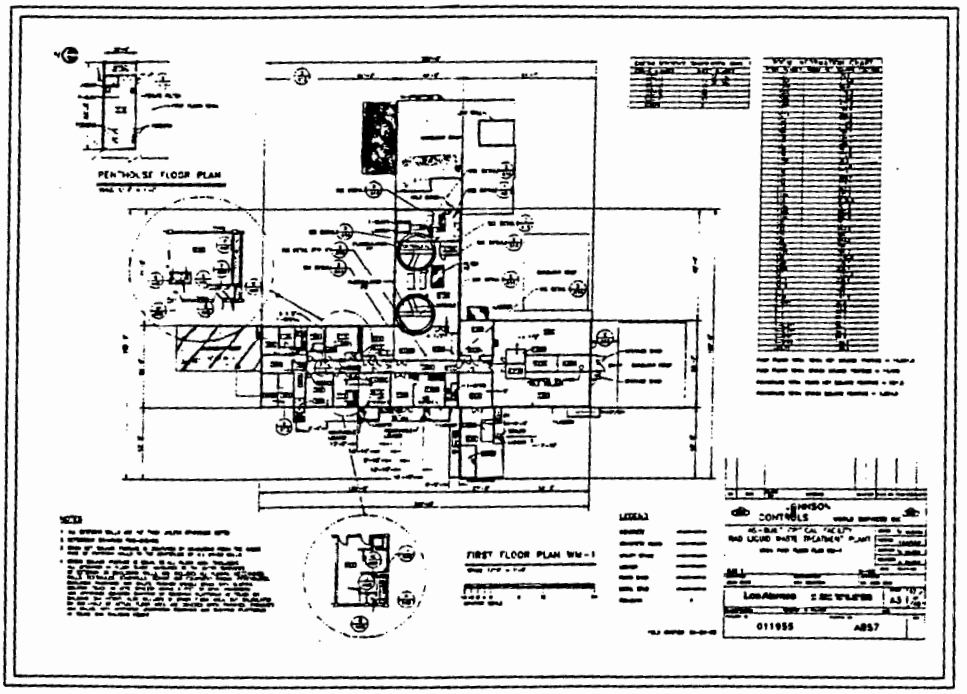

Fig. 8-10. TA-50-1 as-built facility, first floor.

Brown-Olds Corporation employee obtained legal advice, and his attorn opened a suit suing the Laboratory f $20M, naming many Laboratory employees, incorrectly identified. Th was protracted but was eventually set out of court for a much lower amoun

The development of TA-50-1, including designs by LANL, T. A. Wei and R. M. Parsons, is shown in Fig. 8- and 8-10.

SOLAR ENERGY ASPECTS

While the design criteria for upgrading the TA-50 waste treatment plant were being written, the DOE was concerned about the apparent rapid diminishing national supplies of oil and gas. Funds were being made available to study other possible sources of energy su as wind, solar, oil sands, hot springs, hot dry wells, etc. The wiped-film evaporato would likely use hot oil for evaporation; the heat would be provided by a gas-fired boiler. WX-4, in a January 17, 1980, memo to Laboratory Director Donald Kerr, requested that he forward to DOE-ALOO three proposals for solar heating projects at the lab. One of the proposals was to use solar heat as an alternative to the gas heat for the oil for the wiped-film evaporator. The proposals were forwarded eventually to the Solar in Federal Building Program (SFBP) of the National Aeronautics and Space Administration (NASA) and the project was awarded, through ALOO, the sum of $696,400 (Appendix R). ENG-9 completed the design criteria by December 1980. By January 1981, after several revisions—

primarily increases in size—to the first proposed Schedule 44 plan, the estimated cost rose to $846,400. Title I design began in early February 1981, and the Ralph M. Parsons Company was retained to design the site work. After numerous meetings with input from ENG, H-DO, H-1, H-3, H-7, H-8, and WX-4, a previously unexcavated part of Area C, the one-acre southwest corner, was selected as the site for the solar collectors. Though the solar heating system was established as a separate project, it had major interfaces with the Upgrade Project, and the Ralph M. Parsons Company was deeply involved. Fig. 8-11 is a schematic of the proposed system. Only the collector array would be located at Area C; the remainder of the system would be within the fenced area of TA-50 south of TA-50-1.

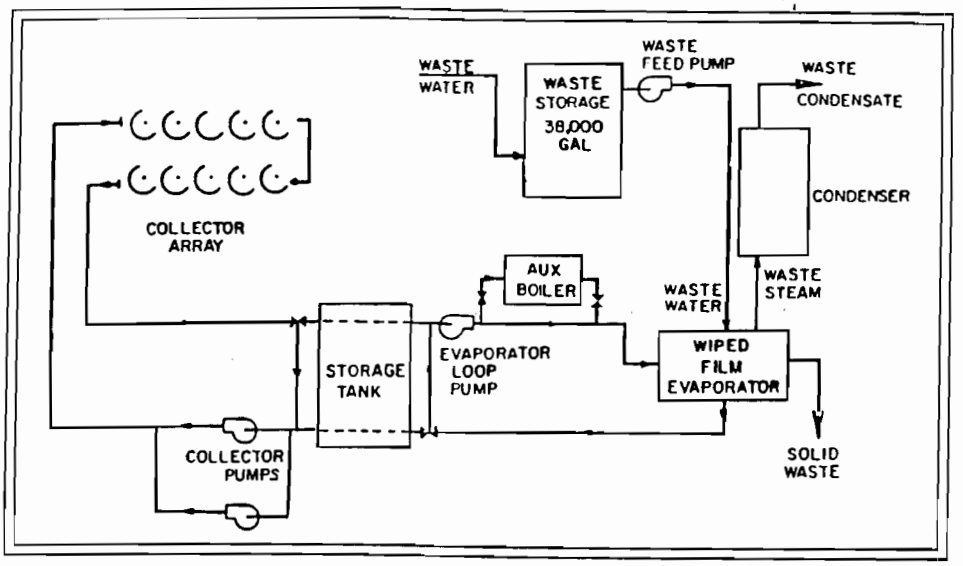

Fig. 8-11. *Proposed solar heating project for the evaporator.*

LANL took separate bids for providing the parabolic solar collectors, and a contract was awarded to SUNTEC. On March 25, 1982, bids were opened for construction of the solar system and installation of government-furnished equipment. Six construction companies bid the project [6]. The apparent low bidder, Snider-Chapman Construction Company of Santa Fe, NM bid $447,700. (The government estimate was revised from $302,000 to $479,000.) The solar project was short, about $200,000, and ALOO initiated efforts to obtain additional funding. The contract was awarded to Snider-Chapman with a Notice to Proceed dated June 23, 1982, and a completion date of December 20, 1982. The additional funding was obtained primarily from contingency funds of the Upgrade Project and the SFBP, but some funds were taken from Laboratory utility, H-7, and Q-11 (formerly WX-4) operating funds, which would operate the system for the first two years as a demonstration project.

Construction was difficult, and the Snider-Chapman contract had not been closed out by late December 1983, over a year behind the original schedule. A December 13, 1983, punch list had 15 items to be completed, including replacement of 21 broken mirrors. The mirrors were designed to turn face down automatically in periods of cloudy weather, but thunderstorms damaged wiring and controllers. By October 1984, the system not yet in operation, required an estimated $50,000 in repairs.

Repairs were made and improvements were incorporated, but the Q-11 demonstration of the system never took place. H-DO and ALOO were doubtful that using the system would be economical and that additional funds should be expended for its operation and maintenance.

Experts retained by ALOO inspected the equipment and its arrangements and reported that developments in using solar energy had made the Laboratory installation obsolete. It stood unused for several years until, in 1987, the collectors were given to a local used-equipment sales operation and the heating oil was sold for use in an incinerator. The DOE maintenance contractor removed the pumping station, the 16,000-gal. oil storage tank, and interconnecting piping. The wiped-film evaporator (room 71), the gas-fired boiler (room 72), and the condenser and appurtenances on the roof were scheduled to be removed in August 1995.

THE ZERO DISCHARGE PLANS

The DOE gave the Laboratory the choice of providing a treatment plant upgrade or constructing solar ponds to evaporate all treated wastes rather than including both in one project as proposed. The former was chosen with the hope that the solar ponds project would follow.

Before that decision was made, some preliminary efforts toward pond construction were completed. An April 9, 1979, memo from H-7 forwarded an H-7 paper attempting to justify using the ponds. In addition to H-7 input, H-1 and H-8 provided considerable data. Nuclide accumulation, wind carry, seepage, berm rupture, and other factors were considered.

As part of the original overall project entitled Radioactive Liquid Waste Treatment Plant Improvements (upgrade plus ponds), the Ralph M. Parsons Company completed Title I for the pond system in 1977 under CP&D fund In 1979, a Schedule 48 requested D funding of $600,000 for Title II pla Laboratory calculations of TEC of t project indicated that $8.1M was req

The Title I plans located the po Sigma Mesa just east of the gas line th crosses the mesa. Five large ponds wi total surface area of 14 acres would b provided. Treated wastes from TA-50- would be pumped to the ponds, whic would be lined and provided with lea detection systems. A pumping station at the ponds would allow filtering the solutions and transferring wastes from a pond to any other pond. It was hoped obtain Title II funding in FY80 so tha construction might begin in FY82.

To better understand the meteorolo conditions in the proposed pond it was decided to construct a pilot pond ju to the west of the main pond area. Th rectangular bottom of the pond was designed as 12 ft × 46 ft. At a 7-ft dep with sloping sides, the rectangular surfa dimensions were 43.75 ft × 83.75 ft. To volume was approximately 100,000 gal. The pond bottom consisted of two sand-clay-bentonite layers with a layer of grave between. The gravel layer included pipi to collect any seepage. The sand-bentoni layer was continued up the sloping sides of the pond. Hypalon sheeting lined the pond, and treated waste from TA-50-2 was hauled by tank trucks to fill it. The hypalon was secured along the berm at th top by trenching, and vents were provide along the longer sides to prevent uplift by crossing winds. Instrumentation for meteorological measurements was installed, and the area was fenced. The

installation was inspected on July 17, 1979, and the first tank truck of treated waste was delivered on August 8, 1979. A small shed was constructed within the fenced area to store supplies and provide cover from the weather for records.

Air temperature, minimum and maximum water temperature, weather conditions, and pond conditions were recorded each working day. It was noted almost immediately that winds across the mesa stirred up dust, some of which was deposited in the pond.

Water samples were collected near the pond surface every two weeks and from the pond bottom every four weeks. They were analyzed for the following.

- americium-241
- cadmium
- nitrogen trioxide (NO_3^-)
- cesium-137
- chromium
- fluorine (F^-)
- hydrogen-3
- copper
- cyanide (CN^-)
- lead
- plutonium-238
- plutonium-239
- mercury
- strontium-89
- strontium-90
- volatile suspended solids (VSS)
- total dissolved solids (TDS)
- total suspended solids (TSS)
- gross alpha
- gross beta
- uranium-total

For one four-month and one 12-month period, 16 in. × 28 in. sheets of hypalon were placed on the sides of the pond, one per side, and located so that there was always some submergence. At the ends of the periods, the sheets were removed and the material deposited on the sheets was analyzed for radioactivity. The main contaminant was cesium-137, with plutonium-239 a close second.

Ambient air samples taken by H-8 at the pond from November 1979 through July 1981 indicated an average 4 fCi/m^3 gross alpha and about 34 fCi/m^3 gross beta. Soil samples taken by H-8 near the pond indicated 0.50 pCi/g cesium-137 and 0.010 pCi/g plutonium-239.

Whenever the pond level became very low, additional tank truckloads of treated waste were hauled from TA-50-2. During the life of the study, approximately 140,000 gal. of waste were trucked. Samples were analyzed to determine the amount of radioactivity, heavy metals, and nutrients being added.

In both surface and bottom samples, tritium was the radioisotope of highest concentration, with cesium-137 a far second, and the remainder much lower. Copper was the main heavy metal, running as high as 0.25 mg/L, but generally below 0.15 mg/L. Nitrates were the most abundant chemical compounds of concern, with fluorides a distant second. Total dissolved solids reached a level of 5500 mg/L but generally were in the range of 2500–4000 mg/L.

While the pond system was being designed and the pilot pond was being constructed and placed in operation, ENG had designed a hot-water heating system

for TA-3 based on a geothermal well on Sigma Mesa. The well location shifted from west of the 14 acres of ponds to east of them, but when drilling began in mid 1979, H-7 learned that the well was within the pond site. Much of the pond area was occupied by drilling equipment and a bermed lagoon for drilling mud. At some depth, much shallower than required, the drillers hit a large open pocket and attempts at sealing the well were futile. The project was abandoned, but the pond system had to be relocated. Funds for further work on this plan were not available, and no new site was located. Studies with the pilot pond continued into early 1982, when the project was discontinued. The data collected were never reviewed, and no report was prepared. The pilot pond was eventually decommissioned in 1987. The fence around the pond area remains, and the area has been designated Solid Waste Management Unit (SWMU) 60-005(a). In December 1985, HSE-7 Operations Section stacked 125 empty, used 55-gal. drums within the fenced area at the pond, where they remained for about eight months. This former drum storage area was designated SWMU 60-004(c)] [7].

"HOT" (PROCESS) WASTES FROM CMB-11

TA-21 was built in 1945–46 to provide a more remote location for the plutonium operations. CMB-11, which eventually handled much of this work at DP West under Bill Maraman, was assigned various new work until the group grew to be as large as many divisions. Though building space wa[illegible]ns[illegible] on the east and west ends of the [illegible] plant, lab space was at a premium, plans were developed to build a [illegible] facility along Pajarito Road. As t[illegible] the original facility approached 30 [illegible] much of the equipment and proc[illegible] required upgrading. The AEC pro[illegible] original funding of about $60M, a[illegible] 1977, a new site, Plutonium Facili[illegible] 55, was constructed on the northwe[illegible] corner of the intersection of Pajari[illegible] and Pecos Drive. The building hou[illegible] the work with actinides was PF-4. [illegible] PF-4 was being completed, H-7 wa[illegible] advised that CMB-11 would transfe[illegible] wastes directly to TA-50 and not us[illegible] existing waste line on Pajarito Road[illegible] acid and a caustic waste with much h[illegible] levels of plutonium and americium [illegible] need to be managed separately [illegible] in the main stream to TA-50 (Appen[illegible] S). While management systems wer[illegible] being developed, in 1982 CMB-11 [illegible] constructed four stainless steel lines [illegible] enclosed in PVC piping to carry the [illegible] waste (1.5-in. line), the caustic waste [illegible] (1.5-in. line), and a lower activity ge[illegible] industrial waste (2-in. line). A 2-in. sp[illegible] line was installed in the same trench [illegible] the other three, and the lines were [illegible] extended to a monitoring pit at TA-50. [illegible] WM-57 (later renumbered as WM-1[illegible] WM-57 was designed to alarm any lea[illegible] from the stainless steel lines as they [illegible] drained along the PVC piping to WM [illegible] A temporary halt in construction was necessary here as plans were developed [illegible] manage these wastes at TA-50.

The process selected and constructed involved providing

- an underground pit (WM-66) with the top at grade to house a stainless steel storage tank for acid wastes;
- a mild steel storage tank for the caustic process wastes; and
- a weir chamber to measure the flow in the industrial waste line.

After measurement, the industrial waste line was extended to the main influent manhole where it combined with all other collection system wastes. The two steel tanks were equipped with mixers and pumps. Because of a scarcity of funding for a separate structure to manage the process wastes, rooms 60 (storage) and 60A (ion exchange regenerant sludge storage and solidification) in TA-50-1 were appropriated. Wastes from the two storage tanks in WM-66 were pumped through two double-encased stainless steel lines along the south side of TA-50-1 to room 60A for treatment. HSE-7 decided that the process wastes would be pretreated by ferric hydroxide precipitation and the effluent pumped to the main plant influent for additional treatment. Precipitates (sludges) would be mixed with cement–vermiculite–water glass in a double-drum tumbler, and the drums would be certified as TRU waste for storage at TA-54. For expediency, HSE-7 designed the facility, purchasing an off-the-shelf 25-gpm chemical precipitation plant with sand filter and squeezing the plant and related tanks into room 60. The first sludges produced by the room 60 plant were tumbled on July 17, 1979. Figure 8-12 is a schematic of the pretreatment plant, and Table 8-6 is a list of operating records from 1983 to 1992.

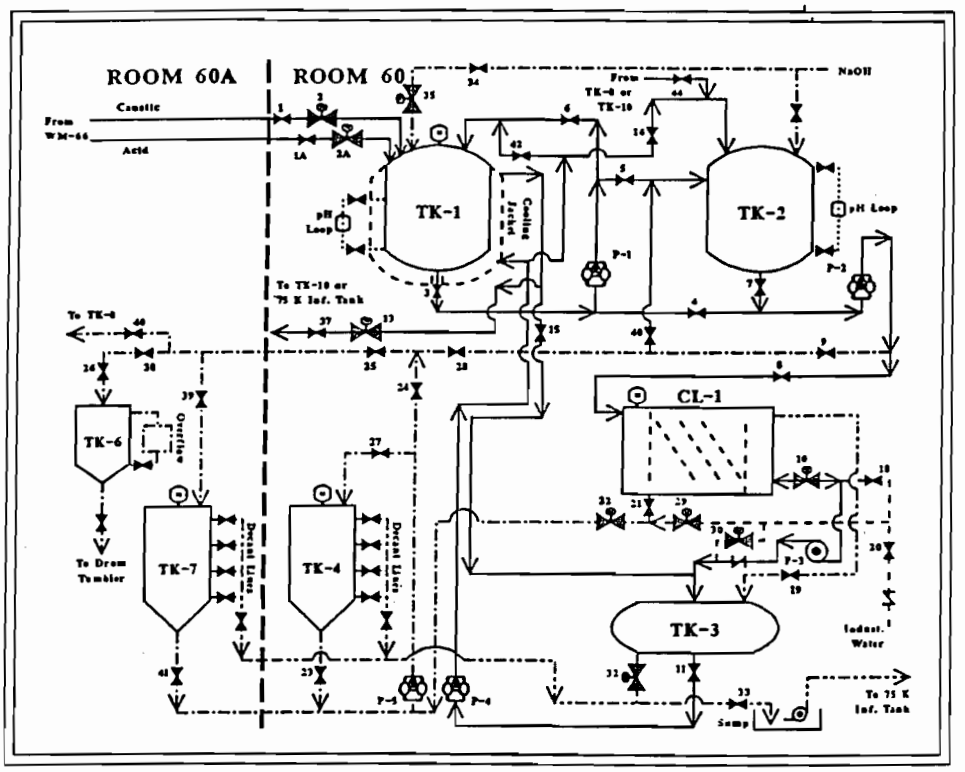

Fig. 8-12. Schematic of the pretreatment plant for process wastes from TA-55.

Calendar year	Process caustic (L)	Process acid (L)	Pu (Ci)	Am (Ci)	Cement paste (drums)
1983	17,430*		102.9	120.6	83
1984	196,200**		34.6	27.7	23
1985	25,379**		34.0	26.0	36
1986	35,991	158,096	60.0	42.0	57
1987	37,073	148,167	75.6	58.6	47
1988	31,455	138,909	38.9	40.8	21
1989	27,196	139,661	69.4	99.1	32
1990	24,077	97,474	90.5	59.2	24
1991	9,236	49,458	19.7	11.7	0
1992	7,918	38,531	3.6	2.8	0

Table 8-6. Pretreatment operations, room 60.

**cement paste*

***process wastes*

A major improvement in the early years of operation was totally enclosing the double-drum tumbler and exhausting the enclosure through HEPA filters.

Under the Collection System Project, electronic controls in WM-66 and room 60 were upgraded, and several tanks provided for other purposes under the Upgrading Project were incorporated into the treatment operation for process wastes.

THE CRITICALITY SAFETY CONCERN

To ensure that space was available in the acid and caustic process wastes storage tanks in WM-66, personnel at CMB-11 (TA-55) called a plant operator at TA-50-1 and provided the volume of waste it wanted to discharge and the plutonium-238, plutonium-239 activity of the waste. Various batches of varying activity levels accumulated in the acid and caustic tanks until HSE-7 operators decided to reduce stored volumes by transferring to storage in WM-2, then later to room 60, WM-1.

Contents of a process waste tank at PF-4, TA-55, were stirred (acid tanks only), sampled, analyzed, and pumped to TA-50-66 storage. Analysis of samples of this batch, collected at WM-66, indicated a much higher concentration of plutonium-238 and plutonium-239 when compared with the CMB-11 reports. The problem was discussed several times with CMB-11 staff, who initially felt that any discrepancies in concentration levels were probably due to sampling and analyses errors by HSE-7. The discrepancies continued, and in early 1981, Jerry Buchholz contacted the criticality group, H-6, to investigate the problem. H suggested H-1 do monthly neutron monitoring of various tanks in the sys at TA-50, and after reviewing the ne data, concurred that CMB-11 concentration figures were substantia error. A December 10, 1981, memo Buchholz to H-6 provided a table indicating that for calendar year 1981 CMB-11 discharged about ten times m plutonium-238 and plutonium-239 tha its records indicated. Because the roor TA-50-1 plant was not yet in operation, the process wastes were discharged to t plant influent flow, greatly increasing its alpha activity level and rendering all plar sludges in the sludge storage tank in TA 50-2 TRU waste. LAAO, ALOO, DOE Headquarters (DOE-HQ), OS-2, and WX-DO eventually became involve late December 1981 when measurements indicated that hundreds of grams of plutonium-239 were concentrated in the WM-66 caustic storage tank (Q-2 estimated 1140 g). It was decided to empty the tank; to ensure no criticality problems, operators first added a slurry of 65 lb. of borax. HSE-7 would pump out the supernatant, and CMB-11 would pump the dilute sludge into safe containers for transfer to TA-55. The operations proceeded safely; however, CMB-11 rescinded its offer to attempt plutonium recovery and the slurries were fixed with cement for eventual transfer to the Waste Isolation Pilot Plant (WIPP).

Intensive efforts by CMB-11 to resolve the discrepancies in activity levels were eventually successful when the group found the causes in PF-4 piping. The TA-50-1 room 60 plant was completed:

the WM-66 caustic storage tank was replaced with a tank of safer geometry; and standard operating procedures (SOPs) were revised. One requirement of the SOP for the room 60 plant was that six of the process tanks would be emptied and inspected, and neutron and gamma monitored each time 250 g of plutonium-239 had been processed. Subsequent reviews of the systems by the Nuclear Criticality Safety Committee found room 60 operations and the SOP completely satisfactory.

IGNORING THE COEFFICIENT OF EXPANSION

During an inspection of WM-57 (WM-106) in 1987, an operator discovered that one of the 1.5-in. lines had a sizable upward bow. The line was used for process caustic wastes, and expansion and contraction along the line might have caused ruptures at any of the changes in grade or direction. While the cause of the bow at WM-57 was investigated, a work order to excavate and inspect the lines at all changes in grade or direction was placed with Pan Am World Service, the Laboratory's support services subcontractor. Investigation revealed that the caustic wastes discharged by MST-12 were supersaturated with certain compounds that crystallized as they cooled. Their solution to the problem was to blow steam into the process tank; the heat of the wastes expanded the stainless steel line and caused the bow at WM-57. Excavations by Pan Am revealed no other distortions, and MST-12 agreed to discontinue steaming. A temporary solution to the bow problem was to cut it out of the line and insert a section of flexible stainless steel pipe. Vacuum tests were then performed on the PVC outer lines, and all were found to leak.

This problem escalated the need for major corrective action, and HSE-7, MST-12, and ENG-DO decided to request Utilities Restoration funds to replace all lines with double-contained lines and to provide monitoring pits at 500-ft intervals in the 1800-ft length. The Engineering Division estimate for the work was $1.4M. However, the Utilities Restoration funds did not materialize. An additional complication appeared: a requirement for waste line service to a proposed Special Nuclear Materials Laboratory (SNML) to be built just south of PF-4. FY90 and FY91 GPP funds of $950K were requested from DOE. Fluor Daniels, a firm involved in the SNML project, became involved in the design, but Merrick & Co., with offices in Los Alamos, was retained to prepare Title I drawings. Meanwhile, the $950K estimated cost had escalated to $3.5M, and the project was submitted to DOE as a 1993 environment, safety, and health (ES&H) line item.

Various changes were made in the project, and the estimates were refined to arrive at a TEC of $950K (Laboratory Job No. [LJN] 11544). The project at this level was submitted to DOE in 1988 as an FY90 production and surveillance GPP proposal. In early 1989, DOE-HQ reprogrammed the proposal as a subproject in a new FY90 construction line item titled "Environmental Improvements." Closer investigation of project

requirements then revealed that extensive revisions in scope, schedule, and cost were necessary. During this time, waste line service for the SNML was under investigation and the A-E, Fluor Daniels, submitted design and cost estimates for the service.

Merrick & Co. was awarded a contract for Title I design in 1989. The work, completed in early 1990, included an 8-ft-diameter utility tunnel and an estimated cost of $6.2M. A review of the Title I plans by HSE, ENG, and Merrick & Co. in March 1990 resulted in fine tuning the project to a TEC of $3.5M (Laboratory Job No. 9137). A revised Construction Project Data Sheet for this amount was forwarded to DOE-HQ for its review meeting of March 21, 1990. Merrick & Co. was contracted to proceed with Title II design, and by March 1991 these plans were circulated for review. Meanwhile, ENG Division had completed and had reviewed Title II plans for Laboratory Job No. 11544, the plan basically to replace the existing lines. In March 1992, the utility tunnel plan, LJ9137, had been cancelled.

Group EM-8 (formerly HSE-8), the Environmental Surveillance Group, proceeded with a reconnaissance survey of the route of the new lines, collecting soil samples, and analyzing them for a long list of radioactive and nonradioactive compounds. ENG-1 scheduled construction to begin in March 1993 and to be completed in September 1993; preliminary work started in May 1992. A new Construction Project Data Sheet for ES&H improvements at [illegible] Laboratory was submitted to DOE. The data sheet included two projects: the new lines at $1.566M and a ne[illegible] hazardous waste treatment facility at $11.50M. Construction was schedu[illegible] to begin in the third quarter of FY9[illegible] be completed in the first quarter of F[illegible] The organization chart showing pro[illegible] management personnel is in Fig. 8-[illegible]

CROSS-CONNECTION CONTF[illegible] ACTIVITIES

The cross-connection control activities began to function as a sectior separate from that of Liquid Waste Treatment (see also Chapter 4). The three-member staff

- actively surveyed building [illegible] water systems,
- investigated complaints,
- reviewed plans of proposed construction,
- inspected new construction for backflow prevention in water line
- discussed in safety meetings issue[illegible] of potable water system protecti[illegible]
- arranged for a Laboratory visit by Dr. E. K. Springer, and
- advised Zia utilities personnel on backflow device testing.

Christenson, Emelity, and Bill Dunne provided a script in 1976 and the Laboratory motion picture personnel produced a film entitled "Water, Water, Everywhere" on cross-connection control It was an improvement over the old "What Happened to Harry" film. Dunn

had the film shown at a number of AWWA meetings and arranged for its lease or sale to organizations all over the world.

Building inspections were proceeding well until the group was charged in June 1976 with providing Laboratory compliance with the NPDES requirements of the Clean Water Act to be enforced by the EPA. All Laboratory outfalls had to be located, identified, sampled and have the flows measured and Dunne and his crew were assigned much of the responsibility until additional personnel could be hired. Dunne also assisted in designing the pretreatment plant for TA-55-4 process wastes in room 60 of TA-50-1.

In the late 1970s, H-DO reassessed group responsibilities and concluded that

- the cross-connection control program was not a waste treatment responsibility and should be managed by H-8 and
- the potable water testing program should remain entirely with H-5.

Eventually these reassignments were completed. In the early 1990s, ENG-6 and ESH-8 were to survey every LANL building to identify and eliminate cross-connections. By April 1994 over 100 cross-connection problems had been identified [8].

Bill Dunne resigned from the Laboratory on May 30, 1980, to accept a position with the US military at a base in Spain. Larry Hupke and Ralph Ward continued inspections but gradually became involved in other assignments; Hupke with the NPDES program and then with polychlorinated

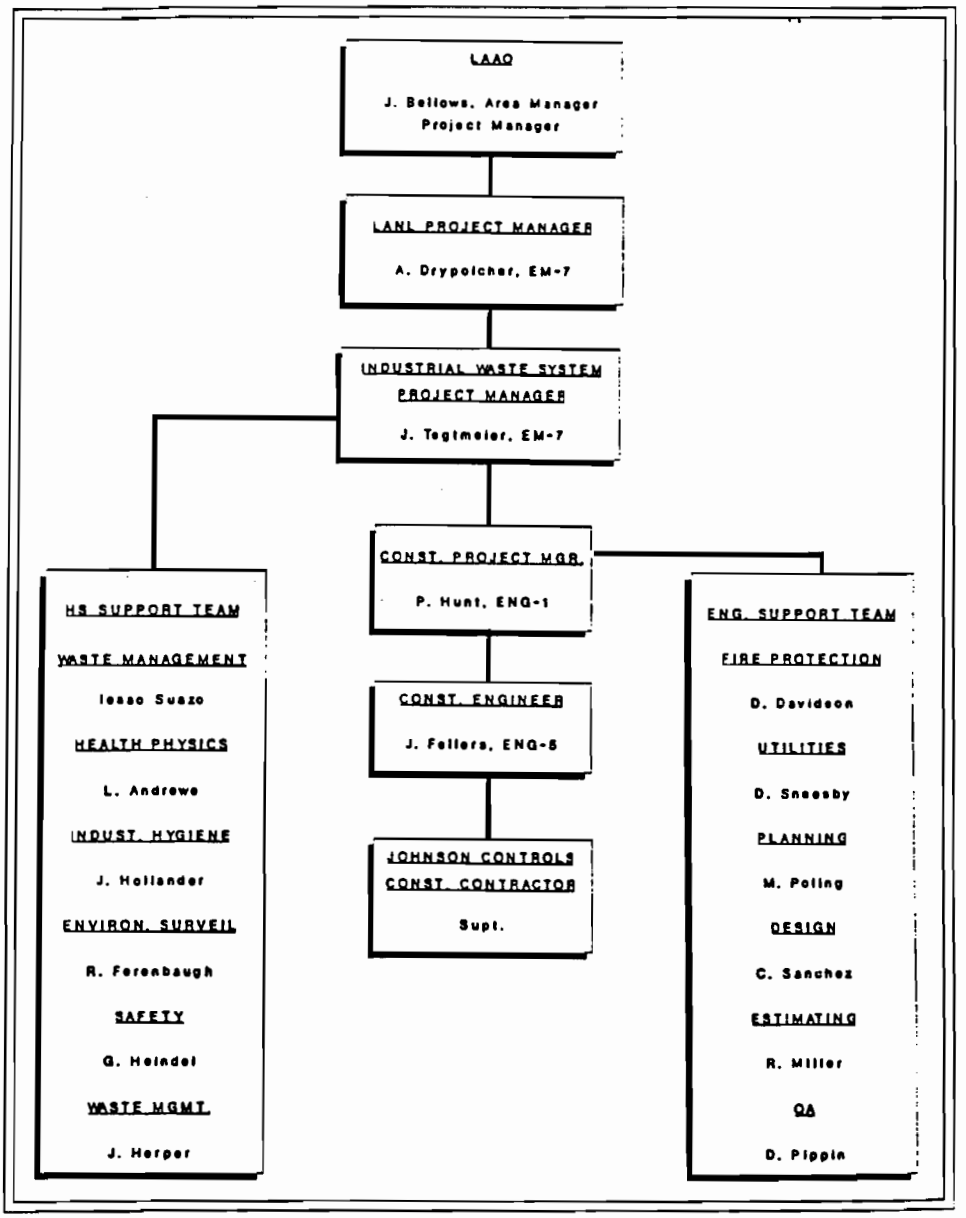

Fig. 8-13. *Organizational chart for project management.*

biphenyl (PCB) wastes, and Ward with the NPDES program.

THE NPDES COMPLIANCE EFFORT

H-DO assigned the NPDES compliance effort to H-7 in June 1976 because H-7 was most familiar with Laboratory waste outfalls. To obtain basic information on the requirements for compliance, Harry Jordan, H-DO, Lud Emelity, H-7, and Bill Crismon, DOE, flew to Austin, Texas, on June 28, 1976, to meet with Dr. Ernie Gloyna at the University of Texas (UT), then have him accompany the Los Alamos contingent to a meeting with the EPA in Dallas on June 30. Most of the engineers at the EPA Dallas office had been students of Dr. Gloyna, and his presence ensured a more congenial gathering with maximum accomplishment.

Efforts at compliance began in July 1976 using personnel from the established sections with the cross-connection personnel—Dunne, Ward, and Hupke—most deeply involved. Field and office work were extensive and time-consuming. Every Laboratory outfall had to be identified and sampled routinely and all samples analyzed as determined by the EPA. Neither the EPA under the Clean Water Act nor the New Mexico Environment Department under the Water Quality Act had the authority to regulate radioactive liquid wastes from source material, special nuclear material, or byproduct material. Analytical results were reported regularly to the EPA, and analyses that indicated concen[illegible]tion above guidelines required a special r[illegible] to EPA and the State of New Mexico. March 1977, the group hired Melvin (Wally) McCorkle and several assista[illegible] manage these efforts. With continued help from Ward and Hupke (Dunne returned to his other assignments), t[illegible] program began to take shape. Compu[illegible] were purchased, and standard reporti[illegible] forms were designed. Pamela Massey assigned temporarily to assist McCorkl[illegible] with preparation of the reports to the[illegible] The NPDES permit that the Laborato[illegible] applied for was, at that time, the larg[illegible] the State of New Mexico for the numb[illegible] of outfalls—120 industrial and 12 sanitary. The industrial outfalls were categorized as radioactive waste treatme[illegible] plant, HE discharges, cooling tower blowdown, boiler blowdown, ph[illegible] discharge, etc. Issued by the Corps of Engineers in 1978, the first permit gra[illegible] to the Laboratory covered only the sanitary waste outfalls. The second permit, issued in 1983 by the EPA—Permit No. New Mexico 0028355—covered all outfalls within Laboratory property. (Los Alamos County applied its own discharge permit to cover the outfalls of the sewage treatment plants operated by the county.)

In 1981, Carla Jacquez was hired t[illegible] replace Massey for inputting data on th[illegible] report forms, and in late 1983, McCorkl[illegible] Jacquez, and Ward were transferred to HSE-8, although they remained in office in TA-50-1. Hupke remained with HSE-[illegible]

The section filed numerous noncompliance reports through proper

channels at the Laboratory to EPA-Dallas whenever a sample indicated that an EPA parameter for a certain outfall was exceeded. Noncompliances included pH, heavy metals concentration, flows, etc., which were outside the permit limitations.

McCorkle stayed with the section within HSE-8 until May 1985, when he transferred to the Engineering Division. Tony Drypolcher of HSE-8 then became section leader.

In 1994, Steve Rae of ESH-8 (ESH-18 beginning in October 1994) was the section leader. The current permit, issued on June 24, 1994, has two sanitary outfalls and 122 industrial outfalls. It remains as Permit No. 0028355, though numerous parameters have been changed. The number of sanitary outfalls declined dramatically because of the Laboratory program of incorporating all sanitary outfalls—except the one from the TA-21 plant—into a new system culminating at a new plant east of TA-46.

SOME ONGOING AND FUTURE PLANT IMPROVEMENTS AND SYSTEM MODIFICATIONS

Completed in 1963, the plant located the control panels and operator's desk in the same room, TA-50-1-16, as the flash mixers, clariflocculators, and sample sink. Though the air in the room was sampled continuously and found acceptable, it was decided in 1985 to improve operator safety by separating the control area from the plant units. A concrete block wall, designed by group engineers and constructed by the Zia Company was installed across the room west of the number one clariflocculator. The upper part of the wall was glassed to provide easy viewing of the operating units. Though relatively low in cost, the improvement provided a higher level of safety for operations and health physics personnel.

Although the TA-50 treatment plant was relatively high on the power-shedding list, group leadership felt that a more positive immediate backup, a standby generator, should be provided to permit operation during power failures. An auxiliary generator was proposed during planning of the plant upgrade and earlier, considering total backup or minimum power to operate only the plant and necessary safety equipment.

Funding was never made available at those times. However, reviewing the need in 1994, agreements were reached that total emergency generator power should be provided. FY95 GPP funds were allocated, a contract was let, and work was underway in April 1995 at the northeast corner of TA-50-1.

The original main power transformer for TA-50-1, a unit that used PCBs was replaced in Fall 1994 under funding provided by the Facility Safety and Security Division (FSS) maintenance group. The new unit is designed so that it may be expanded easily.

In December 1992, the Omega West reactor was shut down because of an operations problem. In early 1993, a leak was discovered in a buried line carrying radioactive water. When these problems were resolved, operations

remained shutdown while budget problems were reviewed. In discussions with the DOE, the Laboratory could not resolve the funding issues, and shutdown procedures were begun in March 1994. These were completed by July 1995, and the reactor is in "standby" condition. Radioactive wastes from TA-2 are no longer injected into the TA-21-257/TA-50-2 line.

ANOTHER REORGANIZATION

On October 1, 1994, in another major LANL reorganization, Waste Management Group CST-7 was split into the following groups.

CST-5	Chemical and Mixed Waste Science
CST-7	TRU Characterization and Treatment
CST-13	Radioactive and Industrial Waste Water Science
CST-14	Radioactive Waste
CST-16	Thermal Destruction Science and Technology
CST-17	Waste Services
CST-18	Technology Implementation
CST-27	Facility Management Office

CST-13, which had been a [illegible]ior under CST-7, became responsible for managing radioactive liquid waste only and was similar to the original Group H-7 before 1975. The group, with Steve Hanson as Group Leader, had 39 personnel including part-time, tempo[illegible] personnel, and contractors. Of the 39, 18 were FTE employees of CST-13. They were:

Steve Hanson, Group Leader
Marc Bailey
Barry Bryan
Alan Bond
Terry Filer
Edward Freer
Jerry Freer
Robert Harris
Richard Hassman
Heather Jackobsen
Dave Knapp
Dave Mass
Kerry Prewitt
Dave Salazar
Lonnie Theye
Doris De la Cruz
Rick Romero
Isaac Suazo

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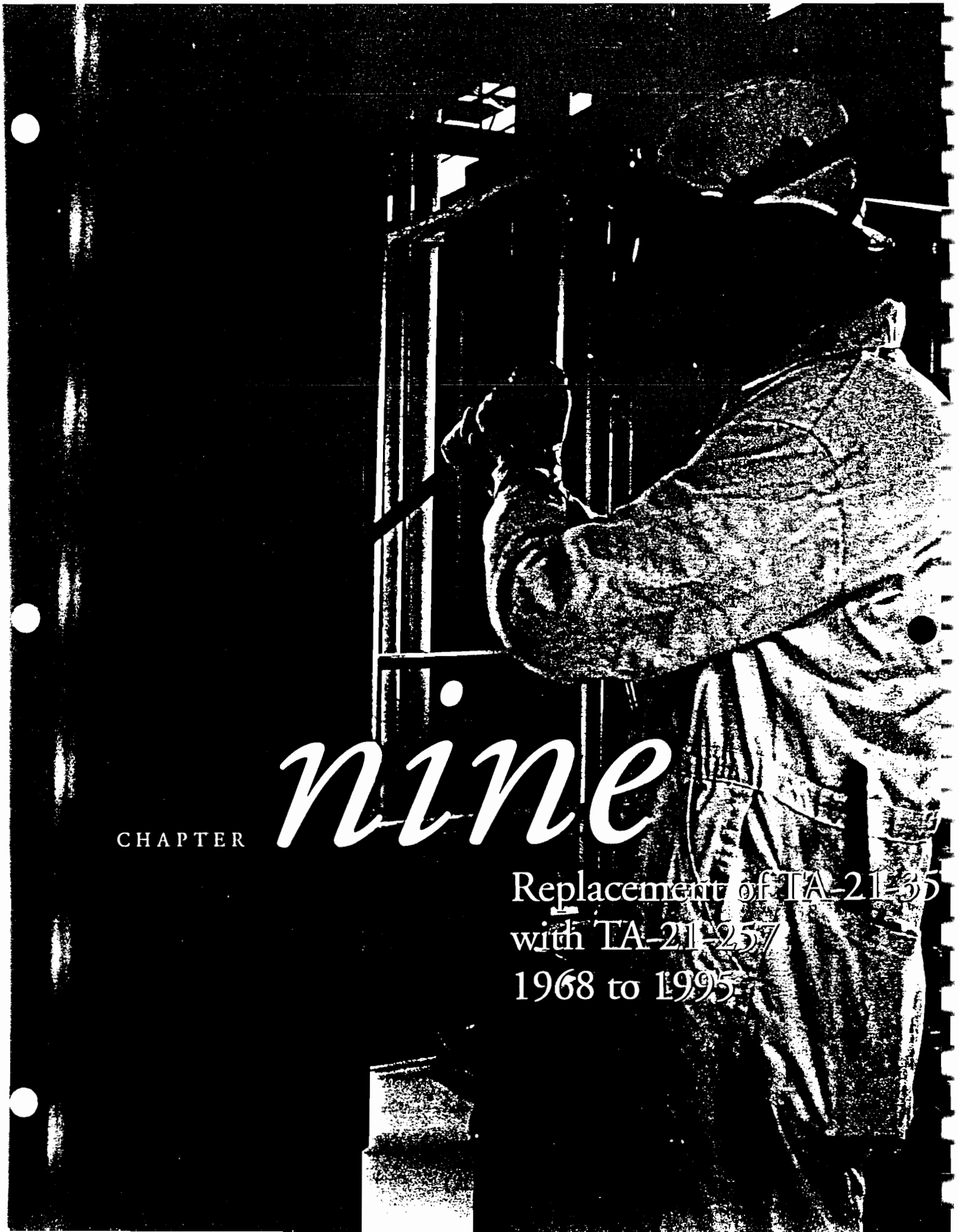
5. "Incident Report - Fire in Filter Plenum FE-2, Room 30, TA-50-1, Feb. 17, 1984," Los Alamos National Laboratory internal document HSE-3-IR-84-1 (April 13, 1994).
6. Bidding Documents and Specifications for Solar Evaporation of Low-Level Radioactive Waste Water, TA-50, Laboratory Job 5526-50, ENG-2-SP-968.
7. "RFI Work Plan for Operable Unit 1114", Los Alamos National Laboratory report LA-UR-93-1000 (July 1993).
8. Doris Garvey, Environmental Status Notebook, Vol. 2, No. 1 (April 1994).



CHAPTER *nine*

Replacement of TA-21-35 with TA-21-257 1968 to 1995

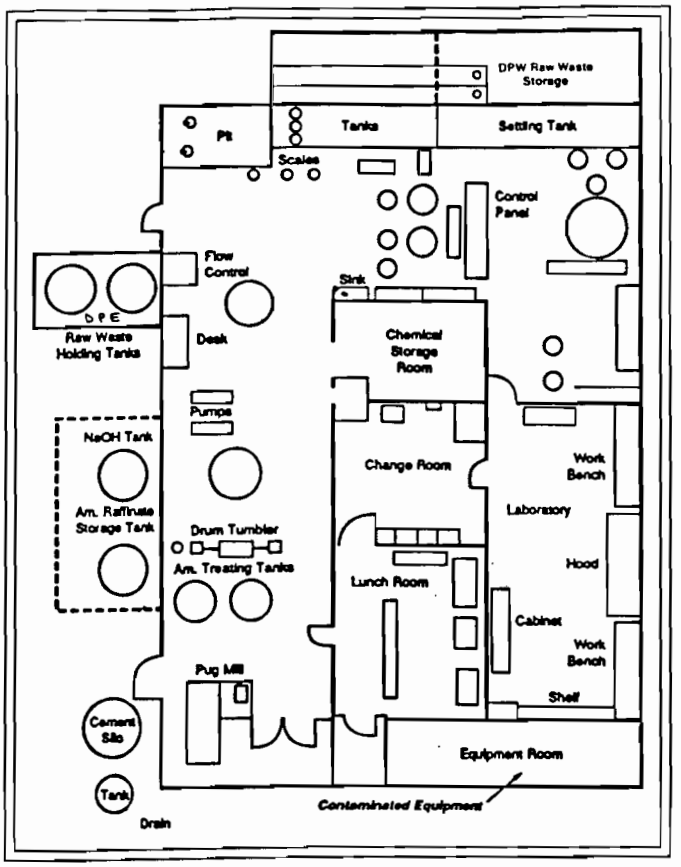


Fig. 9-1. *TA-21 waste treatment facility, DP-257.*

The new waste treatment plant for TA-21 radioactive wastes was a "bargain basement" replacement because of the effort to keep TEC below the GPP level of $500,000 (Chapter 5). Making it a GPP rather than a line-item project advanced construction by several years. However, the preliminary plans for a $1.0M+ facility had to be altered drastically. Duplicate units were eliminated; the facility was changed from a two-floor operation to one; raw waste and treated waste storage tanks from DP-35 had to be incorporated into the DP-257 process; the vacuum filter had to be moved or eliminated; surplus 500-gal. stainless steel tanks were obtained for batch waste storage; and other storage tanks had to be transferred from DP-35.

The facility, completed in August 1967 (Fig. 9-1), provided

- a 4,200-ft² building that includ process equipment, a small chemistry lab, a workshop equi with basic tools, a restroom, a change room, and a lunchroom
- two 28,000-gal. below-grade raw waste storage tanks for DP West wastes;
- two 13,000-gal. steel above-gra storage tanks for DP East waste
- two 13,000-gal. above-grade st storage tanks for treated wastes
- other smaller exterior above-gr tanks for storage of americium wastes and 50% sodium hydro

The treatment process (Fig. 9-2) incorporated was similar to that at TA-50-1 with several differences:

- flash mixer, flocculator, and sedimentation tanks were sepa units;
- design treatment rate was 125
- the clarifier was rectangular ra than circular;
- clarifier effluent was collected "filter sump" from which it w pumped automatically throug pressure filter;
- the final filter was a pressure r than gravity unit; and
- sludge was mixed with cemen the pug mill system and pum into deep vertical pits in Area

An early problem with high air in the clarifier area was traced to th overflow pipe from the clarifier to c the DPW raw waste storage tanks. problem was resolved by covering t

overflow opening in the clarifier with a wooden block that would float out of the way when clarifier levels were too high and would prevent the flow of air from raw waste storage when levels were below overflow.

At first, treatment efficiencies were lower than expected, probably because of the nature of the waste. The clarifier had been designed for 2-h detention, which is customary for treatment of sanitary sewage. The plant operator, Jose P. Valdez, found that by adjusting the treatment rate to the 85± gpm level, treatment efficiencies were much improved because the clarifier detention time increased and the surface settling rate decreased.

The original plant provided two narrow channels along the top of the raw waste storage tanks; the south wall of the channels was the north wall of the building. The channels served as grit chambers and a proportional weir-controlled velocity. Only one channel would serve; switching flow to the standby channel would allow manual cleaning. A timer-controlled pump allowed sampling.

In 1973, it was decided to improve the sampling system, and a mechanical engineering summer student, John A. Tegtmeier, was assigned to design a system at the head of the channel using a V-notch weir with its specific Trebler sampler scoop so that samples would be more accurately proportional to flow.

As late as July 1967, plans called for transferring the vacuum filter and all of its appurtenances from DP-35 to DP-257 to dewater plant sludge. The plans also included moving the double-drum tumbler and accessories to DP-257 to solidify americium wastes. However, the vacuum filter was abandoned, and the pug mill was installed in the southwest corner of the building. Because the installation was not in the Behrent plans, Zia Company installed it and completed most of the work by the end of 1967. Sludge was allowed to accumulate in the storage tank in DP-257 until May 1968 when 22,600 L were mixed with cement in the pug mill and pumped to a disposal shaft in the east end of Area T. The cement paste–waste mixture was 33,350 L and contained 25 g of plutonium-239. The following month, a mixture of plant sludge, strip waste, neutralized americium waste, and various batch wastes—a total of 7,500 L—were mixed in the pug mill with cement and pumped to a shaft in Area T. Strip waste resulted from reprocessing spent uranium fuel. In 1968 and 1969, the volume delivered to DP-257 varied

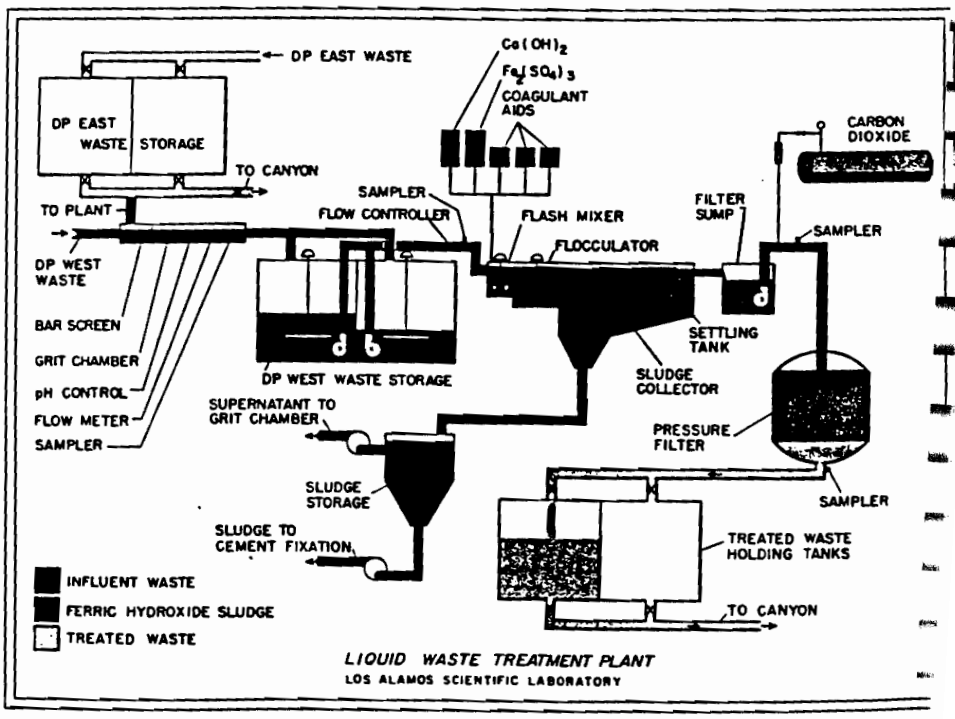


Fig. 9-2. The TA-21 treatment process (schematic).

from 160 to 300 gal. per month. The waste was acidic and was contaminated with strontium-90 and cesium-137. The lab section developed a treatment method involving strontium nitrate, ferric chloride, tribasic sodium phosphate, nickelous sulfate, and copper ferrocyanide from which the strontium and cesium were precipitated. The combination of solids and liquids was then mixed with cement in the pug mill operation.

While the pug mill system was installed and checked, the double-drum tumbler operation at DP-35 continued to handle the americium-241 wastes. The 56 drums of americium-241 paste produced in June 1968 were the last from this facility, because the operation transferred to DP-257. Although neutralized americium-241 waste and plant sludge were the main wastes incorporated in cement, various miscellaneous batch wastes were also disposed of in this manner. Table 9-1 lists the wastes managed by the system in 1972.

MORE PUG MILL OPERATIONS

When the pug mill was first installed, the drive motor was in an uncovered area at the southwest corner of the building. Because servicing the motor and appurtenances was difficult in inclement weather and storage space was needed for pug mill maintenance tools and equipment, Zia Company craftspeople enclosed the area and completed the project on December 31, 1970.

Various problems were associated with operating the silo and pug mill. For example, because of bridging and other conditions, cement powder from the silo would fail to fill the screw that delivered it to the pug mill. A vibrator attached to the bottom of the cone of the silo resolved this problem. Gears and bearings had to be replaced in the pug mill drive system, and the mill itself had to be scraped occasionally because cement accumulated to the point where it prevented the mixing blades from rotating. The pug mill discharge pump, a Moyno-type unit, required frequent maintenance because of the difficult material being pumped and the increasing distance to the disposal point.

The pug mill itself operated uncovered for a period, but for contamination control, a cover was necessary. Lucite sheets quickly clouded with dust and condensation, and were unsatisfactory. Polycarbonate sheeting proved satisfactory.

Three-inch-diameter aluminum tubing, the upper section a foot or so underground, conveyed the cement paste mixture to the receiving pits. However, because of the nature of the mix or the delay in flushing the line at one point, the cement paste set up, and the line could no longer be used. It was abandoned in place and replaced by aboveground 2.5-in. two-ply fire hose. The first hoses were

Waste	Liters	Problem contaminants
plant sludge	85,000	plutonium-238, plutonium-239, americium-241
neutralized americium-241	126,750	plutonium-239, americium-241
strip waste	16,050	mixed fission products (MFP)
KOH waste	82,250	fluorine (F^-)
miscellaneous	3,300	α,β,γ

Table 9-1. *Pug Mill Operation, 1972.*

supplied by the Los Alamos Fire Department, but the group purchased ones from a commercial supplier later.

The fire hose was satisfactory except in a few instances. During a pug mill run on November 5, 1976, the operator noted that the pump discharge pressure had dropped to zero. Looking out at the line to the disposal area, he noted that a stream of paste was spewing from the hose about 50 ft. away. He immediately shut off the pump and began steps to have the area cleaned and to complete the run. In investigating the source of the leak, a small hole (20 mm) was found in the hose. The hose was replaced, and an 18 mil vinyl cover was installed over the hose to limit the spread of contamination if future holes developed. (Hoses were routinely replaced every six months. They were tested to 500 psi, although operating pressures were under 100 psi.) In another instance in June 1979, the hose was kinked when the pump was turned on, and pressure built up on the upstream side. When an operator noticed the kink and removed it, he could not control the discharge of cement paste from the end of the hose and a small ground area was contaminated before he directed it properly.

To determine the stability of the paste mix, compression tests were run on samples of each pug mill run. Equipment such as that used for concrete compression tests was purchased, and the standard test using 6-in.-diameter by 1-ft-high samples was run. Samples were immersed in water for 21 days, and the ends were capped with a standard lead compound to ensure flatness and parallelism before breaking. Compressive strengths were generally 1800–2500 psi, but they ranged from 78–4150 psi between 1969 and 1974. The 78-psi run consisted of equal amounts of KOH solution and plant sludge in the cement paste. In Fig. 9-3, Dave Salazar is shown breaking one of the cylinders.

Fig. 9-3. *A technician tests the compressive strength of a waste cement paste cylinder.*

In 1979, a separate walled enclosure was constructed around the pug mill for additional protection of personnel working in the plant.

SHAFTS AT AREA T

Disposal shafts for the cement paste were drilled in Area T in the space between the absorption beds (see also Chapter 5). The first few shafts were 4 ft in diameter; the procedure was changed to drilling a 3- or 4-ft-diameter pilot hole and reaming it out to an 8-ft diameter. A depth of 65 ft was established as optimum, and most shafts met this criterion. However, they ranged from about 15 ft to 80 ft. The shallow shafts

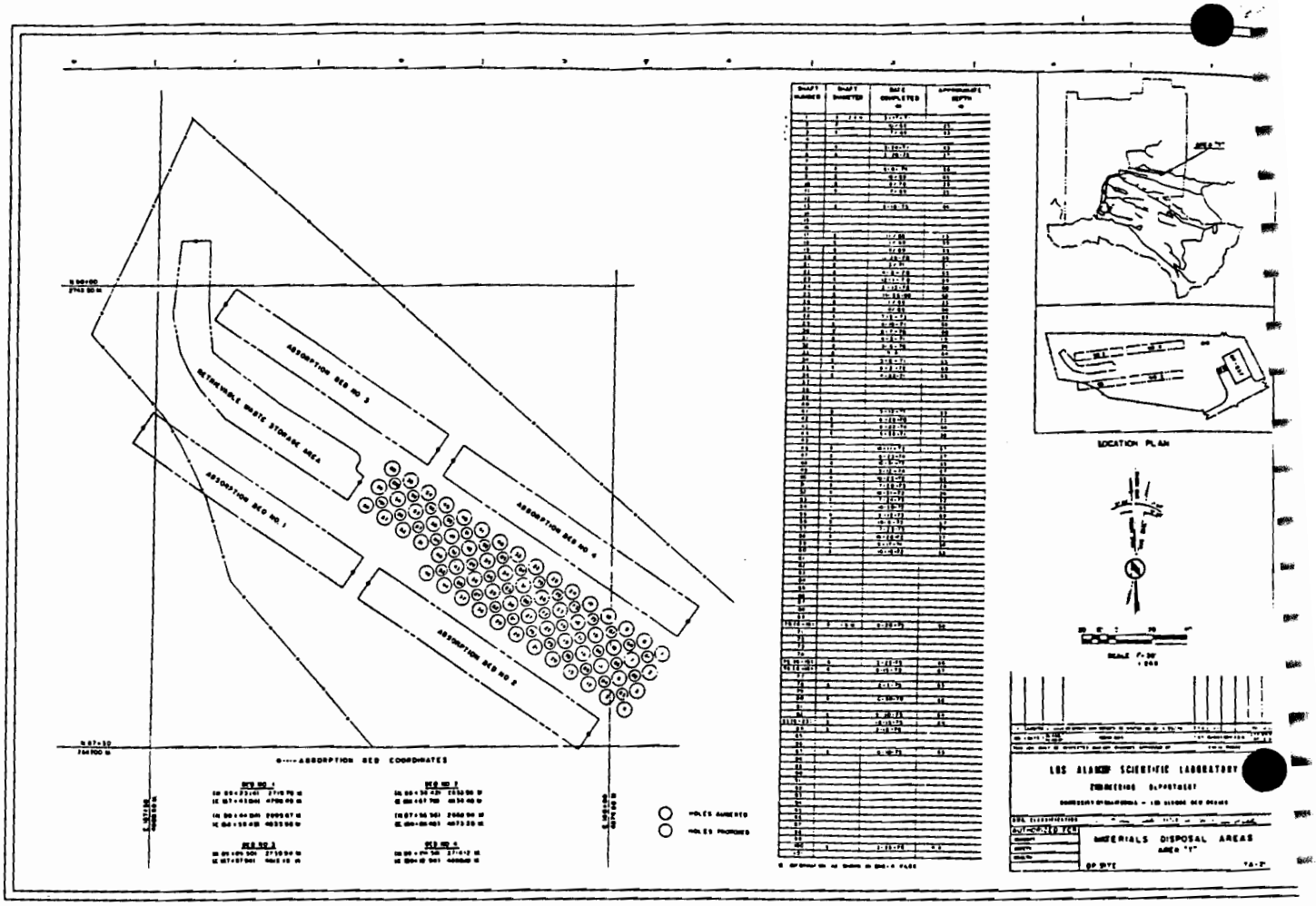


Fig. 9-4. Area T shaft locations.

were the result of the drill being stopped by large boulders. A gravel stratum, approximately 15 ft below the surface at the shallowest point (averaging 28 ft) and underlying the entire area, contained boulders of a size to stop the drill. Appendix T is a letter from the USGS defining the problem; Fig. 9-4 shows the location and spacing of the drilled shafts, and Fig. 9-5 lists the depths and diameters.

Migration of radioactivity through the gravel stratum was a concern and, in an attempt to reduce it, the group purchased a tank trailer for heating asphalt, along with hoses and a spray head. In December 1970, the first pit was coated for its entire depth with hot asphalt. The coating became standard practice.

To protect the operator at the discharge end of the hose from falling into the shaft, a plywood cover with a small central opening was provided. This arrangement was shortly replaced with an angle iron frame containing 2-ft × 10-ft steel panels that could be removed individually.

On the morning of July 2, 1971, one of the plant operators noted that sections of the steel cover on Shaft 44 were removed, overturned, and generally awry. The shaft had received waste from a pug mill run (PMR) the previous day. A PMR

DEPTHS OF NONRETRIEVABLE WASTE DISPOSAL SHAFTS LOCATED AT MDA T.

Shaft Number	Diameter (m)	Depth (m)	Shaft Number	Diameter (m)	Depth (m)
1	2.4	18.7	46	2.4	20.1
2	2.4	6.4	47	2.4	7.6
3	2.4	8.2	48	2.4	19.2
5	2.4	8.8	49	2.4	20.4
6	2.4	8.2	50	2.4	19.9
8	2.4	20.4	51	2.4	9.1
9	2.4	19.2	52	2.4	7.1
10	2.4	7.1	53	2.4	15.8
11	2.4	8.5	54	2.4	19.1
13	2.4	19.8	55	2.4	21.0
17	2.4	15.2	56	2.4	18.9
18	2.4	18.0	57	2.4	7.6
19	2.4	19.8	58	2.4	6.8
20	2.4	19.2	59	2.4	16.5
21	2.4	19.0	60	2.4	19.1
22	2.4	19.5	70 6-10[a]	1.8	20.7
23	2.4	19.1	75 6-15[a]	1.8	20.3
24	2.4	18.6	76 6-16[a]	1.8	20.5
25	2.4	4.9	78 6-18[a]	1.8	19.7
26	2.4	4.6	80 6-20[a]	1.8	20.1
27	2.4	17.7	82 6-22[a]	1.8	19.5
28	2.4	20.4	83 6-23[a]	1.8	7.3
29	2.4	18.5	84	1.8	15.1
30	2.4	18.9	87 6-27[a]	1.8	20.0
31	2.4	5.6	91	1.8	7.9
32	2.4	4.6	92	1.8	8.2
33	2.4	19.5	94	1.8	6.6
34	2.4	18.4	95	1.8	4.9
35	2.4	19.0	100	1.8	20.2
36	2.4	18.7			
41	2.4	18.9			
42	2.4	6.4			
43	2.4	18.9			
44	2.4	19.2			

[a]Designation prior to 3-12-76.

Fig. 9-5. *Depths and diameters of Area T shafts.*

in an 8-ft-diameter shaft would occupy about 6 ft of depth. In this shaft, the cement paste surface at the end of the run was about 40 ft below grade. In removing the cover on July 2, operators noted that the hardened paste was severely fractured and a large section was standing on its edge. The phenomenon was discussed with numerous people at the Laboratory, and the consensus was that the heat generated by the setting cement had created a high-pressure steam pocket that eventually fractured the paste. Reviewing the problem with engineers at Portland Cement Association headquarters in Skokie, Illinois, was inconclusive because they refused to believe that sufficient heat would be generated. In any case, for all following PMRs, thermocouples were placed in the zone to be filled by the cement paste. They were connected to a recorder that provided a printout of the rising temperatures in the paste. Minor paste fractures occurred in a shaft on June 30, 1971, and on September 9, 1971, (PMR 139) when the covers for Pit 5 were found in disarray. In the latter case, the top of the paste was only about 5 ft below grade. The temperature recording showed clearly that steam pockets had caused the fracturing of the paste. Other similar but minor problems occurred August 7, (PMR 193) and August 10, 1972 (PMR 194).

When a PMR was completed, tl paste delivery line was full and had to cleaned out. Early practice was to flu out with water into a shaft not yet in However, a standby shaft was not alwa readily available, and the area surroui the shaft receiving the water would become saturated. On May 23, 1974, the wash water was diverted to the gr chamber, where heavy solids were remc and the supernatant could be treated through the plant.

Table 9-1 lists the usual solutions incorporated in paste through the pu mill, however, many other occasional solutions and various solids were disp in the shafts. In several instances the 270-gal. stainless steel tank trailers from DPW contained waste solutions with relatively high—several mg/L—concentrations of plutonium-238 rathe than the usual americium-241/plutor 239. In another instance, H-7 personn removed 114 small cans containing ur (uranium-233) acetate from vaults at DPW and placed them in eight 55-gal. steel drums that were then filled with vermiculite. Four of the drums were placed in partially filled Shaft 52 and fo in partially filled Shaft 58. The total amount of uranium-233 in the cans wa 731 g. In other research at the Labor heavy-walled steel bathyspheres, 3 ft in outside diameter, had been used to contain explosions in which pluton 239 was involved. No longer of any us the spheres were delivered to DP- disposal in the shafts (Table 9-2).

Shaft number	Depth (ft)	Spheres (number)	Total plutonium-239 (g)
3	27	3	290
17	50	9	342
18	56	3	134
19	65	3	245
26	15	3	210

Table 9-2. *Disposal of 3-ft-diameter spheres.*

In the early 1970s, the AEC promulgated an order requiring retrievability of radioactive solid wastes above a certain level of activity [3]. The solution devised for the pug mill paste required a large open pit, and the area selected prevented drilling any 8-ft-diameter shafts beyond Shaft 60 (Fig. 9-4). Because nonretrievable cement paste would continue to be generated, additional shaft space was needed. Six-ft-diameter shafts could be drilled among the 8-ft shafts with little equipment contamination and few problems. In addition to the 60 8-ft-diameter shafts, the area eventually supported an additional 41 6-ft-diameter shafts. Table 9-3 lists the shafts in Area T and provides their content of americium and plutonium, and Table 9-4 lists the depths and diameters of the pits. Table 9-5 gives the total estimated activities in the Area T absorption beds and in the disposal shafts.

CORRUGATED METAL PIPE RETRIEVABILITY

When the AEC began to consider retrievability for certain activity levels of solid wastes, H-7 was confronted with the problem of managing retrievable pastes from pug mill runs [3]. All runs containing the americium wastes would be retrievable. The first plan advanced to ALOO involved pumping the paste to a hopper-bottomed tank from which the paste would be manually controlled in filling 55-gal. drums on a roller conveyor. This process would include a small building with hoists to move the drums. ALOO believed this type of operation too

Shaft number	americium-241 (g)	plutonium-239/-240 (g)	plutonium-239-/240 in bathyspheres (g)
1	21.836	20.767	
2	2.635	3.688	
3	5.524	10.208	290
5	25.007	12.001	
6	10.6	10.96	
8	30.61	44.97	
9	24.243	24.977	
10	4.378	3.97	
11	2.675	3.217	
13	35.924	39.608	
17	17.278	31.897	342
18	17.757	18.758	134
19	6.414	16.333	245
20	27.455	11.562	
21	23.532	13.255	
22	20.761	18.802	
23	32.609	20.412	
24	26.039	17.427	
25	10.382	7.235	
26	5.829	4.538	210
27	18.768	32.539	
28	34.837	40.429	
29	10.215	4.224	
30	19.52	14.048	
31	3.059	2.965	
32	9.74	5.355	
33	21.275	24.764	
34	22.157	11.425	
35	26.253	16.037	
36	26.915	12.408	
41	18.789	20.479	
42	2.573	4.203	
43	30.628	28.12	
44	22.004	14.542	
46	37.002	33.031	
47	16.157	16.552	
48	24.317	21.71	
49	51.391	62.244	
50	22.027	18.46	
51	12.193	11.398	
52	12.463	26.485	
53	35.248	28.68	
54	35.5	25.792	

Table 9-3. *Americium and plutonium content of disposal shafts at Material Disposal Area (MDA) T.*

Shaft number	Diameter (ft)	Depth (ft)	Shaft number	Diameter (ft)	Depth (ft)
1	8.0	61.4	43	8.0	62.0
2	8.0	21.0	44	8.0	63.0
3	8.0	27.0	46	8.0	65.9
5	8.0	28.9	47	8.0	24.9
6	8.0	27.0	48	8.0	63.0
8	8.0	66.9	49	8.0	66.9
9	8.0	63.0	50	8.0	65.3
10	8.0	23.3	51	8.0	29.9
11	8.0	27.9	52	8.0	23.3
13	8.0	65.0	53	8.0	51.8
17	8.0	50.0	54	8.0	62.7
18	8.0	59.1	55	8.0	68.9
19	8.0	65.0	56	8.0	62.0
20	8.0	63.0	57	8.0	24.9
21	8.0	62.3	58	8.0	22.3
22	8.0	64.0	59	8.0	54.1
23	8.0	62.7	60	8.0	62.7
24	8.0	61.0	70 6-10*	6.0	67.9
25	8.0	16.1	75 6-15*	6.0	66.6
26	8.0	15.1	76 6-16*	6.0	67.3
27	8.0	58.1	78 6-18*	6.0	64.6
28	8.0	66.9	80 6-20*	6.0	65.9
29	8.0	60.7	82 6-22*	6.0	64.0
30	8.0	62.0	83 6-23*	6.0	24.0
31	8.0	18.4	84	6.0	49.5
32	8.0	15.1	87 6-27*	6.0	65.6
33	8.0	64.0	91	6.0	25.9
34	8.0	60.4	92	6.0	26.9
35	8.0	62.3	94	6.0	21.7
36	8.0	61.4	95	6.0	16.1
41	8.0	62.0	100	6.0	66.3
42	8.0	21.0			

Table 9-4. *Depths of nonretrievable waste disposal shafts at Area T.*
**Designation before March 12, 1976.*

Disposal area	Date	Radionuclide	Estimated activity (Ci)
Absorption beds	1945–1951	Pu	9.8
		tritium	14.0
Disposal shafts	1968–1983	^{241}Am	3743.1
		^{238}Pu	31.3[a]
		$^{239/240}$Pu	151.0
		^{233}U (731g)	6.9[b]
		mixed fission	7.7
Retrievable wastes (corrugated metal pipe)		removed to Area G	

Table 9-5. *Estimated radionuclide source terms at Area T.*
[a]Buchholz undated, personal communication to M.A. Devaurs.
[b]Warren, 1980.

costly and requested other suggestion H-7 then recommended using 20-ft lo by 30-in-diameter welded, galvanized corrugated metal pipe (CMP) sitting end with a "cold" concrete plug in the bottom and capped with cold concret about 1 ft deep at the top. ALOO approved this plan, and the area betwee the west absorption beds was selected the disposal site. The overflow pipe fro the south to the north bed had to be removed, and the soil between the beds had to be sampled and tested for radioactivity levels. No problems developed, and a work order dated April 15, 1974, was written to excavate a pit 30 ft × 124 ft × 20 ft deep. CM lengths had been purchased and on December 10, 1973, one length was entirely filled with "cold" paste. January 24, 1974, the Zia Company wa requested to manipulate the filled uni Using fabric straps, Zia Company rigge raised, lowered, and generally moved heavy, filled CMP easily.

Actual filling of CMPs that set vertically in the pit and had "cold" con plugs at the bottom began on Decembe 31, 1975. These pipes were used for retrievable wastes only; the 8-ft and 6- shafts were used for the nonretrievable mixes until April 1983, when pug mil operations ceased. At this time, 227 G units had been filled; 69 of them were removed to TA-54 in 1984; and the remaining 158 were transferred in 1986 Their average weight was 12,000 lb.

In the early 1970s, CMB-11 operations were growing rapidly, and planning for a more modern, larg was underway. TA-55, a 21-acre site at

intersection of Pajarito Road and Pecos Drive, directly across from TA-50, was selected for the new facility. Construction was largely complete by 1977 when the first occupants transferred from DP West. The plutonium-processing facilities were transferred into TA-55 by January 1978, and the americium waste problem had shifted from DP-257 to TA-50-1. The DP-257 pug mill operations focused on the remaining americium waste in storage tanks and on nonretrievable waste. With the vacuum filter dewatering the plant sludge and with the final disposal of all americium waste at DP West, use of the pug mill was discontinued. The last PMR, 499, was conducted in April 1983. The cement silo was transferred for use at TA-55 in 1984, and shortly after that the pug mill and appurtenances were removed. In 1986, Area T was declared an inactive disposal site, and in 1987 the surface of the area was stabilized and measures were taken to control runoff intrusions from surrounding paved areas. Surface stabilization included covering the area with tuff from the pit excavation, then adding 6–12 in. of topsoil for reseeding and mulching.

In 1986, the pug mill, the walls enclosing it, auxiliary tanks, pump and piping were removed and transferred to TA-54 as part of the radioactive waste lines removal project that was funded under Phase B of the Radioactive Liquid Waste Collection Systems Improvements Project. Also removed was the buried aluminum pipe line that originally transferred waste to the pits and that had been abandoned in place when its contents of cement paste had set up.

THE "GENERAL'S TANKS"

The General's Tanks (Chapter 5) were two 50,000-gal. cylindrical steel tanks installed in the west end of Area A (Fig. 9-6). The tanks stored more concentrated plutonium-239/-240 wastes in the hope that the plutonium-239/-240 could be eventually recovered. The wastes also contained plutonium-241, which, over the years decayed to americium-241. It was estimated that the tanks contained 200–400 g of plutonium-239/-240.

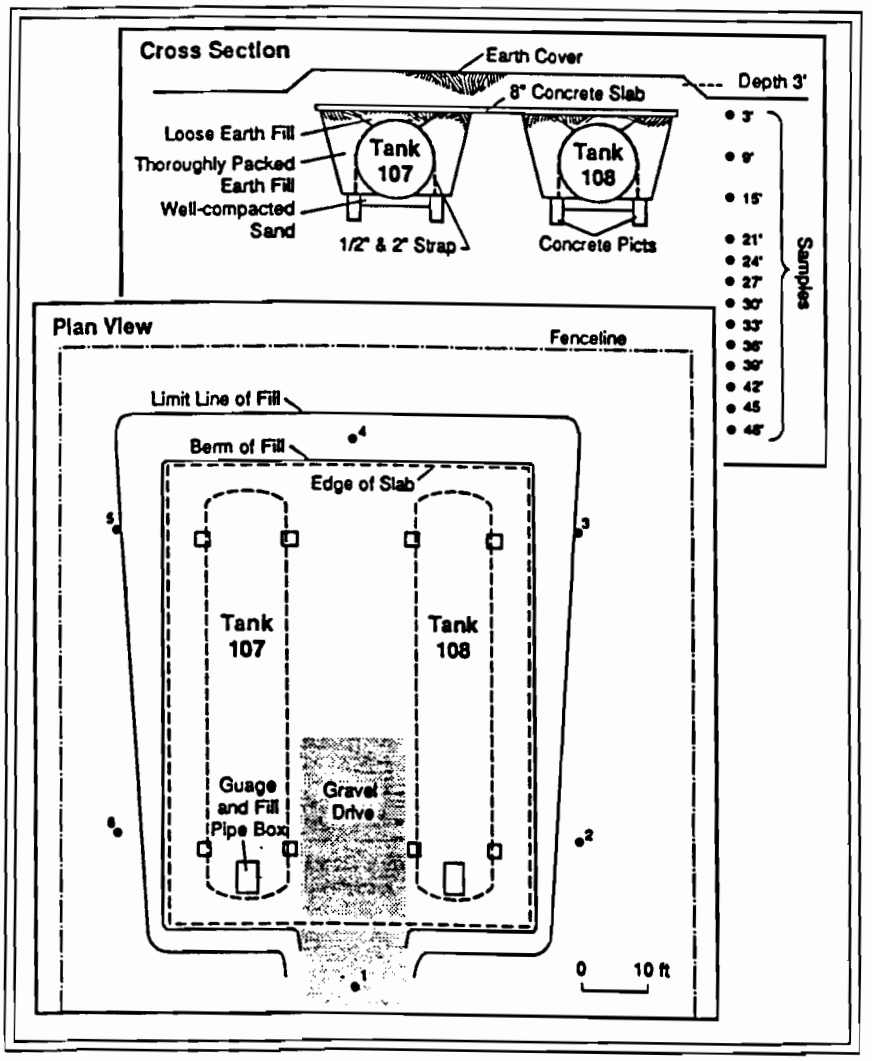


Fig 9-6. The General's Tanks, west end of Area A.

In 1974, because of concern that the tanks might be leaking, H-8 drilled holes and sampled beneath the tanks, and H-7 removed the liquids from the tanks. A work order was placed to excavate a pit over each tank, break a large hole in the concrete slab over each tank, and cut a hole in the steel tops of the tanks. This work was completed in 1974. The wastes were sampled and analyzed, and on June 19, 1975, 40,000 L of the supernatant in the tanks were transferred to DP-257 for treatment. After all supernatant had been removed, it was planned to fill the tanks with cement paste from pug mill operations. To accommodate the wash water used to flush the transfer line, two 4-ft-diameter shafts were drilled in the southwest corner of Area A. The plan was to settle the rinse water for 1–2 days, then to pump the supernatant to DP-257 for treatment. Transfers of waste from the General's Tanks continued sporadically from 1975 to 1983. Because some rainwater had entered the tanks, the openings were sealed in 1985. Most of the original radioactivity remains in the residues in the bottom of the tanks.

H-8 drilled holes around the tanks in 1974 to depths of 35 ft and collected samples every 10 ft. Activities were within background levels and indicated that the tanks were not leaking. However, in a sampling campaign in 1983, holes were drilled to a 30-ft depth at 3-ft intervals at 6 locations around the tanks. Plutonium concentrations above background levels were found in most samples.

The plan to fill the tanks with cement paste from pug mill operations was never implemented.

PROCESS IMPROVEMENTS AT DP-257

In the Preliminary Design Study Documentation and Ralph M. Parsons Co. Title I plans, all as part of the Upgrading Project, improved treatment efficiencies in DP-257 operations were planned. Considering such systems as ultrafiltration, ion exchange, mechanical and solar evaporation, LASL personnel presented a primary concept in a study report in May 1977 that included ion exchange and solar ponds. A first alternate was substituting mechanical evaporation for the ion exchange and ponds, and a second alternate provided either mechanical evaporation of ion exchange effluent or mechanical multi-effect evaporation followed by a final evaporator. Later, a wiped-film evaporator was proposed to process HF and HNO_3 wastes.

At about this time, CMB-11, the major generator of radioactive wastes at DPW, was completing a new facility at TA-55. After CMB-11 relocated, the quality and quantity of DP West wastes were estimated and a major reduction in both was assumed. Plans for process improvements at DP-257 were dropped, and it was decided to pump treated DP-257 wastes through a 3-in welded steel line to TA-50-2; improved pH control was incorporated at the DP-257 plant and the new pumping station was installed at the effluent storage tanks. TA-2 wastes would be injected into the line as it crossed that site. These decisions were incorporated into the Title II documents and became reality when construction was completed.

DPE WASTES IN LATER YEARS

In 1984 the Tritium Systems Test Assembly (TSTA) began operations in DP-155. Liquid wastes were directed to the pump station DP-223 for treatment and disposal at DP-257. The pumping system failed several times, and until Zia Company personnel could get it back into operation—sometimes a matter of several days—wastes would overflow through a line directly to DP Canyon. To correct this situation, in 1979 H-7 installed two 3000-gal. overflow tanks, DP-346 and DP-347, in a bermed area about 110 ft north of DP-223 to contain the overflow. Beginning in 1983, because of the reduced waste flows from DPW, the DPE wastes were pumped directly into the DPW raw waste storage tanks at DP-257. Table 9-6 lists influent flows to the plant during the period of transfer of CMB-11 operations to TA-55.

Calendar year	From DPE	From DPW	DPE + DPW
1975	996.2	4673.4	5669.6
1979	1688.4	163.0	1851.4
1980	1551.5	466.0	2017.5
1981	1245.0	3279.1	4524.1
1982	2843.5	317.5	3161.0
1983			4347.1
1984			3458.0
1985			3130.0*

Table 9-6. *Influent flows to DP-257 in kL. *After July 1, 1985, all treated wastes were pumped to TA-50-2. For July-December 1985, the total was 1,590,000 L.*

ELIMINATING DISCHARGES TO DP CANYON

Wastes treated at DP-35 and DP-257 were discharged primarily to DP Canyon, a small branch of Los Alamos Canyon. For some time, discussions focused on eliminating radioactive waste discharges to this canyon to reduce the number of contaminated waterways in Los Alamos. The early solution given highest priority involved pumping the waste south across the mesa and down into Los Alamos Canyon, which was also receiving wastes from TA-2. However, in the latter stages of developing plans and specifications for the line item project "Upgrading of Industrial Liquid Waste Treatment Plants," H-7 pressed for including a cross-country line to carry treated wastes from DP-257 to TA-50-2 and to collect a pumped discharge from TA-2 waste storage tanks along the way. The idea was approved and added to the project. The project included

- a new pumping station at DP-257,
- welded 3-in. steel pipeline to TA-2,
- a new pumping station at TA-2, and
- extension of the 3-in. steel line to TA-50-2.

Cleanouts were provided at the low points of canyon crossings; vents were included at mesa tops; and cathodic protection was provided. The Ralph M. Parsons Company completed plans and specifications in May 1981, and the successful bidder for the construction contract, Brown-Olds Corporation, subcontracted the line to Paul Parker Construction of Los Alamos. In his weekly report, J. Colvin, the Ralph M. Parsons Co. inspector, mentioned completing the

THE RALPH M. PARSONS COMPANY

INTEROFFICE CORRESPONDENCE

To E. Fisher

Date April 18, 1983

From J. Colvin

Phone 662-9467 Location Los Alamos, N.M.

SUBJECT Weekly Report # 78

Completed all work in the gravity filters except the surface washers.

Tested the entire 3 inch waste line from WM-2 to TA-2 and TA-21. A short section of 1½ inch requires lowering. Holiday testing and back-filling continue in Los Alamos Canyon.

During the bi-weekly meeting Friday Brown & Olds agreed to grout the horizontal pumps.

Continue making terminations in WM-1, pulling instrumentation cable in the boiler house.

The vendor for the chemical feed system spent a week on site checking out the equipment. The lime feeder with out the rotary feeder will not function. He is blaming the knife valves, says it will work with a control valve replacing the knife valve. Also the vibrators appear to be much too strong.

Respectfully,

J. Colvin

J. Colvin

Fig. 9-7. Memo mentioning the completion of the first tests of the line from DP site to TA-50-2.

first tests on the line (Fig. 9-7). All tests and inspections were completed by early April 1984, and the line was placed in service on July 1, 1985. Table 9-7 lists waste volumes treated at DP-257, then pumped to TA-50-2. These numbers do not include TA-2 wastes that were injected into the line.

Calendar Year	Volume Pumped (kL)
1985	590
1986	4847
1987	3857
1988	3507
1989	2347
1990	2033
1991	1075
1992	1448
1993	993

Table 9-7. *Treated DP-257 wastes pumped to TA-50-2.*

A NEW VACUUM FILTER

As CMB-11 transferred operations to TA-55 and waste radioactivities dropped markedly, the pug mill operation was replaced with a precoat-type rotary vacuum filter similar to the installation at TA-50-1. ENG-2, working closely with H-7 engineers, prepared plans and specifications; H-7, primarily Bill Dunne, selected the equipment for purchase; and the Zia Company constructed the system. The filter was placed in operation in June 1983, and during the rest of that year, 231 200-L drums were filled with dewatered sludge.

THE FUTURE OF DP-257

In 1994, the extent of radioactive contamination of TA-21 was defined with the intent of eventually decommissioning the site. In fact, decontamination and decommissioning (D&D) work began in late 1993 on buildings DP-3(S) and DP-4(S), uranium labs.

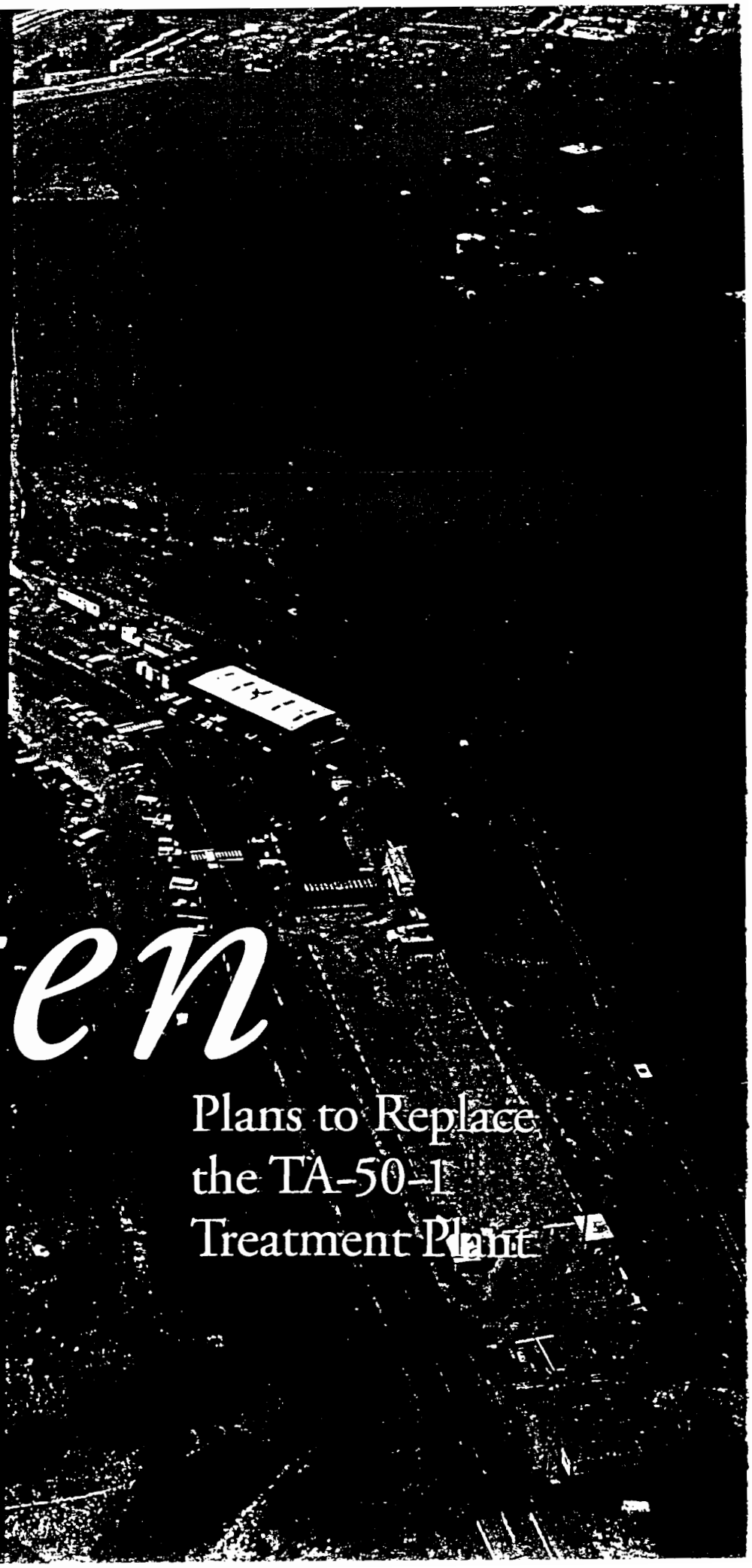
The work is being directed by the Environmental Restoration Project Management Team (Jorg Jansen, Program Manager) under Field Unit 6, Decommissioning (Miguel Salazar, Project Leader). JCI personnel are doing the work, and ESH-1 personnel provide radiation control operations. (In many other decommissioning projects in Los Alamos, the work and radiation control have been let to private contractors, an arrangement that may soon be the case at TA-21). Reference 4, which describes the LANL decommissioning programs to the year 2004, lists the estimated costs for the TA-21 work as $48.2M. The TA-21 project involves 49 structures.

DPE appeared to be excluded from the D&D work for the present, continuing to be involved in fusion programs with funding for the next three years.

The DP-257 plant, still in operation in 1995, but primarily for wastes from DPE, has personnel about one day per week; all effluent is pumped to TA-50-2. In CY93, the vacuum filter was run only in November, producing a total of 11 200-L drums of dewatered sludge. The plant will probably remain operable until the TSTA project is completed.

References

1. Behrent Engineering Company, Denver, Colorado, Plans and Specifications, Contaminated Waste Disposal Facility, TA-21, DP-257 (1966).
2. Emelity, L. A. and C. W. Christenson, "Impact of AECM 0511 on Operations of the Los Alamos Scientific Laboratory (LASL) Liquid Waste Management Group," Second AEC Environmental Protection Conference, Albuquerque, New Mexico (April 1974); Los Alamos Scientific Laboratory report LA-UR-74-530 .
3. DOE Order 5820.2A, "Radioactive Waste Management" (1988). (Retrievability requirements were initially promulgated in the early 1970s as AEC Manual Chapter 0511.)
4. Environmental Management/ Environmental Restoration, LANL, Decommissioning Summary Site Plan (March 24, 1995; updated annually).



CHAPTER *ten*

Plans to Replace the TA-50-1 Treatment Plant

FY	Activity
86	Need to upgrade or replace existing radioactive liquid waste treatement facility (RLWTF) identified. Engineering study identifying treatment options completed.
89	Engineering study completed identifying requirements of new facility.
90	New RLWTF concept presented for validation to DOE.
91	Programming analysis completed to identify scope and costs of existing RLWTF upgrade.
92	DOE-HQ requests submittal of mission need statement (MNS) and short form data sheet (SFDS).
92	MNS and SFDS development begins.
92	DOE-AL proposes value engineering (VE) session to define scope.
92	VE session held to define scope and formulate strategy.
92	RLWTF presented at DOE-LAAO semiannual review and submitted to DOE/AL/PMD as an FY96 line item project (LIP).
92	(September) Anticipated DOE-AL approval to proceed to Energy Systems Acquisition Advisory Board (ESAAB) process for KD-0 approval.

Table 10-1. *Calendar of events—RLWTF Project.*

Waste treatment facilities at the Laboratory were inspected, audited, and appraised in the late 1980s and early 1990s; some—such as the Tiger Team inspections—were extensive and intensive. The audits indicated that the TA-50-1 plant, which began operations in 1963, could not meet the latest DOE and EPA standards and other health and safety standards. Improvements were required in personnel safety, control of environmental contamination, and efficiency of waste treatment. The necessary changes would be too costly in another upgrading project; a totally new facility was needed. ICF Kaiser Engineers, Inc., with the Laboratory Facilities Engineering Division, conducted a feasibility study [1] to refurbish TA-50. They arrived at a project cost of $175M and concluded it could not be considered a viable project. Early estimates indicated that the cost of a new facility would exceed $100M, so efforts were made to place the project on the LANL list of line item needs. A project office (Project Identification No. 10411-50-B) was established in EM-7 on June 1, 1992, with Jerry Buchholz as Team Leader (Fig. 10-1 and Fig. 10-2). Buchholz resigned his position as Liquid Waste Section Leader, and Steve Hanson was appointed to assume those duties. However, the need to replace the plant was not first recognized in 1992. Table 10-1 indicates that this project was recognized as far back as 1986, and Table 10-2 lists consultants involved from 1987–1994. Table 10-3 outlines the scope of the entire project.

A mission need statement [2] was prepared and sent to Allen Tiedman, Associate Director for Operations, who forwarded it to the DOE-LAAO to support the project as an FY96 line item. The FY93 budget estimate for a Conceptual Design Report was $4.0M. An SFDS for FY96 line item projects (Appendix U) lists the total estimated cost at $161.2M.

The question of designation of the project manager arose in late CY92. This was clarified in a memo from Tiedman to division leaders (August 28, 1992) in which he designated the Facilities Engineering Division as "cradle-to-grave" manager of all LANL construction activities. (DOE Order 4700.1 requires that a single organization take the lead in meeting project management requirements.)

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO Distribution

DATE December 20, 1991

FROM Jerry Buchholz

MAIL STOP/TELEPHONE E518/7-7391

SYMBOL EM-7 91-365

SUBJECT STEVE HANSON ACTING SECTION LEADER FOR LIQUID WASTE

Effective January 2, 1992, Steve Hanson will be Acting Section Leader for the Liquid Waste Section of EM-7. I will relocate to TA-50-37, Mail Stop E517, and coordinate the Radioactive Liquid Waste Treatment Facility Replacement Project. This arrangement will probably last until the presentation on the justification for the new facility is made at DOE Headquarters sometime in February 1992.

JB:dp

Cy: Liquid Waste Personnel
EM-7 Section Leaders
Terry Filer, EM-9, MS E518
Charlie Apel, EM-9, MS E518
EM-7 File, MS E518
EM-7 Group File, MS E517

Fig. 10-1. Memo transferring Buchholz to the Waste Treatment Facility Replacement Project.

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Tony Drypolcher, EM-7, MS K491 — DATE: June 1, 1992

FROM: Jerry Buchholz, EM-7 — MAIL STOP/TELEPHONE: E518/7-4301

SYMBOL: EM-7P 92-1

SUBJECT: RLWTF PROJECT OFFICE

As a result of our meeting and discussions on Wednesday, May 27, 1992, the following actions have or will be taken.

- Effective June 1, 1992 a Radioactive Liquid Waste Treatment Facility (RLWTF) Project Office has been formed. Jerry Buchholz will be the Team Leader; Doris Naranjo, Secretary; and Mort Sanders, Bill Midkiff and Isaac Suazo as full time members. Rick Romero will be a member of the team but may be part time.
- The office will report directly to the EM-7 Group Office.
- All members except Bill Midkiff will be located at TA-66 (ATAC), Room C112 after June 2, 1992. Bill will stay at TA-50-37.
- For the remainder of FY92 all members will remain on their present charge codes.
- Effective June 1, 1992, Jerry Buchholz has stepped down as Leader of the Liquid Waste Section.

Cy: Steve Hanson, EM-7, MS E518
Mort Sanders, EM-7, MS E518
Bill Midkiff, EM-7, MS E517
Isaac Suazo, EM-7, MS E518
Rick Romero, EM-7, MS E518
EM-7 Project File

Fig. 10-2. *Memo establishing the project office for the new treatment facility.*

Contact Date	Problem	Firm
April 1987	study of radioactive waste treatment options	Black & Veatch
	sludge solidification system study	Kaiser Engineering, Inc.
October 1989	regulation requirements for disposal of radioactive sludge	Rogers & Associates Engineering Corporation
December 1989	radioactive liquid waste treatment facility engineering study	Kaiser Engineering, Inc., and LANL Facilities Engineering
January 1990	analysis of sludge treatment system upgrade	Rogers & Associates Engineering Corporation
June 1990	RLWTF project analysis	Kaiser Engineering, Inc.
November 1990	RLWTF project analysis	Kaiser Engineering, Inc.
December 1990	summary of design work for new liquid radioactive waste treatment facility at TA-55	Hauck Consultants
January 1991	RLWTF project analysis	Kaiser Engineering, Inc.
February 1991	cost and time estimates for D&D	Jim Cox, LANL
	RLWTF abbreviated conceptual design report (ACDR)	Kaiser Engineering, Inc., and LANL Facilities Engineering Division
	RLWTF ACDR supplemental information	Kaiser Engineering, Inc.
	RLWTF retrofit engineering report	Kaiser Engineering, Inc.
January 1993	preconceptual functional design criteria document for radioactive liquid waste treatment facilities. Vol. I and II	Ralph M. Parsons Company
February 1994	best available technology study for the RLWTF	Ralph M. Parsons Company
February 1994	RLWTF conceptual design, evaluation of best demonstrated technology available	Resource Technologies Group, Inc., and Merrick & Company
1994	RLWTF records management procedure	Wastren, Inc.
1994	TA-53 radioactive cooling water management study	Merrick & Company
1995	RLWTF conceptual design report	Merrick & Company

Table 10-2. *Consultants involved in the RLWTF Project, 1987-1994.*

Element	Scope
FY97 Line Item, (major systems acquisition [MSA])	Project to replace and improve the existing capabilities of the RLWTF
Selected options	• construct new pretreatment facility (PTF) at TA-50 • construct new main treatment facility (MTF) at TA-63 • replace TA-55 to TA-50 radioactive liquid waste (RLW) lines and extend RLW lines from TA-50 to TA-63 • remove existing RLW lines from TA-55 to TA-50 • safely shut down existing plant • extend effluent discharge lines from MTF to existing NPDES-permitted outfall 051

Table 10-3. *Scope of the RLWTF Project.*

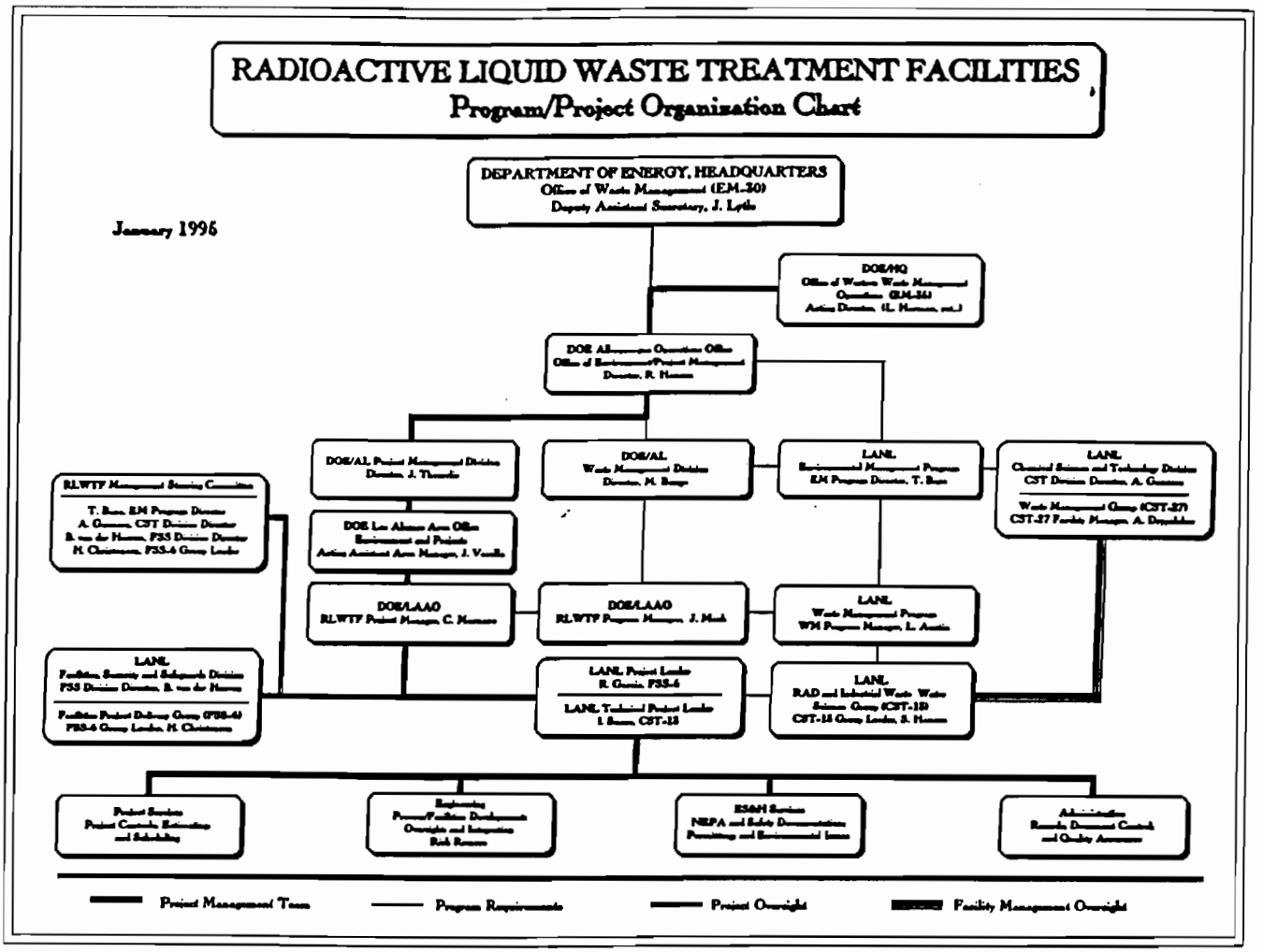


Fig. 10-3. RLWTF project organization chart, January 1995.

Ross Garcia, Jr., FSS-6, was named project manager, and Jerry Buchholz was the "using-group" representative and head of the RLWTF Project Office. In 1993, Buchholz and Sanders retired, and Isaac Suazo succeeded Buchholz as technical project leader of the project office. Figure 10-3 shows the entire project organization chart as of January 1995.

In accordance with DOE 4700.1A, the RLWTF Project is a "major project" that must comply with five key decision (KD) phases (Fig. 10-4). The mission need statement is a requirement of KD-0.

In DOE Order 5400.5, incorporation of "best available technology" (BAT) to treat liquid radioactive wastes is required [3]. To satisfy this order, Ralph M. Parsons Company was contracted in 1992 to recommend the current best processes available to treat the wastes received for processing at TA-50-1 or a replacement facility [4]. The Ralph M. Parsons Company report was submitted in

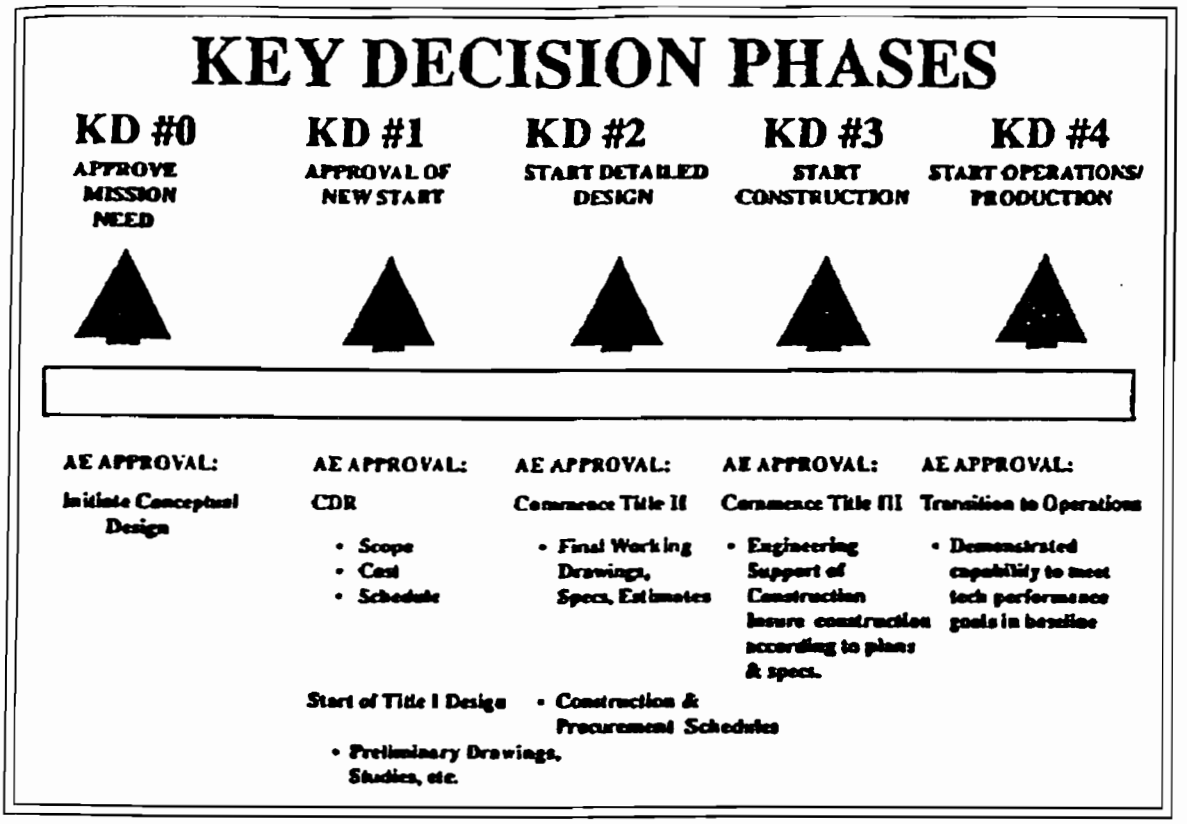


Fig. 10-4. DOE key decision phases.

January 1994, approved, and forwarded to DOE. An additional chapter was requested to reply to the comments and keep the document current.

The Ralph M. Parsons Company BAT reviewed the waste treatment facilities at Savannah River, Hanford, Oak Ridge, and Rocky Flats and concluded that the Rocky Flats system would work well at LANL. The unit processes recommended for a treatment facility at LANL were as follows:

- precipitation–flocculation–sedimentation;
- evaporation;
- oxidation (ultraviolet and ozone);
- fixation in saltstone; and
- a supporting operation of nitrate reduction.

Several comments on the Ralph M. Parsons Company BAT were provided by the Resource Technologies Group, Inc. William Midkiff (CST-18) visited the Graver Company to discuss evaporation, ultrafiltration, and reverse osmosis. A process selection review team was formed with personnel from LANL and representatives from Merrick & Company and Resource Technologies Group, Inc. In December 1994, it was decided to rewrite the BAT, and Resource

FY	Accomplishments
93	• functional and operational requirements, conceptual design criteria completed • mission need statement submitted • seismic study—additional trench—no impact on this project • more solid waste management unit (SWMU) information becoming available • BAT study largely completed • future wastestreams study completed • conceptual design scope and plan being established • major user support verified • working group made up of waste generators formed • "collection system" study initiated; phase 1 completed • refurbishment study completed • systems engineering life cycle developed • environmental and safety information documents being finalized • conceptual design scope and plan schedule developed
94	Planned Activites
	• ESAAB presentations • approval to proceed with conceptual design (KD-0) • complete collection system study • complete conceptual design scope and plan before KD-0 • start Conceptual Design Report (CDR) • Start preliminary safety analysis report (PSAR) • start documentation required by the National Environmental Policy Act (NEPA)

Table 10-4. *Accomplishments and plans for the RLWTF Project.*

Technologies Group, Inc. was contracted for the project. Resource Technologies Group, Inc., working with Merrick & Company, completed a document in early 1995 entitled "Best Demonstrated Available Technology Evaluation." It differed considerably in its recommendations from the Ralph M. Parsons Company work. Specifically, it recommended the following treatment systems:

- UV oxidation;
- chemical precipitation/ membrane filtration;
- evaporation and/or reverse osmosis;
- dewatering of concentrates and solidification/encapsulation;
- nitric acid distillation; and
- pretreatment of TA-55 process wastes.

To meet the requirements of KD-0, approval of the mission need statement by the ESAAB was necessary. The LANL waste management section in cooperation with DOE-AL provided the necessary input for a presentation to the ESAAB by the DOE Office of Waste Management on April 1, 1993. The data included a Conceptual Design Authorization Request (CDAR) prepared by a team coordinated by ENG-2 with management oversight by ENG-1, assisted by ENG-3 (facility design recommendations) and ENG-4 (cost estimates). ESAAB approval was granted. Other accomplishments and plans are listed in Table 10-4.

For FY94, the ESAAB presentations have been completed. Approval by Hazel O'Leary, the Secretary or the DOE, of KD-0 and justification of the mission need statement was received dated October 11, 1994 (Fig. 10-5). An intensive effort is now underway to complete and submit a CDR. Merrick Engineers, Inc. with assistance from Resource Technologies Group, Inc., will likely prepare this document. Completion is scheduled for summer 1996. Then, using the CDR as the basis for bids, the DOE may advertise for a fixed-price contract to design, construct, and operate the RLWTF project. Several

The Secretary of Energy
Washington, DC 20585

October 11, 1994

MEMORANDUM FOR THOMAS P. GRUMBLY, ASSISTANT SECRETARY FOR ENVIRONMENTAL MANAGEMENT

FROM: HAZEL R. O'LEARY

SUBJECT: Approval of Key Decision 0 and Justification of Mission Need for the Radioactive Liquid Treatment Facility at the Los Alamos National Laboratory

I have approved Key Decision 0 and Justification of Mission Need for the initiation of a Conceptual Design Report to study alternatives for bringing the Radioactive Liquid Waste Treatment Facility into compliance with DOE design criteria and environmental regulations.

This approval reflects my understanding that the effort will cost approximately $4.9 million, to be accommodated by the Albuquerque Operations Office budget, and that a Conceptual Design Report will be submitted to Headquarters within 17 months from the date of this approval.

Please plan to brief me on the results of the Conceptual Design Report prior to your formal submission for approval.

Your focal point for these actions is Antonio Tavares, Acting Energy System Acquisition Advisory Board Secretariat. He can be reached on 586-1052.

Fig. 10-5. *Approval of KD-O and Justification of Mission Need for the RLWTF.*

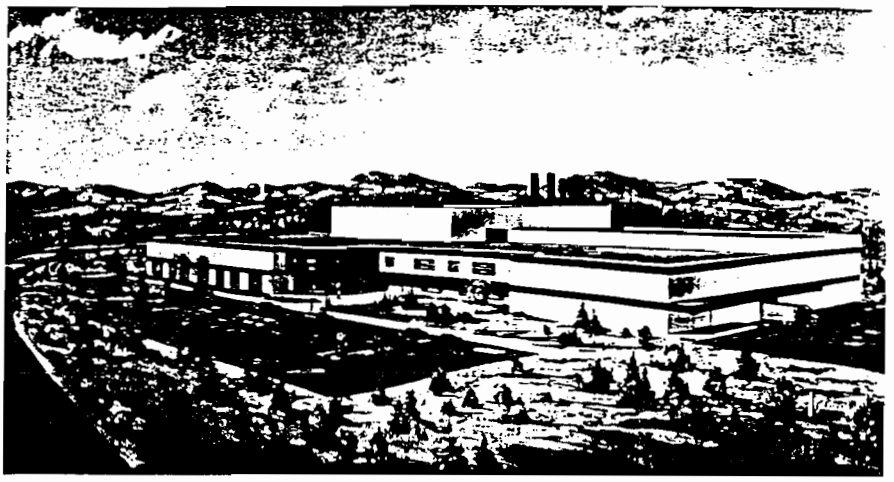


Fig. 10-6. Architect's rendering of the proposed RLWTF at TA-63.

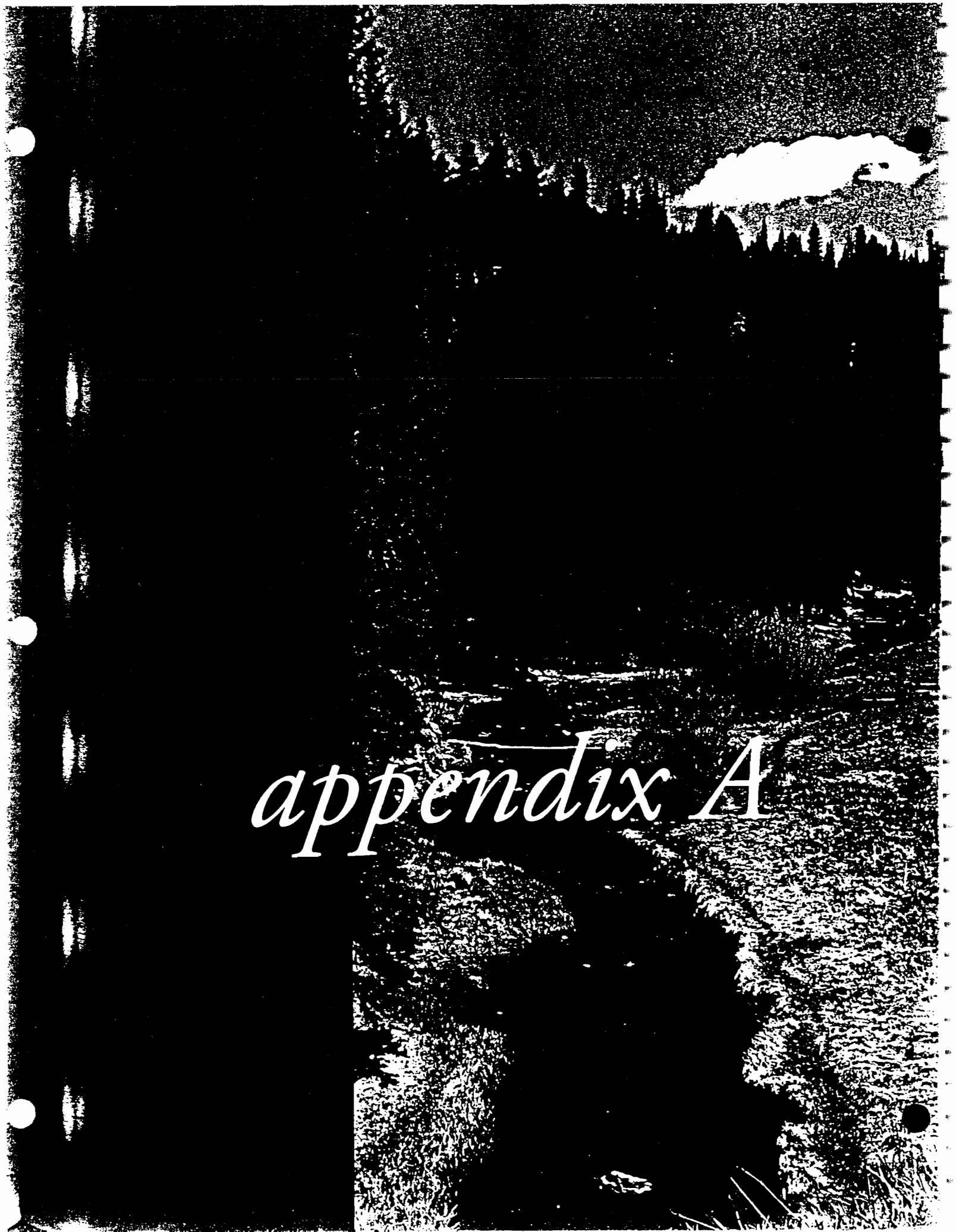
large engineering design firms have already expressed an interest in the work, and many at LANL and DOE believe that privatization of this project would be the most economical resolution. On the basis of the bids and cost estimates for continued LANL operation and maintenance of the RLWTF and appurtenances, the DOE will decide in 1996 which management system it will fund. In December 1994, Merrick Engineers, Inc. was preparing a report identifying all waste generators and the composition of the wastes being discharged to the collection system. In March 1995, Resource Technologies Group, Inc., engineers recommended a treatment system that included ultraviolet/oxidation, chemical pretreatment (probably neutralization), membrane filtration, and reverse osmosis; treated wastes would be discharged to the environment. Treatment of concentrates would probably include evaporation and cementation. In May 1995, further review resolved that, after preliminary solids removal, both reverse osmosis and evaporation would be included; one process would back up the other.

Because of the delay in receiving KD-0 approval, if the time allotted to complete and approve the CDR is inadequate, the project may slip to 1997.

To improve awareness of the project and assist in advertising it, a brochure (Appendix V) was prepared and printed by LANL ("Radioactive Liquid Waste Treatment at Los Alamos National Laboratory," Los Alamos National Laboratory report LALP-93-083, January 1994).

References

1. ICF Kaiser Engineers, Inc., and University of California, LANL, Facilities Engineering Division, "Feasibility Study for Radioactive Liquid Waste Treatment Plant (RLWTP) Refurbishment at TA-50," Project Identification 10411 (October 1993).
2. LANL and DOE Office of Environmental Restoration and Waste Management "Mission Need Statement for the Radioactive Liquid Waste Treatment Facilities (RLWTF) Project" (March 15, 1993).
3. DOE, "Implementation Manual for Application of Best Available Technology Processes for Radionuclides in Liquid Effluents, Interim Final Report" (June 1992).
4. Ralph M. Parsons Company, "Best Available Technology Study for the Los Alamos National Laboratory Radioactive Liquid Waste Treatment Facility" (February 25, 1994).
5. "Abbreviated Conceptual Design Report for the Design of Radioactive Liquid Waste Treatment Facility at Los Alamos National Laboratory," Laboratory Job 10411-63 (February 1991).



appendix A

 LOS ALAMOS REPORT

John F. Newell (1/10/50)

1. ORGANIZATION AND RESPONSIBILITY

The radioactive waste treatment study group at Los Alamos was organized by directive of the Manager, Santa Fe Operations Office in November 1948. The group, organized under the direction and supervision of the sanitary engineer, is a cooperative enterprise to draw upon the experience and knowledge of the following organization:

Los Alamos Scientific Laboratories
United States Public Health Service
United States Geological Survey
SFOO Sanitary Engineer Office

In general, the contributions of these organizations are as follows:

(a) Cooperation of the Los Alamos Scientific Laboratories is through the CMR Division, Health Division and Department of Engineering. These organizations provide consultation service, instrumentation, monitoring, maintenance and design assistance.

(b) The United States Geological Survey provides technical aid in evaluation of the local geology with respect to environmental considerations.

(c) The United States Public Health Service provides staff assistance with the services of two men. In addition, Dr. C. C. Ruchhoft, Sanitary Engineer Director of the Public Health Service Chemistry and Physics Laboratory at the Environmental Health Center in Cincinnati, Ohio, serves as consultant to the program.

(d) The Sanitary Engineers Office SFOO provides a technical staff of qualified bacteriologist, chemists, and engineers. The Sanitary Engineer is held responsible for coordinating the program and conducting the work.

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BY AUTHORITY OF (Signed) C. W. Christiansen
BY Lorraine Gallegos POSITION Chief, IWSP
DATE 12/13/54

2. SCOPE OF WORK - LIQUID WASTES

The scope of the work which has been developed at Los Alamos can be described in three parts:

a. Research on and development of adequate methods of treating and rendering innocuous the liquid wastes containing the plutonium and other chemicals which may be dangerous if discharged to nature.

b. Operation of liquid waste treatment plants.

c. Study of the environmental effects of the present and past discharges to nature of these waste liquids.

The working group described in paragraph 2 attacked the problem of treating these wastes on the basis of using or adapting the use of known methods of waste treatment. Consideration was first given to utilizing the organisms present in activated sludge for concentrating and removing the plutonium from the waste liquids. Laboratory experiments proved that this method of treatment could be applied but would require from two to three stages of treatment before the desirable degree of plutonium removal could be obtained on the particular wastes at Los Alamos. The activated sludge would remove an average of at least 90% of the plutonium from the waste solution. The percentage of removal appeared to be about constant regardless of the plutonium concentration. One objection to the use of activated sludge is the deleterious effect of certain ions (for example copper) on the working organisms. Spectrographic analyses of composited waste effluents, performed by the Los Alamos Scientific Laboratory did not show the presence of any substances in sufficient concentration to be harmful to the organisms. This was no assurance, however, that substances would not be discharged in sufficient concentration to be harmful to the organisms. Experimental work indicated that plutonium had no harmful effects on the sludges.

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BY Lorraine Gilbert POSITION Chief, IWS
DATE 12/13/54

It was also learned that supplementary food should be added to the liquid wastes to provide a diet favorable to the development of the organisms. Experiments proved that sludges developed using a sanitary sewage feed were no more efficient than sludges developed using a synthetic feed.

Exploratory screening work also conducted to study the adsorptive characteristics of various inert materials using different types of carbons, fullers earth, pumice and volcanic tuff. Of these materials the finer grained carbons and volcanic tuff appeared more promising. It was found that the plutonium removal ability of the carbon and tuff was dependent upon pH, concentration of adsorptive material and the time of contact. The pH was very critical. More work is under way on these studies as a follow up of the screening explorations.

The most promising and seemingly most foolproof treatment method to date for Los Alamos laboratory wastes consists of co-precipitation with ferric hydroxide at a high pH followed by mechanical filtration with sand filters. Results of experimental work indicates a preponderance of removal values exceeding 99.9%. A pilot treatment plant to accommodate the present tech area wastes has been designed and is now under construction. Upon completion of the plant actual operation experience will furnish more complete data and will allow better evaluation of the method. The sludge obtained from co-precipitation will be dewatered to around 85% moisture content by means of an Eimco Filter. Further treatment of the sludge is being held in abeyance until studies can be made to determine the type of treatment that may be most applicable.

Fluorine, a non-radioactive element of great concern from the environmental standpoint, was found to be present in concentrations up to 200 ppm. Since most fluoride compounds are highly soluble it is improbable that their concentration will be diminished by percolation through the earth. Therefore, the strong

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probability exists for contamination of ground water supplies with untolerable concentrations of this element. Since the recommended optimum concentration of the fluoride ion in drinking water is only 1.5 ppm the removal of fluorides is indeed no less acute than the removal of radioactivity. Laboratory studies indicate that our proposed pilot plant will remove most of the fluorides present in the wastes by the use of excess calcium in the treatment procedure. The solubility of calcium fluoride in normal pH ranges is about 17 ppm. Experimental laboratory work indicates that the fluoride concentration in the final effluent from the pilot plant can be reduced to about that figure. Further studies are in progress on fluoride removal.

Consideration of the laundry effluent, which contains relatively low concentrations of plutonium indicates that biological treatment of these wastes by means of a trickling filter would be desirable. Experimental work is under way to study the feasibility of this method; not only from the standpoint of plutonium removal but also from the standpoint of BOD removal. It is thought that since trickling filters have been successful in treating commercial laundry wastes that the application of this method would be apropos.

3. ENVIRONMENTAL SURVEY

A study of the environmental aspects to determine the effects of the present and past discharges of dangerous wastes was initiated in January 1949. Previous surveys conducted by the Los Alamos Scientific Laboratory Health Division indicated that most of the radioactivity contained in the liquid wastes remained in the upper reaches of the dry canyon to which they were discharged. However, since the wastes eventually disappear below the ground surface and the natural gradient of the area it was deemed mandatory that an investigation should be made to determine these environmental aspects. This study is being conducted with the cooperation of the SFOO, AEC through the Sanitary Engineer, U. S. Geological survey and the Los Alamos Scientific Laboratory Health Division.

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Source of Waste	Daily Flow gpd Max.	Min.	Ave.	Present Disposal	Per C/M/L Max.	Min.	Ave.	pH Max.	Min	Ave.	F ppm Max	Min	Ave	Total Solids ppm Max	Min	Ave
Tech Area	35,000	5,000	20,000	To Canyon	40,000	2,000	3,000	12.0	2.0	3.0	200	0	100	10,000	300	800
DP Area	10,000	1,500	5,000	Subsurface leaching	500,000	20,000	100,000	12.0	2.0	2.8	200	0	100	10,000	300	700
Laundry	20,000	10,000	16,000	Open gravel	20,000	500	1,500	9.0	6.0	7.7	0	0	0	1,200	500	800

The above table shows the sources, volumes, present disposal methods and some of the general characteristics of the liquid wastes at Los Alamos. The present methods of disposal have been in use since the establishments were constructed.

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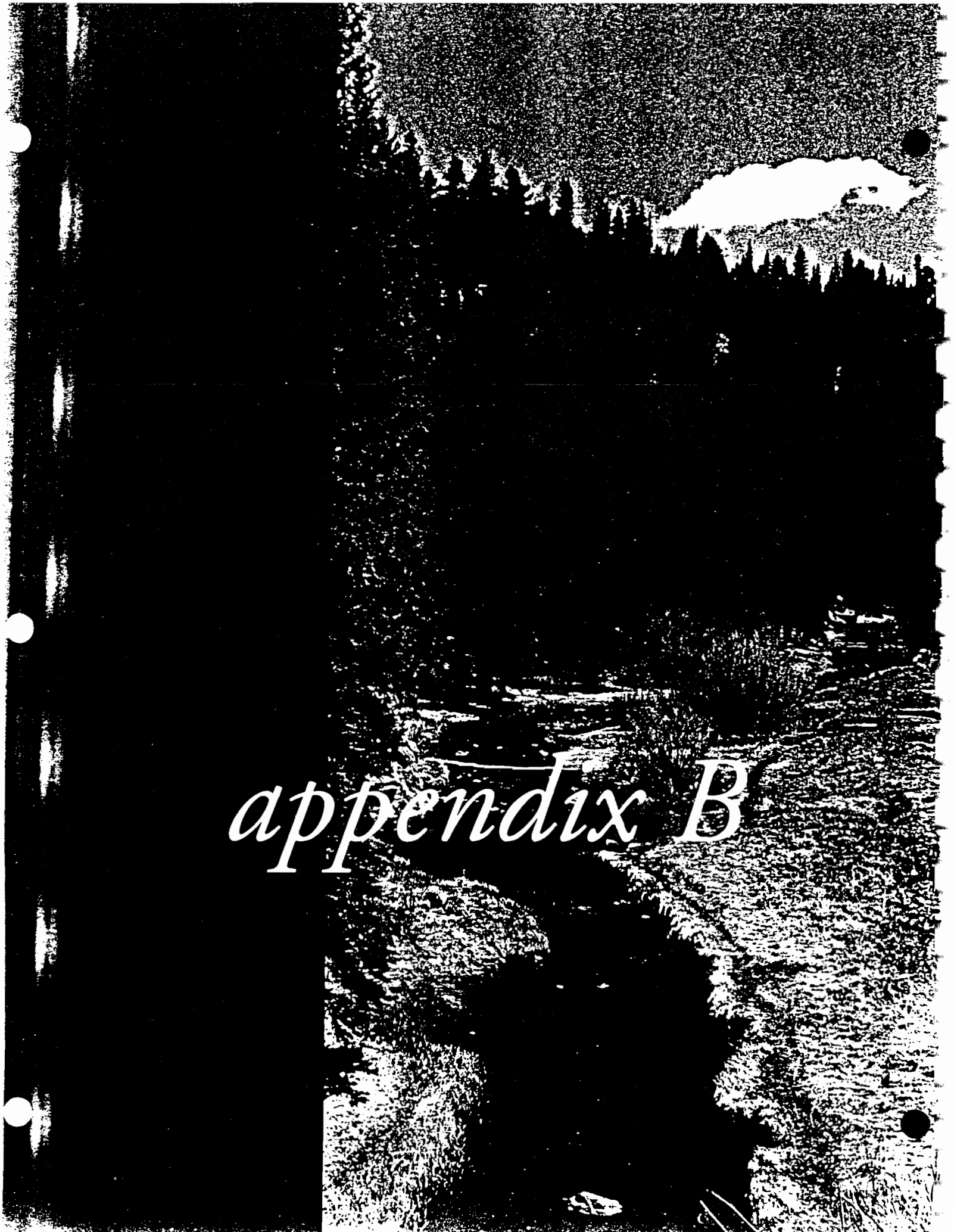

appendix B

NVR.aft.

SUBJECT: WORK OF INDUSTRIAL WASTE SECTION, NOVEMBER 10, 1948 TO JUNE 1, 1954

The Industrial Waste Section was formed as the result of conferences between John F. Newell, C. C. Ruchhoft, A. E. Gorman, E. R. Jette, and T. B. Jenson in 1948. In the fall of 1948 the nucleus of the organization was started and a letter from Carroll L. Tyler to R. S. Warner dated November 12, 1948 subject: "Los Alamos Contribution to Commission-Wide Program on Waste Disposal" stated in part:

> "Liquid waste disposal studies at Los Alamos is directed toward obtaining information important to the design of waste disposal facilities for the new Tech Area and for satisfactory disposal of radioactive and toxic wastes at other operating and research areas without surface and sub-surface contamination."

The letter went on to state specific problems and methods of approach with target dates, etc.

Tech Area Wastes:

The first objective as pointed out in Tyler's letter above was to design facilities for the treatment of wastes expected from the new Tech Area - TA-3.

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Save for future reference.

Accordingly, the group consisting of: John F. Newell, C. W. Christenson, K. C. Kohr, and two non-professional workers, all employees of the Los Alamos Hospital (at that time a Zia Mandatory Contractor), and M. B. Ettinger, and G. G. Robeck of U.S.P.H.S. together with C. C. Ruchhoft of the U.S.P.H.S. acting as a consultant started working toward this end. A small laboratory costing $20,000 had been constructed for this purpose at 640 DP Road. The first approach was the use of the biological process of activated sludge for the treatment of these wastes. Laboratory tests were conducted until the spring of 1949. Concurrently with these tests, extensive data were gathered on the volume and characteristics of the waste stream from TA-1. In the spring of 1949 additional

tests were started on the possible use of other adsorbents such as activated carbon and local earths. _____ the use of coagulants common to the water works field were tried. ~~Ei~~ In connection with all of these studies it was necessary to overcome several obstacles such as toxic substances, complexing , etc. the recounting of which is too lengthy for this report.

In April 1949 it was determined that the pilot plant should consist of chemical coagulation using one or more of the coagulants commonly used by the water works industry with provision for adding activated carbon and other unusual features. Black and Veatch immediately started drawing plans for the pilot plant and also ~~ex~~ an extensive laboratory was to be included.

In November 1949 Craftsman was awarded the contract for construction of the pilot plant and laboratory for a cost of $253,027.50. About $150,000 of this cost was for the pilot plant, $10,000 for the building in DP Area and the remainder was for the laboratory facilities.

Since the total waste volumes were very low (200 - 300 gal/day) the pilot plant was in actuality a full scale treatment plant. It was believed that construction of the full scale plant would furnish more accurate data that the planners could use for future NEC use. Furthermore it was estimated that the pilot plant would be a full scale plant for the waste volumes involved, ~~but not large~~

In December 1950 the plant was given its first shake down operation and by April 1951 xxxx was ready to take the TA-1 flow and has been run continuously since that time.

DP Area:

In February 1949 the group started collecting data on flow, chemical and radiological characteristics of the waste stream from the DPW Area. These wastes were experimentally treated by biological as well as chemical methods. The nature of the wastes was such that the two methods were deemed necessary. This work was continued on a laboratory scale as well as outdoor small-size pilot plant scale until March 1950 when the building at DPW was completed. At this time it was possible to set up pilot plant scale operation for further determining the best method of treatment of these wastes. By early summer of 1950 it was apparent that the seepage pits in the DP Area were no longer adequate and plans were rushed to design a plant for treatment of these wastes.

Black and Veatch started the design for the DP Area Plant in October 1951, the contract was let to Brown and Olds in December 1951 for a cost of $61,000 and the plant was put in operation in April 1952.

Laundry Wastes:

In the spring of 1949 work was started toward determining characteristic flow data and other characteristics of the laundry waste from the DP Laundry. Trickling filters were set up outside to get preliminary information on the best method of treating these wastes. In the fall of the same year it became necessary to take over the building formerly ~~occup~~ ~~occupied~~ occupied by the Health and Safety Branch on DP ~~Rx~~ road for conducting these tests. The work on trickling filters continued until the fall of 1951 and presented at the A.C.S. meeting in Chicago October 1951. Preliminary plans were drawn for a full scale plant to treat these wastes but it was determined that there was no great health problem connected with the laundry wastes at present and ~~then~~ these plans are being held in abeyance.

In February 1949, in cooperation with the U.S.G.S., a study of the effect of liquid radioactive wastes on the environment was initiated. This includes a survey of soil and rock formation in and around Los Alamos, stream surveys, underground water studies, etc. In 1950, six test holes were drilled at strategic points in the area and since that time analyses have been made on water from these ~~hxx~~ holes to determine any possible contamination from waste discharge of LASL. This work has been expanded recently to include samples from several points in rivers and streams around the area, soil samples from Acid Canyon, sewage sludge from Los Alamos and from thirty-six states, as well as the capacity of various soils in the area to adsorb radioactivity. In this connection, a study has recently been concluded to determine if the radioactivity in seepage beds at DPW and the laundry has moved toward the underground water strata.

appendix C

HISTORY OF INDUSTRIAL WASTE SECTION - LAFO

John F. Newell

In May 1947 I accepted employment with the Zia Company at Los Alamos as a Superintendent in the Maintenance Division in charge of the Sanitary Engineering activities. Initially the activities assigned to me were community sanitation including eating establishments, insect and rodent control, fumigation, garbage collection and disposal and responsibility for water quality control and adequacy of sewage treatment. The staff consisted of one sanitarian in charge of the community sanitation activities, one technician in charge of water quality control and a clerk-typist. Other personnel in the group were a fumigation crew and the garbage collection and disposal crew. At that time Mr. Elmo Morgan was Project Manager for the Zia Company and Mr. Hugh Holland was Superintendent of the Maintenance Division. Lt. Col. ? was the manager of the Los Alamos Operations later succeeded by Captain Tyler as Manager for the AEC. Ted Jensen was Chief of Operations for the AEC.

In September 1947 a committee on Health and Safety representing the AEC in Washington made a survey of Los Alamos. The committee was composed of personnel from Biology and Medicine, Safety Engineers, Health Physicists and Sanitary Engineers. Specifically, I recall the following persons:

Dr. Parker, Health Physicist from Hanford
Dr. Phillip Drinker, Harvard School of Public Health
Dr. Abel Wolman, John Hopkins University
Mr. Arthur Gorman, later employed by the Commission

Wolman and Gorman were interested in the sanitary engineering phases of the survey and they spent a considerable portion of their time with me in reviewing activities and operations which are normal to that profession. As a result of their survey the committee recommended that the sanitary engineering functions

be reorganized to exclude direct operation of the garbage collection and disposal and fumigation crews but include a stronger section on water quality control, domestic waste disposal and initiate research and development on industrial waste treatment. The committee also recommended that my functions be transferred from a direct Zia operation to the health officer, who at that time was the Director of the Los Alamos Hospital. Before, the committee had left Los Alamos this transfer was effected. Since the Los Alamos Hospital was paid by the Zia Company and responsible to the AEC the sanitary engineering functions also were placed on the "mandatory employee" status.

In January of 1948 Mr. Gorman, who was then a Sanitary Engineer for the Division of Engineering, AEC, Washington, again visited Los Alamos and in meetings with Manag and Chief of Operations and Dr. Jette of LASL, arranged for the research and development program on industrial waste treatment be initiated under my direction. At that time the LASL apparently was not in a position to perform this work and they had no one on their payroll at Los Alamos who had any experience in this field. In addition, through Mr. Gorman's influence the sanitary engineering group obtained a small laboratory for use in connection with community sanitation activities. At that time the group was staffed with a sanitarian, water technicia and a clerk typist. Later on a chemist, bacteriologist and dishwasher were added to the staff. Thus, coverage was completed for the community sanitation function as per the committee's recommendations.

Actual organization for the industrial waste activities began in February 1948. Dr. C. C. Ruchhoft of the USPHS visited Los Alamos and meetings were arranged with Dr. Jette, members of H Division and the Engineering Department, LASL, the Chief of Operations, AEC, and the Chief of Laboratory Engineering Branch, AEC to discuss the industrial waste problem. Dr. Ruchhoft acted as a consultant to

the AEC in this field. Preliminary arrangements were made for organization of theindustrial waste group and assurance of cooperation in the program was given by Dr. Jette and other members of LASL. Plans for a small laboratory to study the problems were drawn up and the laboratory was built adjacent to the DP Laundry, being completed in August 1948. Staffing for this work was initiated in March 1948 with a search for a chief chemist who had experience in sanitary chemistry. Mr. C. W. Christenson agreed to accept the position and arrived for duty at about the time the laboratory was completed. Concurrently, Dr. Ruchhoft had two of his experienced men "Q" cleared and they arrived for duty within two weeks of Mr. Christenson's arrival. To complete the initial staffing the chemist from the community sanitation laboratory was transferred to the industrial waste group. Also, the bacteriologist was frequently utilized in the work.

The sanitary engineering activities were organized into two groups, one dealing with the environmental sanitation and one studying the industrial waste problems. However, as indi ated above, there was an interchange of personnel when needed to accomplish certain objectives. Excellent cooperation was received from LASL. The personnel remained constant through 1948 and 1949 with the exception that Ed Hermann was added to the staff in the fall of 1949.

By the spring of 1949 the industrial waste work had progressed to the point where several pilot scale treatment units were in operation to determine design factors for a full scale treatment plant for the Technical Area Wastes. Design of the plant started in the spring of 1949 and included the present plant and laboratory located on Canyon Road. Construction of the plant was completed in the spring of 1950 and was placed in initial operation during the month of May. Since there were a lot of unknowns in the treatment of the chemical and radioactive wastes it was decided that the industrial waste group should operate

the plant and continue to make studies on the process involved. This paid off later in construction of the DP Area plant.

In the winter of 1949-50 plans were formulated to increase the staff to handle the operation of the treatment plant and to increase the scope of the activities to include studies on the effects of discharging the industrial wastes to the surface and subsurface environment, studies on treatment of the contaminated laundry wastes, DP Area wastes and to study treatment plant operation problems. At this time, there was considerable thought given toward transferring the industrial waste activities to LASL. I was consulted on this question by Mr. Elmo Morgan, who was then Assistant Manager of Santa Fe Operations. The primary considerations were:

1. The industrial waste activities as well as the community sanitation program were not properly functions of the hospital or the Zia Company. (Mandatory operations were being reviewed and transferred either to AEC or to one of the contractors. The hospital was being organized into a corporation to be subsidized by the AEC.)
2. It was considered that the industrial waste activities should be a function of LASL but the community sanitation should be a function of AEC. There were also some reasons why it was considered that the industrial waste activities should be a function of the AEC. Among these reasons was the desirability for the AEC to retain direct control over the industrial waste program and the fact that considerable progress in the work had already been accomplished under AEC direction.
3. The problem boiled down to three possibilities:
   (a) Leave the functions on a mandatory status.
   (b) Transfer the industrial waste activities to LASL and the community

sanitation to AEC.

(c) Transfer both activities to AEC.

4. Plan (a) was eliminated from consideration because of the desire to eliminate all mandatory functions.

5. LASL was contacted on plan (b) and were apparently agreeable to accepting the function but must have been somewhat neutral on the subject. Dr. Shipman and Dr. Jette of LASL were contacted on the question. Obviously Dr. Bradbury as well as others must have been consulted but I have never been informed of their reactions. The plan (b) would have transferred the industrial waste functions to LASL, community sanitation to AEC, and it was proposed that I would be transferred to the AEC to perform staff supervision over the activities.

I was never informed of the reasons for the final decision to follow plan (c), i.e transfer both functions to AEC. However, the transfer was effective April 30, 1950 with the industrial waste group becoming a part of the engineering division and the community sanitation activities assigned to the community management division. I was transferred to the engineering division with the industrial waste group as chief of the industrial waste branch.

In making the transfer to AEC I was requested to adequately staff the community sanitation section and to remain as acting chief of the section until a chief was selected. In addition I was requested to make a recommendation on whom I consider best able to handle the chief's position. Accordingly this was accomplished and I recommended Mr. Ed Hermann as the individual I considered best qualified to handle the duties of the chief's position.

Upon transfer to the engineering division approval was granted to the industrial waste branch to provide the following staff:

Chief of Branch 5 GS-5's Chemists

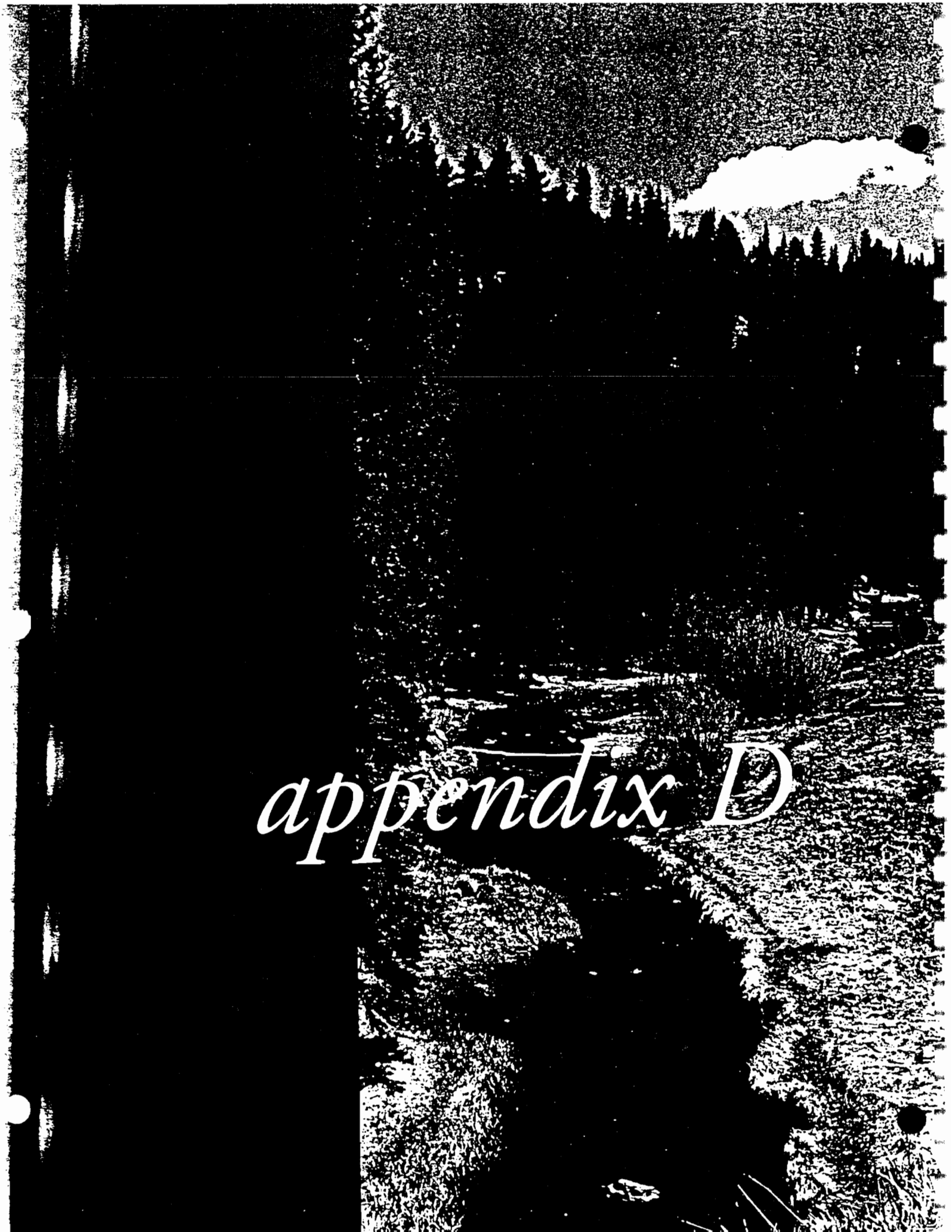
Assist. Chief of Branch	1 GS-9 Bacteriologist
Chief Chemist	2 GS-1's Laboratory Helpers
2 GS-9's Chemists	1 Clerk-Typist
1 GS-9 Sanitary Engineer	

In addition, the staff was supplemented by two personnel on loan from the USPHS. Job descriptions and positions were not established for the USPHS personnel; however, one was a GS-9 Chemist and the other was a sanitary engineer, in the regular copre of the USPHS. Recruiting to fill the vacant positions was started in May 1950 and the positions were essehtially filled by December of that year. At the request of the U. S. Army medical liaison officer a Captain, Sanitary Engineer member of the Medical Service Corps, was assigned to the industrial waste branch in July 1951 for a two year training period. The captain completes his tour of duty in the near future. In the spring of 1952 the USPHS transferred one of their personnel to Oak Ridge leaving one person on duty at Los Alamos.

In December 1952, the industrial waste group was transferred to the Health and Safety Branch in line with a reogranization of the Los Alamos Field Office.

The above is a chronological history of the conception and development of the industrial waste section, LAFO. Some of the dates may be in error but it is believed that the general information is essentially as it happened.

(Note: This was written in the Spring of 1953 for Mr. Maddy's information and in accordance with a verbal request from him. John F. Newell)



appendix D

FUNCTIONS OF INDUSTRIAL WASTE SECTION

The Industrial Waste Section has an authorized strength of 18 and at the moment there are 14 on the payroll. Two vacancies exist in the GS-7 classification of Assistant Chemist and Assistant Engineer and there are two vacancies in the position of Laboratory Technician, GS-5.

With the staff at full strength, the effort is divided equally between operation and research. At the present, however, because of a shortage of personnel the proportion of work devoted to operation exceeds that expended in research.operation.

The plant at WD-2, TA-45 utilizes the principle of coprecipitation for removal of radioactivity.

This plant treats all of the liquid industrial wastes produced by the laboratories at TA-1 and TA-3. It was designed to treat 25,000 gallons per day and at present is treating an average of 35,000 gallons per 8-hour day.

Operation of this plant requires the full time of an operator and an operator helper in addition to supervision and half the time of a Laboratory Chemist for analytical work.

A similar plant at Building 35, TA-21 treats the wastes produced in that area. Most of the time the plant is able to take care of these wastes by operating three days per week and utilizing an operator and an operator's helper in addition to supervision and the part-time of a Laboratory Chemist for analytical work. During the two day non-operating period the operator and helper are sometimes concerned with additional operational problems, such as at present, removing sludge from the holding tanks. However, most of the time they are utilized in performing research work on the treatment of special wastes.

Recently an ion exchange plant has been constructed at Ten-Site and is only now being prepared for operation:--It is contemplated that after an intensive "breaking-in" period that this plant will require the service of four man-hours per day plus supervision and laboratory assistance.

All of the above plants are unique in their operation and set-up and are still considered to be experimental. Because of the very nature of the wastes and the extreme variability of the material being treated, very close control of operation is necessary. For this reason, it has been the practice of the Section to employ a graduate engineer for operator as it is felt that a comparatively high degree of technical skill is required to operate the plants properly.

The continually changing characteristics of the waste as well as the constant influx of new wastes requires the time of one man to devise means of treating the new wastes satisfactorily or to revise present methods of treatment.

Effect of discharge of wastes on environment.

The Section is carrying out a continuing program of analyses of test holes, wells, surface water and soils in and near Los Alamos to determine what if any, is the effect of past discharge of radioactive wastes to the environment. This includes mineral and radiological analyses of some 200 well waters; 100 surface water; and 200 soil samples per year. This work is being done in co-operation with the U. S. Geological Survey. At the present, this work is quite limited but when fully staffed this portion of the efforts of the section requires three men on a full time basis.

Research Projects

In late 1954 it was decided that the Industrial Waste Section, because of its unique position and peculiar talents of the personnel, would participate in a research program designed to provide economical methods of disposal of radioactive wastes from AEC Sites and power reactors. This program is in co-operation with other AEC Sites, contractors, and universities performing similar studies as well as the governmental agencies such as U.S.P.H.S., U.S.G.S., Bureau of Mines, etc. This program will require the services of four men at present and future requirements may be higher depending on the intensity of the program.

Three projects are presently being carried out by the Section under this program.

1. Fixation of radioactivity by mixing with clay, extruding in brick form, drying and firing. Preliminary work on this project has been carried out for the past two years. Recently an experimental extrusion machine has been installed and a laboratory-made pug mill has been built. These two pieces of equipment will make possible more elaborate and accurate experiments to perfect this method of treatment of local as well as high-level wastes. Presently this requires the service of one man.

2. Use of soils for treatment of low level wastes. This involves the testing of a wide variety of local and imported soils for ion exchange capacity, porosity, selectivity of ion retention, analyses of raw and treated wastes and a variety of other determinations. When the above factors are determined then actual design figures will be determined such as proportion of various materials to be used, size of pit to be used, flow distribution layouts, etc.

3. Reduction of nitrate nitrogen in Industrial Wastes. Many wastes produced by AEC installations are extremely high in nitrate nitrogen and in many cases this presents a serious health hazard. Attempts have been made to reduce the concentration of nitrate by chemical means but, to date, no such method has proved feasible. Present efforts are directed towards biological methods and the one most promising is a facultative anaerobic process which could be considered similar to an activated sludge plant. The method is quite promising and, with further requirements, we feel it can be made usable. This project requires one man full time.

In addition to the above projects some time is being spent on finishing off previous projects and writing up the reports. These include: treatment of laundry wastes, effect o ammonia and nitrate ions on activated sludge; travel of plutonium through soils; effect of high level radiation on activated sludge organisms and radioactivity background of sewage plant sludge throughout the United States.

Major achievements of the Section to date have been:

1. Conception, development, planning and design of the three local treatment plants described above.

2. Assistance in designs of similar plants for Rocky Flats.

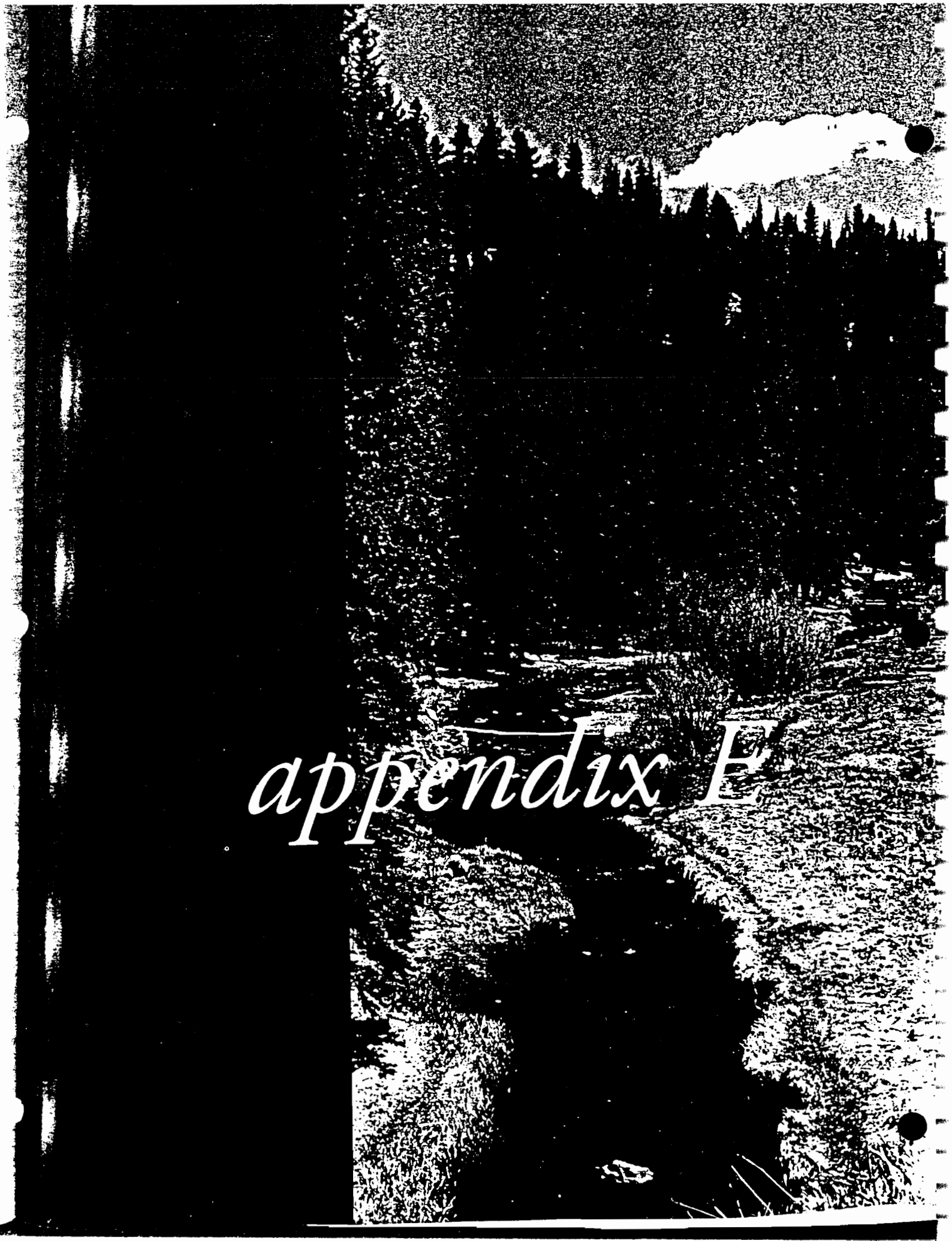
3. Development of a process for treatment of radioactive laundry wastes.

4. Development of a process for treatment of a mixture of radioactive laundry wastes and sanitary sewage. This was followed by assistance in design of a plant which was put into operation recently at Arco.

5. Development of a method of treatment of wastes containing large quantities of citric-acid by activated sludge.

6. Development of a process of treatment of wastes containing oxalic acid by activated sludge.

7. Development of a process of concentration of radioactivity in local ferric hydroxide sludge by precipitation as bismuth oxalate. This process was later adapted by CMR for a short period, as a method of production.



appendix E

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION
LOS ALAMOS, NEW MEXICO

IN REPLY REFER TO:
LP:JJK

May 23, 1955

Dr. Norris E. Bradbury, Director
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

Subject: TRANSFER OF INDUSTRIAL WASTE FUNCTION TO LASL

Dear Dr. Bradbury:

This will acknowledge receipt of your letter of May 18, 1955, indicating that the Laboratory is willing to accept responsibility for the operation of the Industrial Waste Section of this office on or about June 3, 1955. The following is offered by way of confirmation of the various discussions held with you, members of your staff, and directly responsive to certain points raised in your letter:

a. Leave:

Annual leave will be liquidated and direct payment made for such accumulated equity prior to transfer. With respect to sick leave, since our last discussion, it has been determined that it would be improper to automatically extend present sick leave credits in AEC to those employees upon transfer to the Laboratory. With regard to the contract provisions cited in your letter, this office concurs with your view that sick leave can be extended thereunder, under the following conditions: (1) any regularly earned sick leave resulting from LASL employment shall be used first before granting sick leave privileges under this paragraph 5f; and (2) any leave granted to former AEC employees under this paragraph should be granted in accordance with generally applicable policies of the Laboratory.

b. Housing:

Housing allocation of the LASL is hereby increased from 2,003 to 2,018. Employees involved in the transfer will retain present housing.

c. Salaries:

It is our understanding that employees will be transferred at their current salaries with fringe benefits accruing to them consistent

COPY

with those accruing to similar employees within the Laboratory. Adjustments in salaries and rates will be made when positions similar to theirs are adjusted in accordance with appropriate survey data.

Based on consultation with Mr. John Young, concerned employees are being advised that negotiations have been completed and that they may expect a firm offer of employment from Mr. Young's office, which will outline in greater detail the conditions of employment, salaries, and fringe benefits.

In the interim period prior to June 3, Dr. Shipman and his group are invited to participate actively in consultations with members of the Industrial Waste Section. Any such efforts to become familiar with the current operations and problems characteristic of this activity could do nothing more but facilitate the continuity of operation when responsibility is assumed.

Your interest and cooperation in this entire matter, as well as those of your staff, are appreciated. I am convinced that the past performance of this group will be over-shadowed by their future advances in the treatment of wastes under the able direction of your organization.

Very truly yours,

Frank C. Di Lusio
Manager

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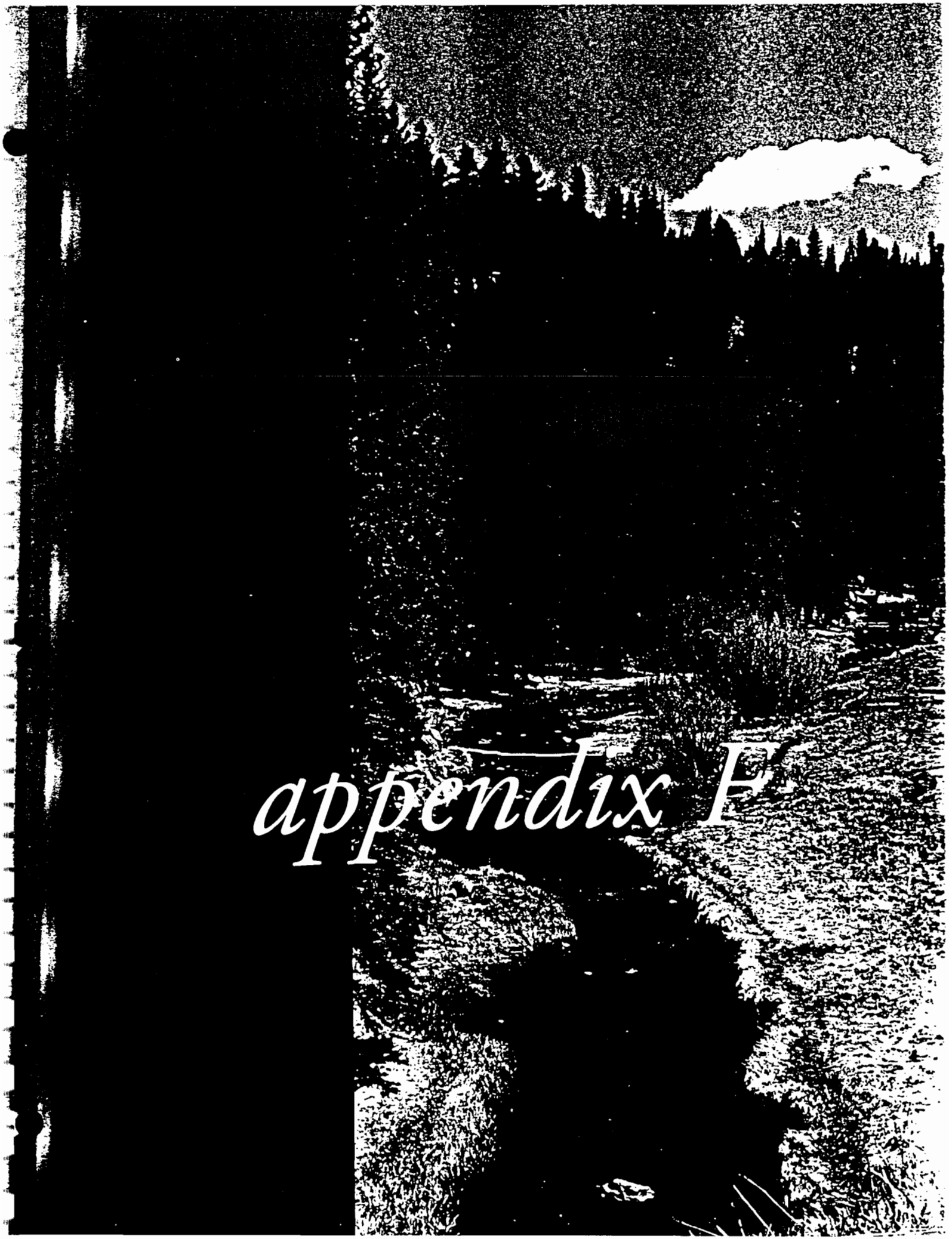

appendix F

(2)

AB 4/10/85

A-84-019
60-11

April 14, 1948

Capt. S. A. Musser

Ray Powell

New laundry for contaminated garments.

It is necessary, from a health standpoint, for the majority of CM Division technicians to wear protective clothing in the laboratories. This clothing must be washed in a Project operated laundry to ensure proper decontamination of the garments and to minimize the spread of contamination. At present, this work is being carried out in a small laundry (D-2) located within the Technical Area. The laundry load has steadily increased until these facilities are wholly inadequate. Furthermore, it is expected that the enlarged operations at DP Site will triple the quantity of clothing requiring decontamination. This additional load cannot possibly be handled in the present laundry and rigid fire regulations prevent the expansion of the existing facilities. Since it would not be economical for the Division to operate two separate plants, it is requested that a new laundry, with sufficient capacity to decontaminate all the garments of the CM Division, be erected at DP Site.

A preliminary floor plan of the proposed new laundry is attached. This plant has been designed to decontaminate the expected load of 45,000 garments, 24,000 rubber gloves, and 5000 respirators per month (approximately three times as many pieces as are handled at present). The total floor space of the proposed new structure is approximately 6200 sq. ft. This provides a working area approximately three times as large as D-2. In addition, space is provided for a small office, toilet facilities for 25 employees (15 persons are employed in D-2) and necessary storage space. The electric power, water, and steam requirements of the new laundry are listed on the attached print. The additional laundry equipment needed is listed in the attached table.

Your aid in obtaining approval for this building and expediting its construction will be greatly appreciated. The early availability of D-3 for the expansion of certain operations now being carried out in D Building is very desirable.

Ray Powell

RP:cb

cc Hinch
Kennedy
Veltman
File

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UNCLASSIFIED
Mark Jones 4/10/85

Best Available Copy

Received by ER-RPF
JUL 21 1992

Equipment for New Laundry

Type of Equipment	Total No. of Units Needed	No. of Units in Present Laundry	No. of Units to be Procured
Tumbler Type Washing Machines			
Wooden Cylinder	6	2	4
Metal Cylinder	1	0	1
Centrifugal Extractors	3	1	2
Mangles	3	2	1
Sewing Machines			
Table Type	4	2	2
Boot Type	2	1	1

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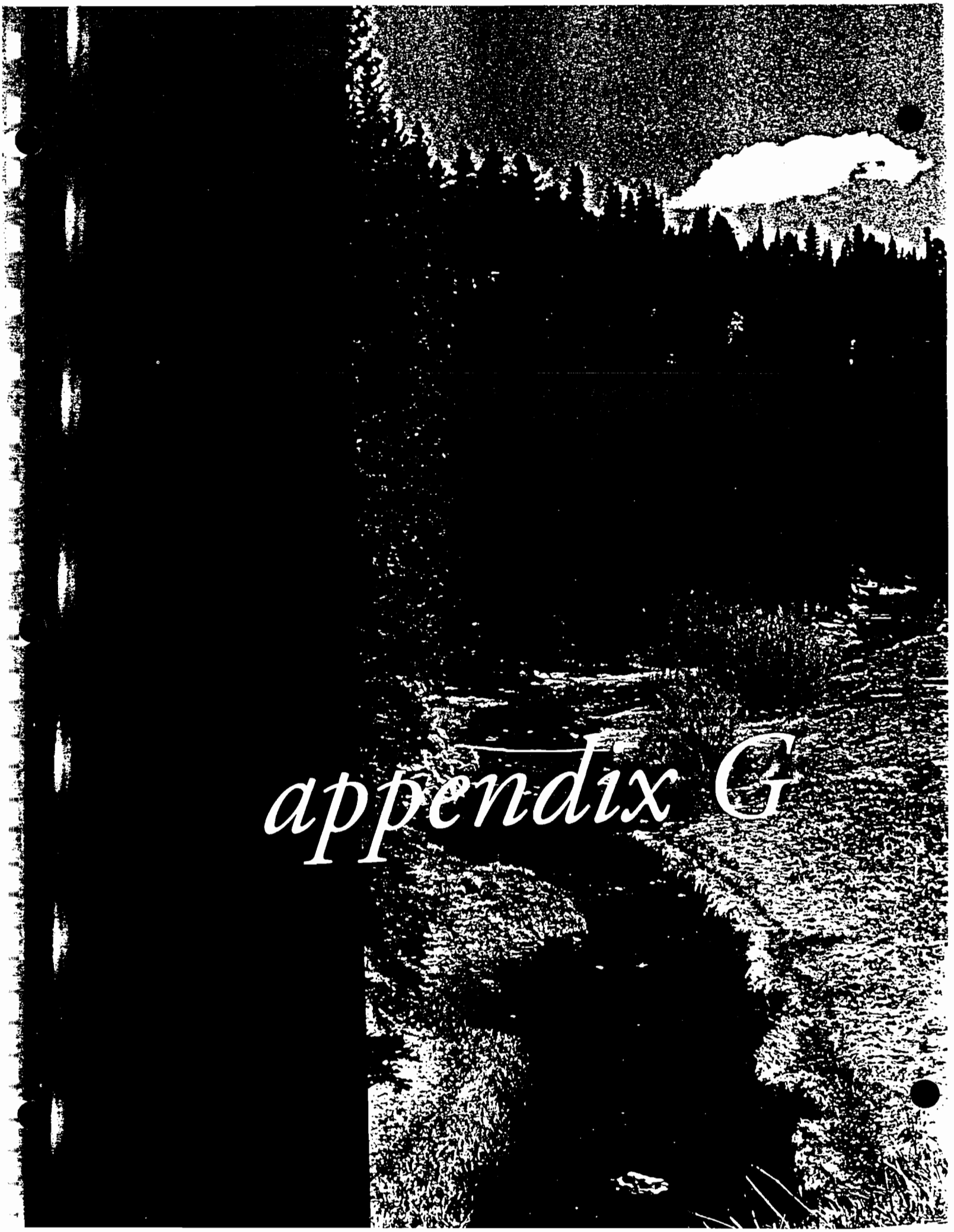


appendix G

H

February 2, 1960

The Honorable Clinton P. Anderson
Senate Office Building
Washington, D. C.

Dear Senator Anderson:

I was interested this morning glancing through your weekly newsletter dated February 2, to see an item relating to the contaminated laundry service at the Los Alamos Scientific Laboratory. I very much fear that the information on this subject had become somewhat distorted by the time it came to you.

In the first place the Los Alamos Scientific Laboratory is not "looking for somebody to wash its dirty clothes," although I am sure that any proposal from a qualified commercial firm would be studied with extreme care. Furthermore, I feel quite certain that if such a proposal were economically favorable and at the same time gave assurance that both the public and the Laboratory's personnel would be properly protected, it would probably be accepted. One such proposal has already been considered, a proposal made by a firm in Springfield, Massachusetts which is already licensed for such work by the AEC. In view of the fact that this firm has no facilities for doing work in this part of the country, the discussions were obviously very tentative. Preliminary studies, however, indicated that the proposal if accepted as presented would undoubtedly cost the Laboratory--and the taxpayer--more than we are paying at the present time.

The contaminated laundry work currently being done at Los Alamos most certainly is not being carried out "under an improvised arrangement." The laundry has been in existence here since the very early days of the Laboratory, and it has grown in accordance with the requirements placed upon it. Except for the monitoring instruments which are used to make sure that contamination has actually been removed, all of the equipment is perfectly standard commercial laundry equipment. Special provisions, of course, must be made for the treatment and disposal of the waste water.

The total laundry payroll consists of 26 people including 2 supervisors. Of the remainder about half operate the laundry itself while the rest are engaged in the work of collecting, distributing and transporting the soiled and cleaned clothing, a responsibility which would still be ours even if the laundry were done by a commercial firm. Housing at Los Alamos is assigned to only 3 of the 26 people, and the others, the majority of whom are women, commute daily from Espanola and other nearby communities.

Just to give you an indication of the size of the operation, during the month of January just ended there were washed 7,300 pairs of coveralls and 421 respirators. The other items which are processed routinely include surgeon's caps, canvass shoe covers, underwear and bath towels. In addition to the actual laundering of the articles, seeing to it that a supply is always available when and where needed is of equal importance. Furthermore, the laundry must be prepared to face sudden and unexpected demands for a greatly increased quantity of clothing, as for example is the case if a room becomes contaminated and requires careful decontamination.

As you may have suspected, our laundry is part of the Health Division's organization. It is in truth a health service probably only a few of the Laboratory's employees realize the part the laundry plays in protecting their health and safety. It is one of those things which can very easily be taken for granted. I am very sure that the Laboratory administration would be perfectly willing to turn this service over to a commercial firm, but as I said above such a change certainly should not involve increased costs and must give absolute assurance that the service and the safety will be at least as good as what we have at the present time.

There is one final item which might amuse you. As I mentioned above we have had some discussions with representatives of a Massachusetts firm relative to this subject. A week or two ago a letter came apparently from the firm's advertising representative addressed to the President of the University of California at Los Alamos. It offered to send a representative to Los Alamos to participate in a one or two day meeting on the subject of contaminated laundry. The letter found its way to my desk, and I replied that I could not quite make out from the letter whether they were supposed to tell us how to run a laundry or wanted us to tell them how to do it. I believe that the President of the proving ground in Nevada received a similar letter, as I am sure did many others.

You will at least be happy to know that the Albuquerque Journal quoted your remarks on this subject quite accurately.

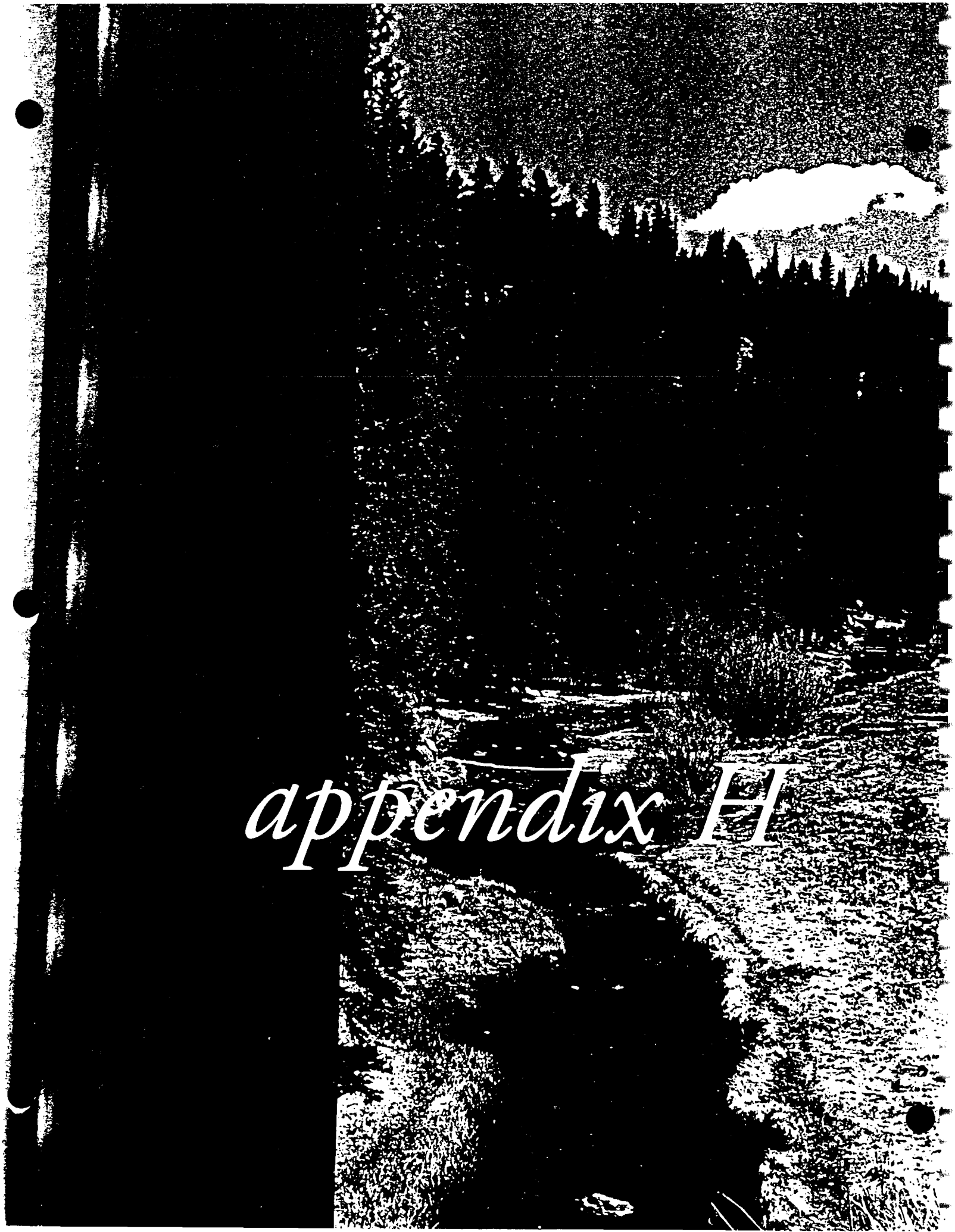
Very sincerely yours,

ORIGINAL SIGNED BY THOMAS L. SHIPMAN, M. D.

Thomas L. Shipman, M.D.
Health Division Leader

TLS:rr

cc: N. E. Bradbury
bc: C. W. Christenson
C. B. Ponton



appendix H

T. L. Shipman, M.D., H-Division Leader May 21, 1957

Carl W. Buckland, Leader, General Monitoring Section, H-1

REPORT ON THE SPREAD OF Sr^{90} CONTAMINATION WITHIN THE WASTE TREATMENT LABORATORY (TA-45-2) AND RESULTING PROBLEMS
H-1

Shortly after 8:00 A.M. on May 20, 1957, Dean Meyer of H-1 was notified by C.W. Christenson that he and Elgin Rex of H-7 had been contaminated with Sr^{90} sometime on Friday evening, May 17, and that Rex still had 2 mrep/hr on his hands. He requested that H-1 survey the area as well as the personnel involved.

Two monitors dispatched to the area surveyed the building with the following results:

Shoes of personnel	- With the exception of one person in H-7, all persons in the building had contaminated shoes, with some readings as high as 20 mrep/hr.
First floor of building	- (Floor surfaces)
Group Leader's Office	- 5 to 10 mrep/hr general count
Secretary's office	- 5 to 10 mrep/hr
Main hallway	- 10 to 20 mrep/hr (spots)
Shower room	- Negative
Men's locker room	- 20+ mrep/hr thoroughfare to outside door. Remaining area 5 to 15 mrep/hr. Tracks from door outside of locker room and in parking lot 5 to 20 mrep/hr.
Ladies' rest room	- 3 mrep/hr
Instrument room	- 5 to 10 mrep/hr
East lab.	- 2 mrep/hr general
General office area	- 2 mrep/hr general
West lab. in which spill occurred	- 2 spots of 150 mrep/hr. Spots of 20 mrep/hr and some of 5 to 10 mrep/hr.
Storage room	- 2 to 5 mrep/hr
Tunnel room	- 2 mrep/hr general
Sludge room	- 2 mrep/hr general
Pool room	- 2 mrep/hr general
Stairs leading to basement	- 2 mrep/hr
Basement lab.	- Two spots of 20 mrep/hr, one of which was an old impregnated spot. Several other spots read from 2 to 5 mrep/hr.

Following these finds, the H-1 decontamination crew was dispatched to the area to commence cleaning the building and personal shoes. Four Zia janitors were

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also commandeered. An effort was then directed toward locating other persons that had been in the area, as well as survey personal and government vehicles, and lastly, to monitor the homes that might be involved. Fortunately, no security personnel had been in the building. The fire guards had no contamination on their shoes. No government vehicle was contaminated; however, three personal vehicles were positive, the worst of which was that of Elgin Rex. In excess of 20 mrep/hr was measured on the floor mats.

Mr. Rex's house at 1135 10th St., Apt. 30, was then surveyed with the following results:

Steps leading to apartments	-	2 to 5 mrep/hr
Rug in apartment	-	15 to 18 mrep/hr

Two decontaminators were dispatched to take care of the household.

Rex then mentioned that he had left his apartment shortly after arriving on Friday night and drove to Albuquerque while wearing the same shoes. He then visited his brother's home at 3513 Calle del Sol in Albuquerque. At 1:30 P.M. on May 20, a monitor and one decontaminator were dispatched to the Albuquerque home.

At this point, it may be well to mention the cause leading up to these events. Rex was working with a Sr^{90} liquid sample in millicurie amounts at about 4:00 P.M. on May 17. Since he was not aware of his hands or shoes being contaminated at the time, no one is certain how or exactly when the spill occurred. The guess is that in transferring the liquid from one container to another, a single drop reached the floor and then tracked. At 9:00 P.M. on the same evening Christenson commenced working with the same sample and found that his hands and the flask container were contaminated. He did not think about the floor being contaminated at the time. Thinking that Rex was also contaminated, he phoned the Milton Rex home in Albuquerque at 11:30 P.M. on Friday evening to inform Elgin Rex of possible contamination.

From this point on, a mention will be made of various events and results as they transpired. They are as follows:

<u>Rex house in Albuquerque</u>:
4 P.M., May 20. Report by phone that the floor areas and shoes of the family were extensively contaminated (up to 20 mrep/hr). Monitors' shoes picked up 2 mrep/hr from walking through the house. The Rex girl had baby-sat the previous night in the Whitener household next door while wearing contaminated shoes. No check was made of the neighbor's house. There were two Rex children, both of whom were in school with shoes that may have been contaminated. Milton Rex was at work with the A.E.C. The rugs in the living room and dining room had over 20 mrep/hr and the den 5 to 10 spots over 20 mrep/hr. One floor mop had 18 mrep/hr. The men were instructed to clean what they could, cover what they couldn't, and Mrs. Rex was told that a full crew would return in the morning to continue with the cleanup.

A.M., May 21. Report on Rex house - work completed through P.M. of May 20.
Sealed front door.
Cleaned den to no swipe - less than 1 mrep/hr direct count.
Garage - negative in the first place.
Rear concrete porch - mild HCl wash. Spots remaining marked.
Kitchen - cleaned to no swipe, direct 1 mrep/hr.

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Half bath - Partially cleaned
Dining room and living room rugs bad - 20+ mrep/hr. Path of newspapers laid between essential rooms.
Bedrooms and full bath also papered.
Hall closet - negative.
Vacuum cleaner - not checked but suspected. Left instrument with the family.
Twenty pairs of shoes - running from 1 to 20+ mrep/hr. One pair of shoes was cleaned for each member of the family so they could leave the house again.
Family car was negative - Rex rode to work with someone else. His shoes were not highly contaminated.

4 P.M., May 21. Report on Rex house.
Situation looked good with the exception of the rugs and shoes. After continued decontamination, the shoes would still swipe. The rugs could not be reduced below 5 mrep/hr by vacuuming. The rugs and a few additional items will be brought back to Los Alamos. A list will be left with Mrs. Rex of the items removed. Two sedans, one panel truck and seven H-Division personnel journeyed to the home on this date to complete the cleanup.

10 P.M., May 21. Report on Albuquerque Rex house.
Generally speaking, the house looks good. No swipe count remains. The den and bathroom have one spot each of 3 mrep/hr. The rest of the house .2 mrep/hr or less. Twenty pairs of shoes were reduced to no swipe count and direct between 2 and 3 mrep/hr. The following items were returned to Los Alamos:

10 rugs
2 mats
Head to floor sweeper
2 old brooms
1 dust mop

The car was found to read 18 mrep/hr but was cleaned. A spot was also found in the garage and cleaned. No request from the next door neighbor came forth to survey the house.

<u>Los Alamos houses</u>

Elgin Rex apartment after cleaning - apartment itself below background of instrument. Rugs removed to decontamination lab. Stairs and hallway down to .5 mrep/hr and no swipe.

Christenson home - <u>Before</u>
Vacuum cleaner - 1 mrep/hr on outside. May be more inside.
Rug - Spot of .4 mrep/hr
Two bedroom mats - .5 mrep/hr.
<u>After</u>
Negative. I don't have disposition at this time on cleaner and floor mats.

Mhy Nivens home - Negative to start with even though shoes were high. We probably caught her before she reached home.

George Johnson home - Same findings as Nivens.

Fowler home - One spot on concrete steps, .5 to 1 mrep/hr. Yet to be cleaned.

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Shirley Phillips Apartment 32, 1135 10th St. - Negative except one mop of 2 mrep/hr which was confiscated. All day Saturday, May 18, Dwight Clayton moved the household goods from apartment 32, adjacent to Rex. He brought in 4 pairs of shoes that read no higher than .1 mrep/hr and were readily reduced with sandpaper to .03 mrep/hr. The household goods were moved to 3789 Gold, Apt. 11. This apartment was surveyed and found negative. Clayton's presentapartment, 799 6th St., Apt. 12, was also negative. The Dempster Dumpster outside the Rex apartment was checked and found negative. Clayton had placed trash in the Dumpster that had been pushed down the then contaminated hallway. All this would tend to indicate that secondary contamination may have been insignificant.

Personal cars

Rex - Had over 20 mrep/hr. Reduced to 7 mrep/hr. Can't go further.

Christenson - .5 mrep/hr is all I have at this time; however, a later report indicated that the level must have been higher since it was not considered acceptable as yet. He also has another car and I don't know the answer on that.

Richard Thomas ~~Terry Thompson~~ - 2 mrep/hr. I have no record of decontamination on this.

Maxine Nims - Negative. Nivens rode in this vehicle and it was therefore suspected.

Dwight Clayton - Negative.

Waste Treatment after cleaning, as of 10:00 P.M., May 20

No swipe count remained in the building.
Room where spill occurred - One side of room has a spot of 100 mrep/hr and several of 10 mrep/hr. The tile in this area will be removed under a work order. The rest of the room, spots of 2 mrep/hr. A bootie station was established outside this room.

Locker room - One impregnated spot of 10 mrep/hr.

Basement lab. - One impregnated spot of 20 mrep/hr.

All other rooms and hallway now read .5 mrep/hr or less with the majority reading .2 mre/hr or less. The outside parking area is now negative.

Reimbursement

Should any reimbursements be made, Dwight Clayton and Al Dyhre, through Clayton, were notified so that they would have all the information as the events took place.

Air Samples

Things took place so fast and furiously that no chance was available to move the Queens located in Waste Treat; however, it can be said that the Pool Room read 26 d/m/m^3 and the Sludge Room 30 d/m/m^3 on May 20, with a tolerance of 444 d/m/m^3 for Sr-90.

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Urine Samples

Urines for Sr^{90} will be taken in the near future on those persons most intimately involved.

Meaning of mrep/hr

For the purposes of this memorandum, mrep/hr merely signifies the presence of beta radiation and that the actual reading on the GM instrument was in mr/hr and of the same numerical value as reported. The instrument calibration is made with radium.

Yet to be done

The major task remaining concerns the decontamination of personal gear (rugs, car mats, etc.) and final disposition should the cleaning be unsuccessful.

The removal of tile at Waste Treat will require health coverage.

ORIGINAL SIGNED BY CARL BUCKLAND
CARL W. BUCKLAND

cc: T. L. Shipman, M.D. (2)
C. W. Christenson
Dean Meyer
Dwight Clayton
Al Dyhre
File (thru Charles Blackwell)

MAY 22 1957

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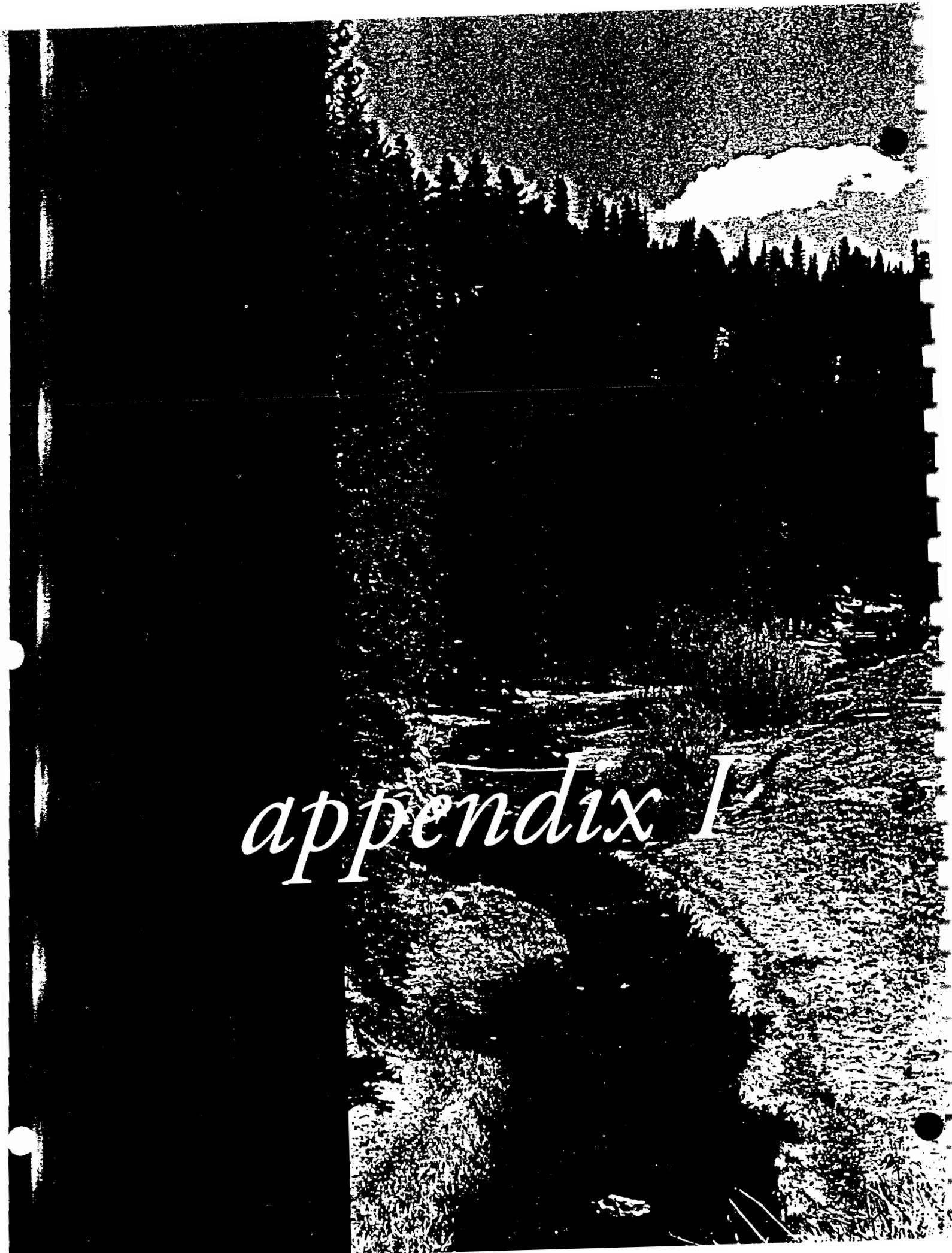


appendix I

REPORT ON THE SPILLS OF LIQUID RADIOACTIVE WASTES ON JULY 9 AND SEPTEMBER 3, 1974

ABSTRACT

Cause of Incident July 9

On Wednesday, June 26, some core drilling was done for the construction of the new TRU waste volume reduction facility. It was noted that the rig was perilously close to our waste line, so H-7 checked the location. The rig was several feet away from the line but as a result of this inspection it was noted that one of the cleanout caps was missing and another may have been damaged. The waste line had been checked periodically prior to this time but not on a regular basis. The line had been inspected less than a year prior to July 9 and nothing unusual was found. H-7 checked the cleanouts on the afternoon of July 9 and about 3:00 p.m. reported that a leak may have developed at the cleanout joint near OHL (this cleanout was not shown on the "as built" drawings). H-7 returned to the location with a health physics surveyor and a quick survey indicated counts of up to 40,000 per minute. The surveyor reported the activity to H-1 who notified others. H-7 notified H-8. All parties hurried to the location to investigate the problem. Samples were taken at the ditch and 10, 20, 30 and 40 feet towards the canyon as outlined by H-1. H-7 analyzed these samples roughly by wet chemistry that evening and found counts of 130K to 10K on the surface.

The problem was discussed with all contributors of waste and their cooperation in reducing waste volumes was excellent. They were notified on July 15 to resume operations but to exercise care in the volume of wastes produced.

On the morning of July 10 the area was excavated and it was determined that the cleanout joint riser pipe was loose and waste water was seeping out at the joint in the pipe as well as over the cap, some two feet above the pipeline. The joint was repaired. About sixty feet of pipe was exposed and there were no other leaky joints. The fact that there was at least two feet of head at this point indicated that there was an obstruction downstream of the joint. The design of clay tile pipe is such that there is no pressure on the line. A small sewer line "snake" was inserted in the line

and some roots were discovered. At about 2:45 p.m. a large "sewer rodder" was put into service to rod out the entire line, and after some changes in operation the entire line (about 4,000 ft) was rodded by 7:00 a.m., July 11. The rodding was done in increments of about 400 ft each, working upstream from TA-48 where the cast iron line around TA-55 was constructed.

Friday, July 12, at 2:00 p.m. the tanks at Bldg. SM-700 were full and the waste was pumped to TA-50 at a reduced rate of about 100 gpm. This was done until 9:00 p.m. On Saturday pumping from Bldg. SM-700 was started again and at the same time the holding tanks at the CMR Bldg. were drained and pumped from SM-700

Later more detailed checks were made and a flow-meter installed at Bldg. SM-700. These checks indicated no major leaks but, of course, it is impossible to detect leaks of a gpm or less which was about the order of magnitude of the leak. It was not known how long the leak had been going on but routine checking of the line last year did not show anything above ground. The percentage of plutonium-238-239 indicated the leak had been going on for less than three and one-half years.

The original samples that were collected indicated the average radioactivity in the soil would be less than 100 nCi per gram of plutonium-238 so it was decided to put the soil in the nonretrievable raidoactive dump. Since there was no idea at that time how much soil would have to be removed, the soil was dumped in the burial ground and covered with tuff and the drums reused.

On July 10 and 11, 29 drums, or 6 m^3 of soil were removed from the ditch and buried at TA-54.

In the period August 16 to August 30 a total of 43.4 m^3 of soil were removed in the immediate area prior to and during the installation of the new pipeline.

The total area involved in the spill was about 1000 sq meters. The range of concentration of gross alpha was rather wide from background (dpm/g) to 682 000 dpm/g. The depth of detectable contamination varied from 5 cm to 10 cm with some samples as deep as 75 cm.

An estimate of the total amount of plutonium lost during this period is extremely difficult. Our best estimate is that the total inventory of ^{239}Pu and ^{238}Pu is of the order

of 200 mCi. This represents some 10^6 liters of waste. The amount of ^{89}Sr, ^{90}Sr, and ^{137}Cs, the only other isotopes present, was detectable but of no significance.

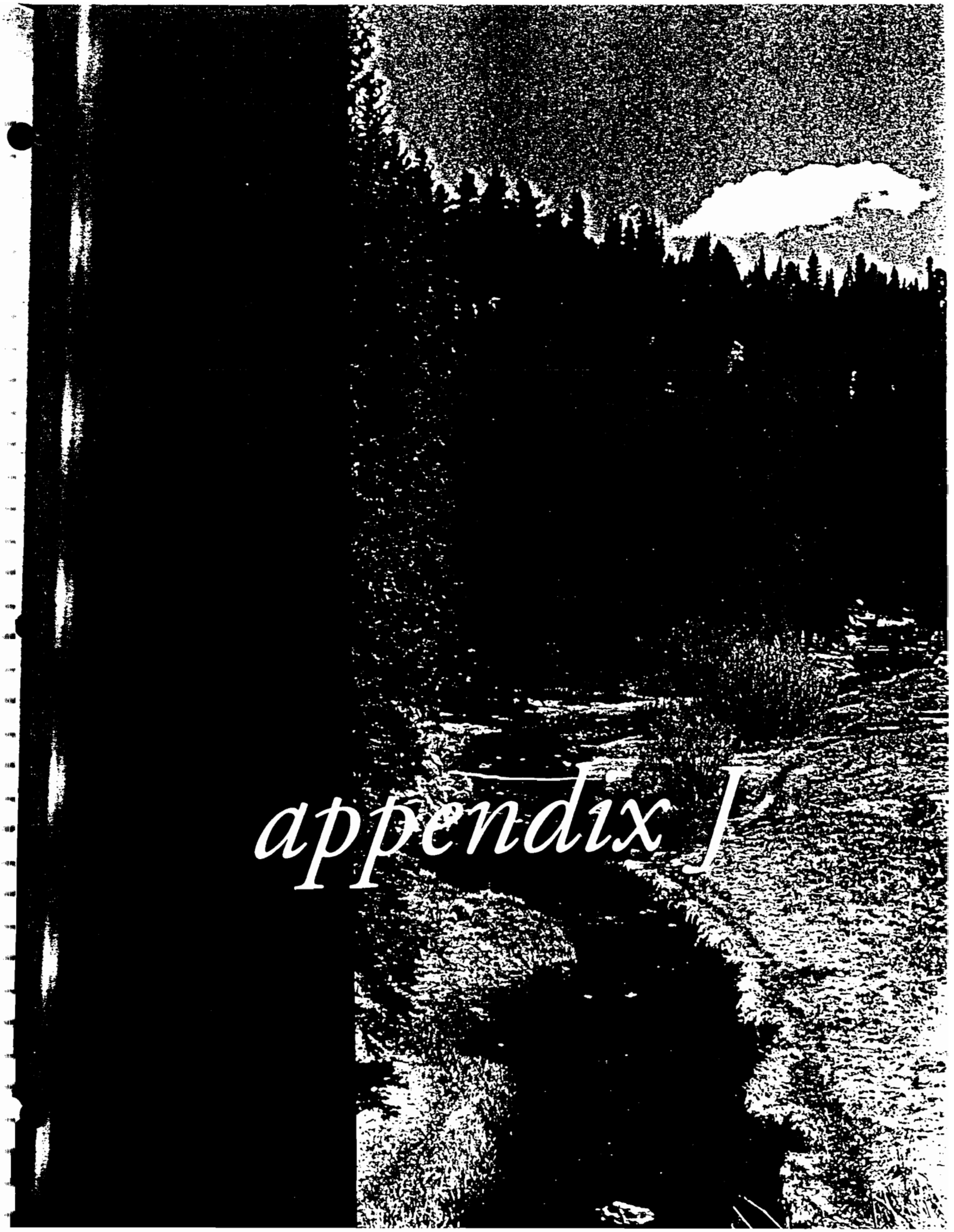
The removal of the contaminated soil in the area was accomplished October 14-17 during normal working hours. About 600 yards of earth were removed and taken to TA-54. During and after the cleanup operation about 150 samples of soil were taken. After cleanup the count varied from background to 20 dpm/g and the area was declared clean. Restoration operations were started on October 23 and about 1,150 yards of fill material and 350 yards of top soil were replaced. The excess fill and soil was used to regrade about 1,000 feet of the new and old line to prevent erosion. Finally, the area was reseeded and stabilized with straw and emulsified asphalt. The final work was delayed because of rains and was not completed until November 15.

Actions Taken to Date to Correct the Situation

It was apparent that the integrity of the existing line was questionable. Lining the existing clay tile with polyethylene pipe was investigated but the idea was discarded because of the relatively long down-time of the pipeline. Instead, 8,000 ft of 5 3/8" OD pipe was ordered and put in a separate ditch paralleling the existing line; this was butt-welded which permitted a pressure test of the pipe before use. Meanwhile, for insurance, the availability of tank trucks at the Nevada Test Site was looked into; these were available in the event of any recurrence of leaks.

September 3 Spill

On September 3 during a test of the new line to check some suspected deficiencies at TA-48, some 2000 to 4000 liters of waste containing about 0.4 mCi of plutonium spilled out of manhole #736 at Diamond Dr. and Pajarito Road and ran down the gutter. Some waste entered the CMR parking lot and some went into a drain which emptied into Mortandad Canyon. Although the original estimate of the capacity of the line was about 1200 liters per minute, when the flow rate was increased to about 1000 liters per minute from SM-700 the capacity of the line was exceeded, causing the water to flow out of the manhole. H-DO, H-1, Eng-4 and the Zia Company were immediately notified and traffic was halted in and out of the parking lot as well as the south lane of the security station. Until help arrived an attempt was made to prevent the spread of water by sweeping the water off the street into the parking lot.



appendix J

The area was immediately cleaned with much of the water and soil soaked in rags or removed by vacuum cleaners and put into 200-liter drums with vermiculite. The area around the manhole was hand excavated to remove contamination. About 13 m^3 of solid waste was disposed of in this manner.

The contaminated areas were immediately covered with asphalt and an emergency exit from the parking lot was built. There was no contamination of personnel or vehicles during this incident.

On September 5 and 6 the soil in the canyon which had been previously dammed to prevent movement of plutonium was removed. About 200 m^3 of soil were involved in this operation.

On September 28 and 29 the contaminated roadway and parking lot were removed and transported to TA-54. This amounted to about 175 m^3 of asphalt, base course and concrete curbing. More soil was excavated around the manhole and later a .75 to 1.5 meter high berm was constructed around the manhole. This area was stabilized with emulsified asphalt.

Forty-eight samples were taken in the cleared area which had shown contamination. Wet chemistry analyses on these 100 gram samples were all below background. The analyses were started Saturday morning and on Sunday the area was declared clean and later restored to its original condition.

Steps Taken to Eliminate a Recurrence of this Type of Incident

Pumping rates have been reduced to a maximum of 100 gpm with an observer at the manhole and an operator at Bldg. SM-700. Dual radio contact is maintained.

Plans have been drawn to increase the height of manhole #736 and construct an overflow to manhole #727 some 130 feet northwest. Manhole #727 is connected to the existing gravity line which carries waste to Bldg. SM-700. Moisture detectors will be installed in the manhole and should the water level reach the probe the pumps at Bldg. SM-700 will be shut off and the SCAM alarm will be transferred to SM-223. The controls will be mounted inside the fenced area across Pajarito Road adjacent to SM-177.

A rather extensive review of the entire waste management system is being conducted at this time with several alternatives being considered. It is anticipated that several years and several millions of dollars will be required to meet the "best available" or "no discharge" requirements of the EPA.

OFFICE MEMORANDUM

TO : Distribution DATE: November 6, 197

FROM : G. L. Voelz, M.D., H-Div. Ldr.

SUBJECT : LIQUID WASTE MANAGEMENT STUDY GROUP ASSIGNMENTS

SYMBOL :

A study group is being formed to prepare a report on problems in liquid waste management at LASL. It has been decided that the group should develop the following items:

(1) A report for LASL management that describes the problems anticipated in LASL liquid waste management from FY-76 through FY-81. This can be considered a start on the FY-76 long range planning guide for management of radioactive liquid wastes required by AEC, but will be used primarily as an in-house document.

(2) The report shall evaluate the problems in sufficient depth to be able to place priorities on their solution so that a schedule of possible improvements or modifications are outlined.

(3) Individual projects recommended for action through the FY-78 period should be studied in sufficient detail so the document can be used to discuss and evaluate funding proposals (operating funds, GPP, or line item construction). The group report should put some emphasis on the requirements (criteria) and alterations (if any) to the TA-3/TA-50 waste collection system. This section of the report should be written so as to make any future conceptual design study by ENG more realistic.

(4) In addition to possible improvements, modifications, or additions of facilities or processes, the group will describe research areas that should be emphasized during the same five year period (this may be in H-7, other H-groups, or other LASL divisions). The group might also suggest possible means of support for such research items (overhead funds, operating projects, or designated research projects from DWMT).

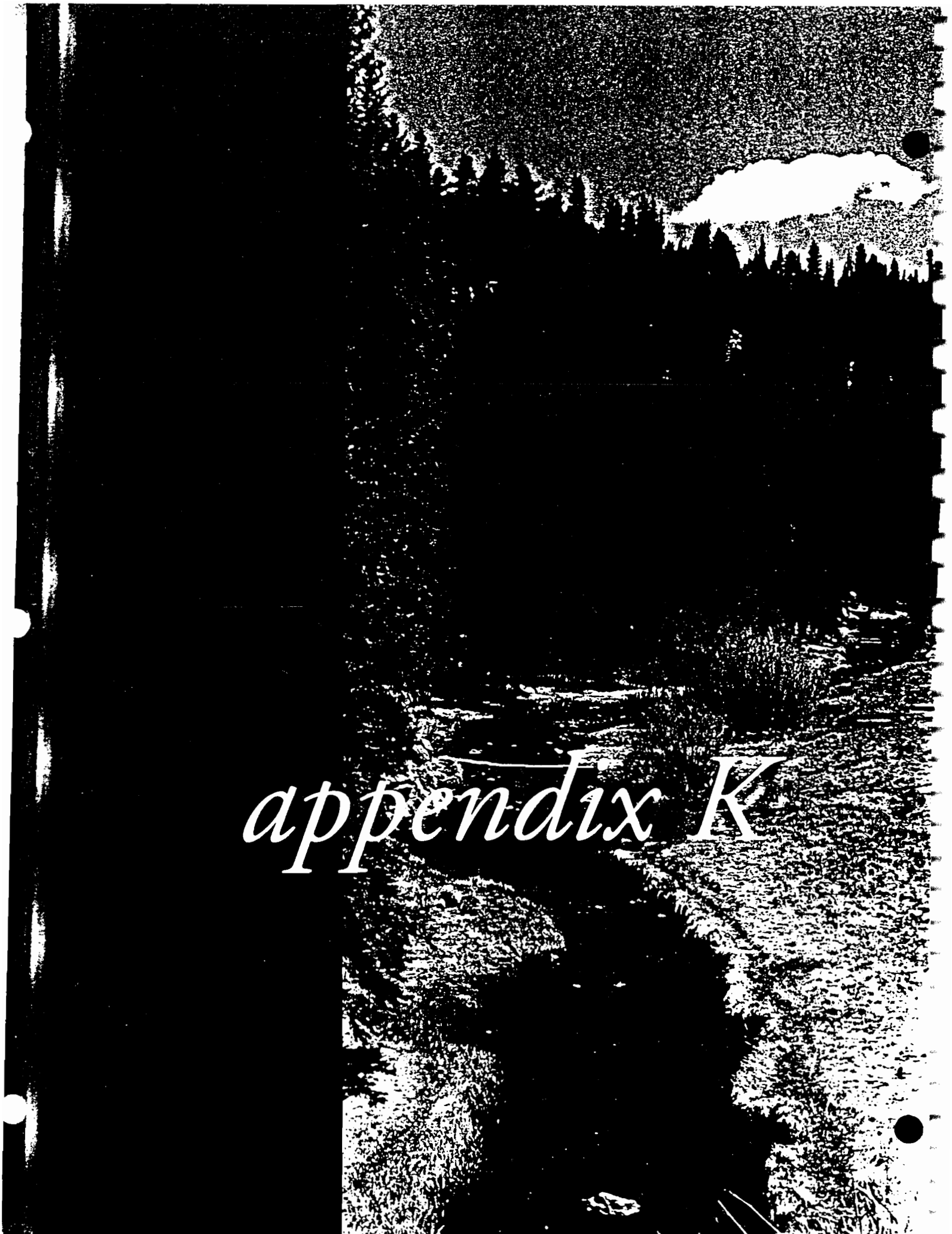
L. A. Emelity of Group H-7 has been named as leader of this group with J. R. Buchholz as his assistant. It is requested that Groups H-1 and H-8 and the Engineering

Department office designate a staff member who can serve as a member of this team. Please advise me of your nominations by November 13, 1974. It is imperative that the group begin work immediately.

GLV:

Distribution: L. P. Reinig, Eng-DO, MS-610
J. Dummer, H-1, MS-692
L. Johnson, H-8, MS-490

XC: L. A. Emelity, H-7
C. W. Christenson, H-7
J. R. Buchholz, H-7
E. B. Fowler, H-7



appendix K

T. L. Shipman

August 3, 1955

C. W. Christenson

SLUDGE FILTRATION EQUIPMENT FOR TA-21

H-7

For the past three years the sludge produced at the waste treatment plant in Building 35, TA-21 has been hauled by a 200 gallon tank trailer to TA-45 for filtration and final disposal. This involves about three trips per week.

The filtration equipment at TA-45 is being operated 22 hours per day, 6 days per week. By filtering all of the sludge from TA-21 at Building 35, it is felt that the equipment at TA-45 could be operated a good deal of the time on an 8 hour per day basis. (Using short filter runs, the filtration rate can be increased). Operation of the present equipment at night, while it is unattended, results in a certain amount of spillage of radioactive sludge which becomes air-borne and has, not infrequently, caused air-contamination above accepted tolerance values. Although this condition is not considered extremely hazardous (because of short periods of occupancy in the room), we feel that it should be eliminated if possible.

Transportation of wet sludge, which may contain as much as one gram of plutonium per load, across town presents a hazard which has been viewed with alarm on several occasions in the past. Although there have been no accidents, it is felt that this operation should be eliminated if reasonably possible.

The present sludge filtration equipment is operating almost at the peak of capacity and, in all probability, the load will increase in the future. The addition of another filter at TA-21 will provide a factor of safety for possible future increases of sludge production.

It is requested, therefore, that a vacuum sludge filter be installed in an extension of the East end of Building 35, TA-21.

This extension can be constructed on the existing 15' x 20' concrete slab at the Eastern end of Building 35. Only ordinary provisions for heating and lighting will be required. An 8 x 8 door should be installed in the East end of the building with a 1/2 ton trolley hoist for loading 55 gallon drums of filter cake. A paved access road to the Eastern end of the building will be required.

This building will provide much needed additional space for operation of the treatment plant as well as housing the filter.

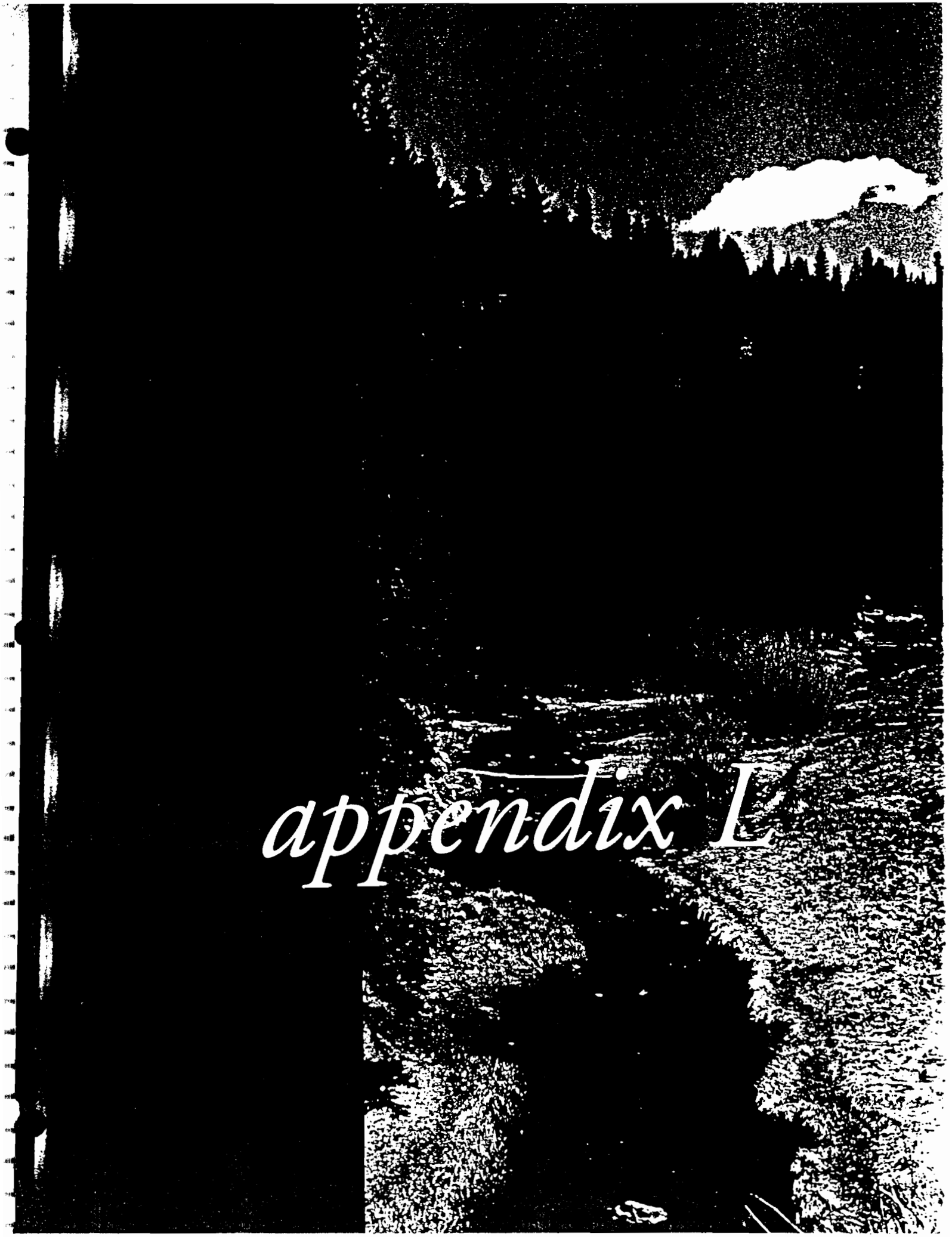
It is estimated that the cost of the filter and appurtenances will be appr mately $6,000 and the building cost will be in the neighborhood of $4,000.

I am enclosing quotations from Dorr-Oliver and Eimco for the filtration units. Based on our operation of a 3 foot diameter unit, we do not feel that the 1 1/2 diameter unit quoted by Eimco will have sufficient capacity for this operation. Furthermore, our past experience with Eimco Corporation has been extremely disappointing in regard to obtaining servicemen, spare parts, etc. For these reasons, I strongly recommend that the Dorr-Oliver filter be obtained for this installation.

C. W. Christenson, Group Leader H-7

fs

Enc.



appendix L

UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87544

OFFICE MEMORANDUM

TO : C. W. Christenson, H-[redacted]
L. G. Chelius, H-1

DATE: November 15, 1973

FROM : J. W. Schulte, CMB-14

SUBJECT : Summary of Disposition of Impurities Received in ^{140}La Shipments

SYMBOL : CMB-14

LOS ALAMOS SCIENTIFIC LABORATORY
NOV 15 1973
H-1
LOS ALAMOS

A careful study of the Group recrods concerned with the receipt and processing of ^{140}Ba shipments has been made. Listed below is the summary of disposition of the ^{90}Sr contaminants.

TABLE I

^{140}Ba HISTORY

Years	Source of Material	Quantity of ^{140}Ba	Estimated Quantity[a] of ^{90}Sr
1945 through 1956	ORNL	511, 000 Ci	4000 Ci[b]
1956 through 1963	CPP at NRTS	1, 823, 000 Ci	740 Ci[c]

TABLE II

^{140}La HISTORY

Years	Source of Material	Quantity of ^{140}La	Estimated Quantity of ^{90}Sr in ^{140}La
1945 through 1956	ORNL	247, 900 Ci[d]	<750 mCi[d, e]
1956 through 1963	CPP at NRTS	85, 340 Ci[d]	< 40 mCi[d, f]

[a] It is assumed that all of this material minus the total shown in Table II below was buried in waste pits used at that time.

[b] Average of two analyses for ^{90}Sr from ORNL product indicating 1000 Ci and 7500 Ci total.

[c] Based on analyses of product from CPP in Idaho.

[d] Airborne following detonation.

[e] Arrived at by using ^{140}La contained < 0.1% ^{140}Ba

$$\frac{\text{ORNL } ^{90}\text{Sr}}{^{140}\text{Ba}} = \frac{150}{5000} = 0.003; \quad 247,900 \times 0.001 \times 0.003 = < 741 \text{ mCi}$$

[f] Arrived at by using ^{140}La contained < 0.1% ^{140}Ba

$$\frac{\text{Idaho } ^{90}Sr}{^{140}Ba} = \frac{10}{20,000} = 0.0005; \; 85,340 \times 0.0005 \times 0.001 = <43 \text{ mCi}$$

John W. Schulte
John W. Schulte
Group Leader, CMB-14

JWS:mn

xc: F. J. Fitzgibbon, CMB-14
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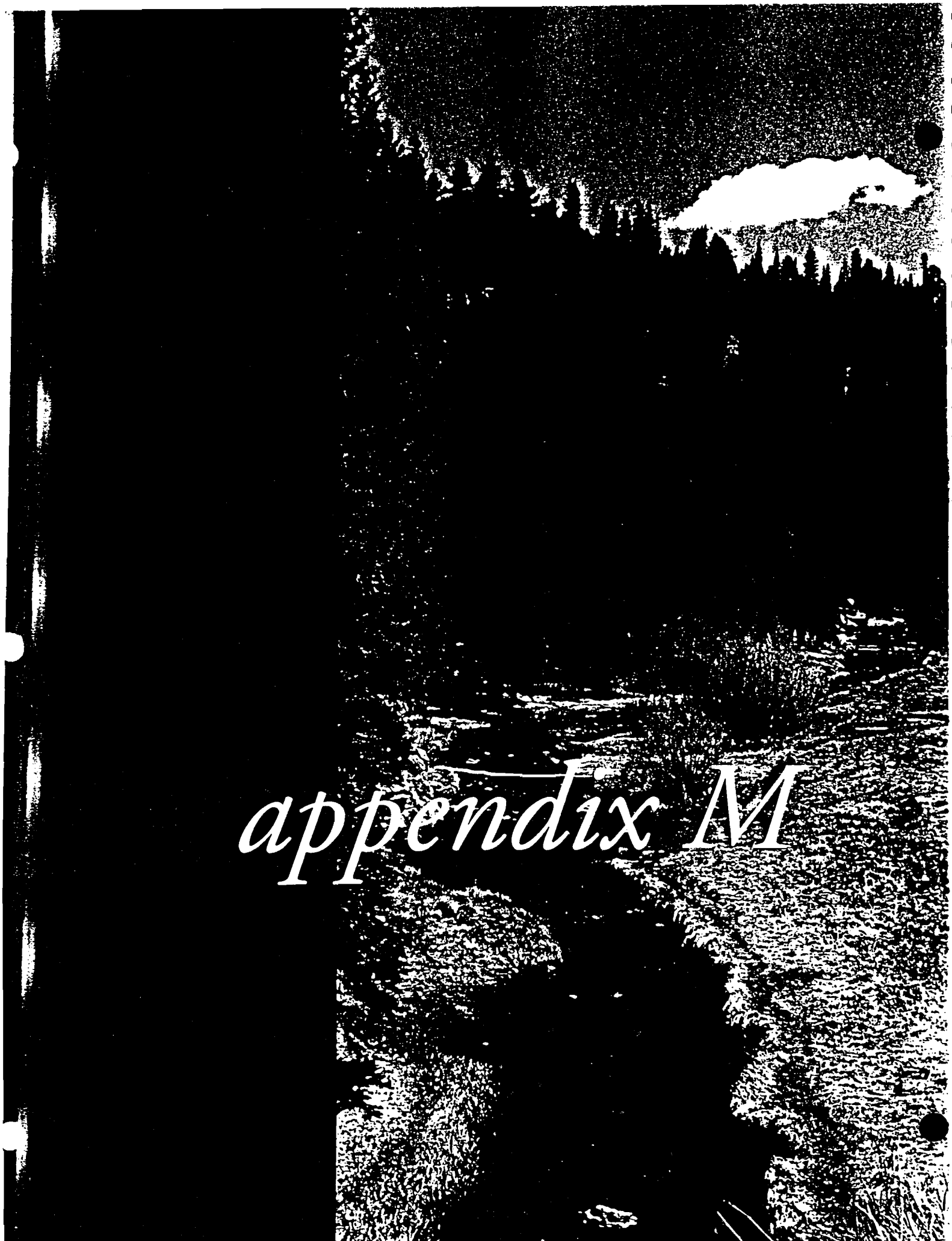


appendix M

OFFICE MEMORANDUM

TO : T. L. Shipman, M.D., Health Division Leader DATE: December 11, 1957

FROM : Dean D. Meyer, Group Leader, H-1

SUBJECT: PLANNED OVEREXPOSURES - WASTE DISPOSAL PERSONNEL, H-7

SYMBOL : H-1

The attached memo covers the radiation exposure problem at Ten Site. I agree with paragraphs two and three, Mr. Christenson has been extremely cooperative in trying to maintain the yearly exposure of his men to 5 rem.

I would like to extend the permissible yearly exposure for the group beyond 5 rem. The 5 rem limit as yet is not an official A.E.C. directive. When the report of the National Academy of Sciences was made public last year we unofficially began a campaign to reduce Los Alamos exposures from the 15 rem per year which has been the working level at Los Alamos for years and is based on NBS Handbook 59.

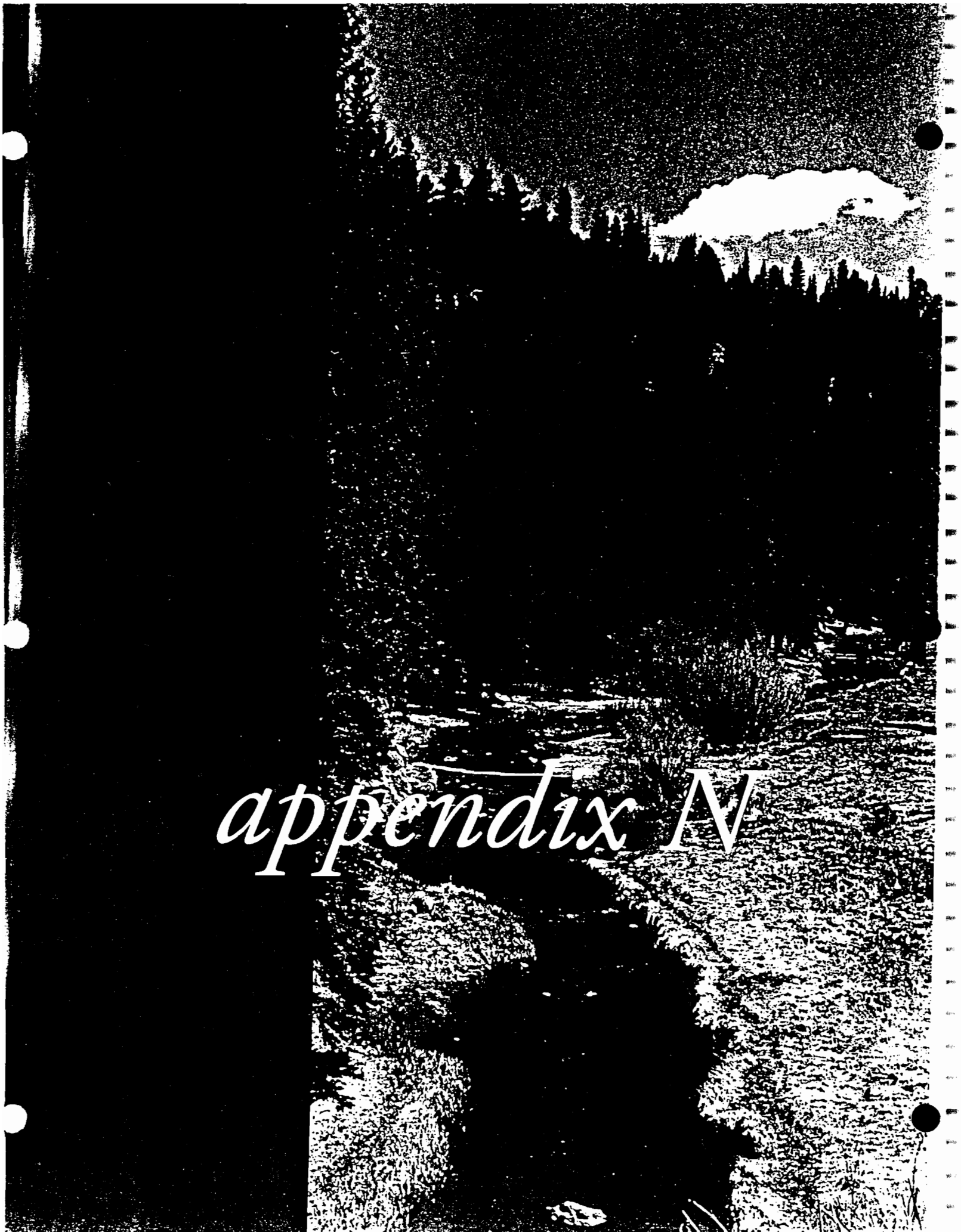
The exposure record of the four men is as follows:

Name	Age	Accumulated Exposure up to 1-1-57	Exposure for 1957 up to 12-6-57	Exposure Accumulated in 4th Quarter 1957 up to 12-6-57	Allowable Exposure Based on 5(N-18)
C.W. Christenson	42	2.51 rem	2.50 rem	2.50 rem	120 mr
R.H. Harmeson	37	0.33	4.71	1.16	90
J.P. Hutchinson	47	8.23	4.74	0.34	140
R.G. Thomas	42	2.74	4.55	2.89	120

Based on the above exposure record I propose that we allow the four men to receive up to 3.9 rem for the last calendar quarter of 1957. This would allow them to exceed 5 rem for the year, but we would attempt to keep at or below the 1 rem proposed by Mr. Christenson. This extension would still keep the individual yearly exposure of the group to less than 50% of the allowable exposure used by the Laboratory last year.

Dean D. Meyer
Group Leader, H-1

DDM:phr
cc: Shipman (2)
Christenson
Buckland
File



appendix N

HISTORY OF TEN SITE PLANT

Summary:

The original Ten Site plant consisted of four storage tanks representing about 200,000 gallons. Part of stored waste was recirculated through air cleaning equipment. Since evaporation in equipment was approximately equal to waste production, the tanks represented a very long storage period and it was expected that barium-140-lanthanum-140 activity would be reduced by natural decay to satisfactory levels for periodic discharge. It was found that tolerance levels for these relatively short half-lived isotopes could be met but that initially insignificant quantities of strontium-90 prevented discharge even after very long storage periods. For that reason additional equipment for removal of strontium-90 was considered necessary.

After a great deal of laboratory experimentation removal by ion exchange was found to be most practical. The first ion exchange unit installed in June 1955, was strictly an experimental device and extensive laboratory work was carried on concurrently or as a result of plant operating problems. Runs through the remainder of 1955 were generally short and much of the effluent was recirculated. The primary objective of treatment was to improve waste quality as losses in waste volume by evaporation closely approximated radioactive waste production and storage space was not a serious problem. This situation continued through 1956.

During 1956 the plant was operated much more frequently but 54.5% of effluent was recirculated. Waste accumulated over a period of several

years had been concentrated by evaporation and was highly mineralized. Runs were relatively short and the single resin column quickly exhausted. Operation was frequently interrupted by raw feed pump failures. Concurrent laboratory work continued and many operational procedures were changed and numerous equipment modifications installed.

As a result of the experience of 1956 the plant was re-designed. Installation was completed early in 1957. The modified plant permitted much longer runs and better control of effluent quality although control equipment was subject to frequent failure. Due to expanded operations at Ten Site the rate of waste production nearly tripled and only 7.6% of plant effluent was recirculated. In general, effluent quality improved even though runs were much longer. Improvement was due to series operation through two resin columns, controlled acidification of raw feed and a "fresher" and less highly mineralized raw waste. Increased rate of waste production and several "spills" resulted in highly radioactive waste in the storage area and the necessity for treatment of waste containing considerable gamma activity during the latter part of the year. Concentration of radioactivity in the resin columns caused excessive exposure of operating personnel even through 2-inch lead shielding and waste was chemically treated in the storage tanks in order to reduce activity to a reasonable level for further treatment.

Further increased waste production in early 1958 indicated the necessity for pre-treatment facilities and a chemical treatment plant was designed. Chemical treatment is expected to reduce gamma activity to tolerable levels for further treatment and to remove the plutonium

from wastes expected in the future. The effluent from a chemical treatment plant will be of much better physical quality than the present raw feed to the ion exchange unit (which contains a great deal of sludge) and of more uniform chemical quality.

With respect to the ion exchange unit most major technical problems have been solved but mechanical difficulties continue to impede satisfactory operation. Flow control with 1-inch stainless steel solenoid valves, for example, has proved to be entirely unsatisfactory. The valves fail so frequently that maintenance is prohibitive. Motor operated valves are expected to be more satisfactory and will replace the solenoid valves.

The following tabulation shows relative volumes of waste produced and treated since installation of the first ion exchange unit:

Year	Number Of Runs	Total Waste Treated (Gals)	Treated Per Run Avg.	Treated Per Run Max.	Treated Per Run Min.	Waste Produced Gals/~~Run~~ DAY
1955	9	67,850	7,500	12,350	2,560	400
1956	58	420,790	7,250	34,260	1,020	450
1957	16	465,850	29,100	61,560	7,900	1,180
1958 (Date)	5	189,830	38,000	80,900	18,440	1,790

The attached chronology describes major changes.

CHRONOLOGY TEN SITE PLANT

June 1, 1954: Design for ion exchange plant submitted by H-7.

John Schulte's letter to ENG-4 dated June 1 requests installation of plant and states:

"The storage system was originally designed for sufficient storage for Barium-140-Lanthanum-140 decay to tolerance levels. Quantities of strontium-89 and strontium-90 were initially insignificant. However, after storage 6 to 12 months strontium activity may constitute 50% of the total. The concentration of strontium activity is too high for discharge even though barium-140 tolerance level is met."

Jan. 1, 1955: Original plan for Ten Site plant submitted by ENG-4. Included "accelator", spent regenerant tank, acid tank, one resin column and a self-priming pump in the pump house.

May 10, 1955: Revised construction drawings issued. Estimated cost $11,300.

June 5, 1955: First run with stainless steel equipment.

June 15, 1955: Larger acid tank installed.

July 12, 1955: First overnight run.

July 15, 1955: Monitoring of column and operating area started.

Aug. 23, 1955: "Lightnin" mixer installed in spent regenerant tank.

Sept. 1, 1955: Laboratory experimental work with series operation of two cation exchange columns started. Note: Laboratory work was carried on concurrently with plant operation throughout this period. Considerable laboratory work devoted to methods of regeneration.

Operation Summary - 1955

No. Runs	Waste Treated	Waste Treated Per Run Avg.	Max.	Min.	Waste Produced Gal/Day
9	67,900 gal.	7,500	12,350	2,560	400

Jan. 31, 1956: New method of spent regenerant treatment used. Very large reduction in supernatant activity without increase in sludge volume. Method was:

1. Add 3 - 5 lbs. $Sr(NO_3)_2$.Mix.
2. Neutralize with NaOH.
3. Add 25# Na_2CO_3.
4. Add 5 - 10# $Ca(OH)_2$ and 2 - 5# ferrifloc. Flocculate 30 minutes. Settle overnight.

The previous method had not included stable $Sr(NO_3)_2$ and had included carbonation with CO_2.

Supernatant counts were reduced from 100,000 - 200,000 c/m/ml to less than 1,000 c/m/ml.

Feb. 11, 1956: A break in the recirculation line to the Filter Building caused loss of the entire contents of T-6 to the canyon over the weekend of Feb. 11-12, 1956. A periodic soil sampling program in Mortendad Canyon was started shortly thereafter.

March 3, 1956: Attempted unsuccessfully to use "Accelator" for treatment of wash water. Capacity too low.

March 20, 1956: Laboratory sampling cart installed at TA-45.

March 26, 1956: Plant shut down for two months because the raw feed pump continually lost prime. During the period 3/26/56 to 6/5/56, foot valves were installed in all suction lines and the auxiliary self priming pump was installed.

Aug. 7, 1956: As a result of laboratory experimentation a second ion exchange column was requested for Ten Site.

Sept. 27, 1956: Upflow regeneration used in plant operation first time.

Oct. 31, 1956: Changed resin in ion exchange column after Run #60. Old resin pumped into 55 gallon drums which were taken to the contaminated dump.

Nov. 5, 1956: Lead shielding installed around regenerant tank and resin column.

Nov. 14, 1956: Experimental acid pre-treatment started-manual control.

Nov. 30, 1956: Construction drawings for plant modification including second resin column and sump pump raw feed and circulation system issued. Estimated cost $8,375.00.

Dec. 20, 1956: Installation of piping system for storage tank sump pumps started.

Dec. 21, 1956:	Shut down for installation of new column and other plant revisions.
Feb. 18, 1957:	Old resin transferred to Col. #1. New resin in Col. #2.
Feb. 21, 1957:	Lead shielding installed around new resin column.
Feb. 27, 1957:	Piping and electrical work complete on plant modification. First two column series operation started Feb. 27, 1957.
Feb. 27 to Mar. 19, 1957:	Tried separate column regeneration after series operation. Very difficult and time-consuming because of limited capacity of regenerant tank.
Mar. 20 to Apr. 19, 1957:	Tried regenerating Col. #1 only and continuing run. Col. #2 effluent quality deteriorated rapidly.
Apr. 19, 1957:	First dual regeneration (acid upflow through Col. #2 across overflow line and downflow through Col. #1 to spent regenerant tank) after Run #72-B. Worked very satisfactorily for both columns. Has been used since.
May 5, 1957:	Tried running initial part of effluent to canyon and final to T-6. Substantially reduced effluent activity long after Col. #2 effluent quality was unsatisfactory for canyon discharge. Practice abandoned June 13, 1957 because increasing waste production made canyon discharge mandatory. Also return line to T-6 is subject to serious corrosion unless Col. #2 effluent is neutralized.

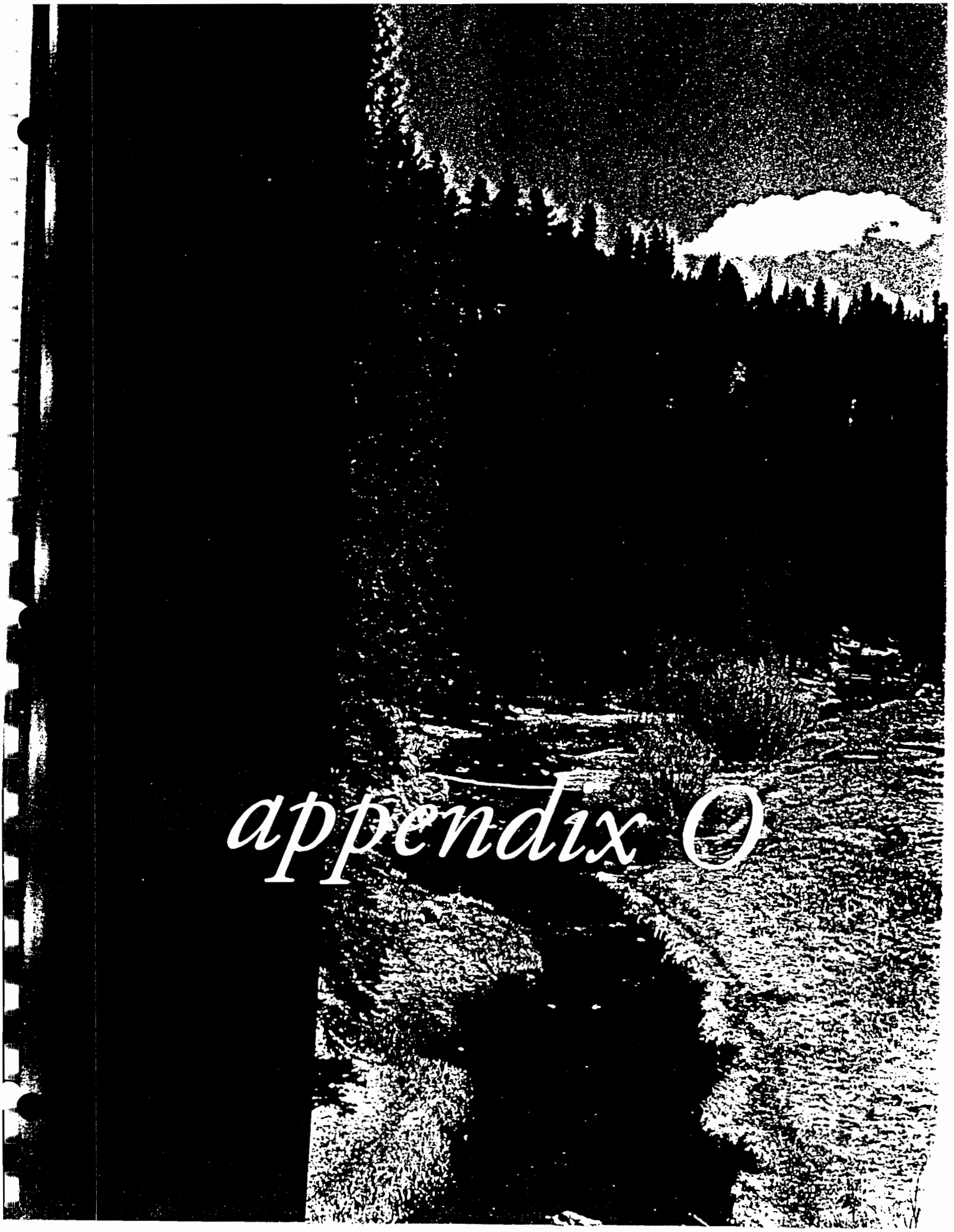
Jan. 13, 1958: Partly because of the radiation situation existing in the tank farm and treatment unit areas at the end of 1957 and partly because of new facilities to be constructed at Ten Site new waste treatment facilities were proposed. In addition to ion exchange columns the proposed plant would include chemical treatment units. Chemical treatment would be used to:

1. Reduce activity in extremely "hot" to a satisfactory level for further treatment.
2. Provide adequate facilities for handling radioactive sludges.
3. Remove plutonium from wastes to be produced at Ten Site in the future.
4. Protect operating personnel from excessive exposure.

March 11, 1958: An estimate of cost of a pipeline from the existing plant at DPW to Ten Site was requested. If economically feasible, wastes from both areas would be treated in a plant at Ten Site with a considerably reduced operating personnel requirement.

March 14, 1958: One to 1½ kilocuries lost from processing source. T-4 extremely "hot".

April 7, 1958: Plant shut down because of defective Col. #1 effluent solenoid valve and inability to have it repaired because of strike.



appendix O

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : C. W. Christenson, Group Leader, H-7 DATE: November 26, 1957

FROM : Richard G. Thomas, H-7

SUBJECT: TEN SITE WASTE TREATMENT, NOVEMBER 25, 1957

SYMBOL : H-7

Ten Site Tank Farm

Tank Levels		Friday, November 22
T-3	11' - 0"	Same
T-4	11' - 2"	Same
T-5	5' - 4"	4' - 5"
T-6	10' - 5"	10' - 11"

Received 11" waste ≈ 4,050 gallons in T-5 over weekend.

Evaporated 6" in T-6 ≈ 2,200 gallons.

Monitor Check, November 25

Tank Farm Area:

(1) Access road north of tanks - 0.1 r

(2) West edge of tanks - T-3 - 2.5 r
T-4 - 1.0 r
T-5 - .175 r
T-6 - .175 r

(3) Pump House - transfer piping - 1.5 to 4.0 r; All three pumps - .5 r.

(4) Ion exchange column area - .05 - .15 r.

Tank Space to go: T-6 - 0' - 11"
T-5 - 6' - 0"
6' - 11" ≈ 30,500 gal.

During past week 11/18/57 - 11/25/57, 3,300 gallons more plant waste than loss due to evaporation with 1,850 gallons over weekend.

Operation:

(1) Sump pump (T-6) transferring from T-6 to constant head tanks for air filters continuously. Anticipate no trouble in near future.

(2) All tanks sampled this morning.

(3) Auxilary Marlow pump started T-5 to T-6. Plan to transfer all T-6 will hold (11") today.

Estimate of Future Operations:

1. At present waste gains over evaporation losses, 10 to 15 days will fill all tank space. Called Rossiter on this and he is checking water use today. The air filters do not appear to be draining at all to plant waste.

2. Solenoid valves - ordered out of Denver one month ago. Rossiter said he would check again today.

   By installing solenoid valve on raw inlet to ion exchange columns and getting a tee fitting for constant head tank connection, it would be possible to split the flow to columns and air filters treating and evaporating at same time.

3. The best course at present seems to be: (a) keep all wastes from Ten Site to absolute minimum, (b) use only T-6 waste in air filters, (c) use Marlow auxilary to transfer lowest activity waste to T-6. The rubber diaphragm to this pump may have to be replaced at any time. (We have extras.) (d) keep temporary hook-up from T-6 sump pump to air filters running and (e) when activity at tank farm decays to permit workmen in for any length of time:

   1. Finish installing sump pump on T-4 to existing discharge piping in place.

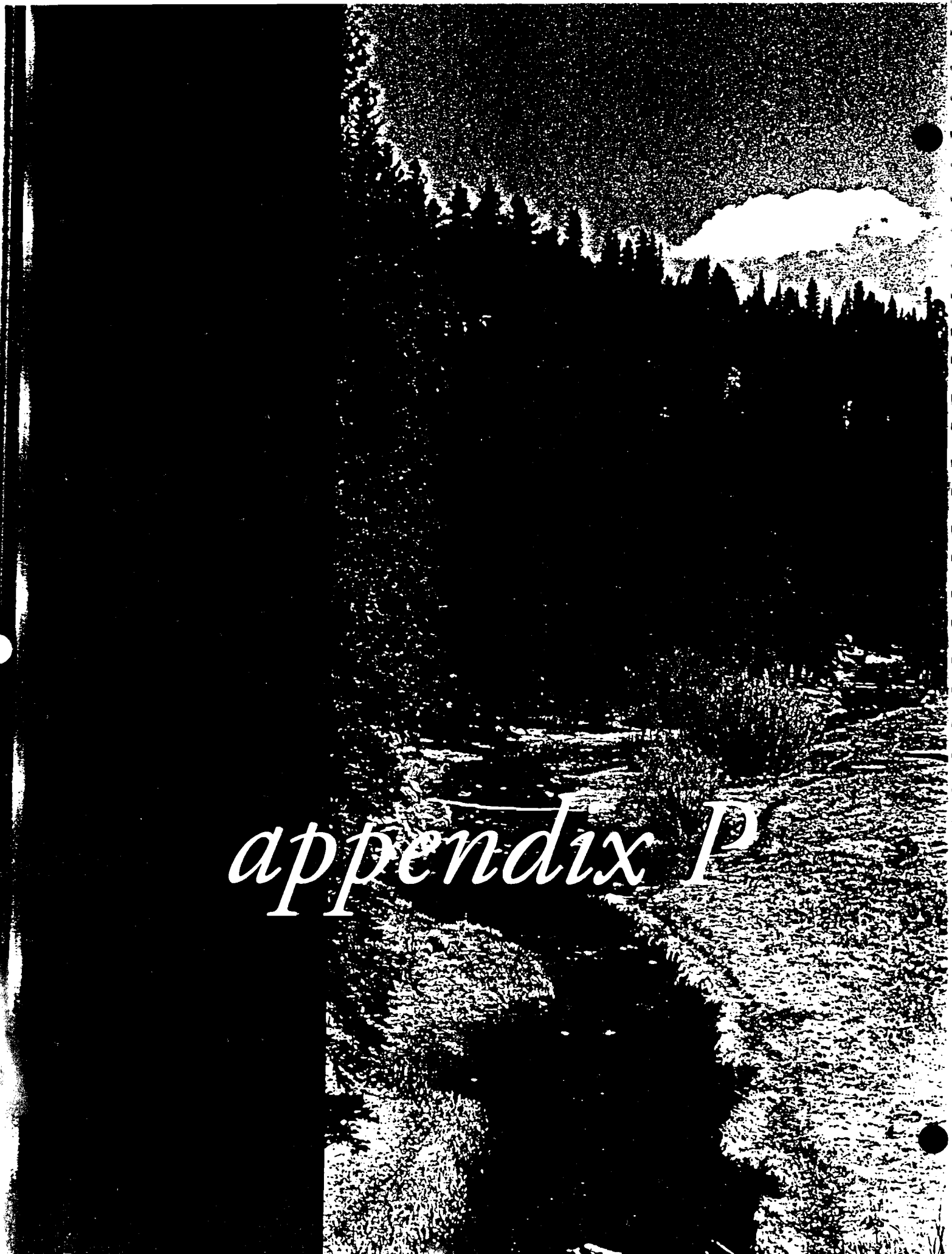
   2. Wiring could be taken from pump house now to either transfer pump.

   3. Additional piping from T-6 discharge on sump pump to constant head tank line with valve necessary.

   4. Two sump pumps be placed on order with necessary work orders for installation. Necessary wiring from filter building.

The tank farm activity decay trend since November 15, 1957, in gross c/m/ml.

	T-3	T-4	T-5	T-6
11/15	8,533,000	1,432,000	259,000	1,619,000
11/18	7,288,000	2,231,000	185,000	1,687,000
11/22	5,409,000	1,431,000	259,000	934,000
11/25	2,828,000	548,000	212,000	629,000



appendix P

PLANS AND DESCRIPTIONS OF EXISTING WASTE LINES

los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87545

Affirmative Action/Equal Opportunity Employer

No. 836
2629

UNITED STATES
ENERGY RESEARCH AND
DEVELOPMENT ADMINISTRATION
CONTRACT W-7405-ENG. 36

NO	IDENTIFICATION NUMBER	DESCRIPTION FROM - TO	FEET LENGTH	SIZE	MATERIAL	ENGINEERING CONSTRUCTION DRAWING a	DATE INST	STATUS
1	R-03-1	SM-700 TO MH-SM-708	1935	8"	VCP	ENG-C-6034 6035	1952	
2	• •-2	MH-SM-716 TO MH-SM-708	1300	8"	VCP	7399	1951	
3	• •-3	SM-40 TO MH-SM-716	515	6"	VCP	11340	1953	
4	• •-4	SM-39 TO MH-SM-714	127	6"	VCP	14702	1953	
5	• •-5	SM-28 TO MH-SM-714 (STUB OF LINE 2)	80	3"		37046	1968	
6	• •-6	SM-216 TO MH-SM-712	114	4"	DURIRON	35895	1967	
7	• •-7	MH-SM-725 TO MH-SM-708	1038	6"	VCP	7639	1952	
8	• •-8	SM-29 LAB WINGS 2 & 4 TO MH-SM-719	600	6"	VCP	7638 7639	1952	
9	• •-9	SM-29 LAB WINGS 3 & 5 TO MH-SM-722	634	6"	VCP	7638 7639	1952	
10	• •-10	SM-29 LAB WING 7 TO MH-SM-725	118	6"	VCP	7639	1952	
11	• •-11	MH-SM 728 TO MH-SM-725	707	8"	VCP	7401	1951	
12	• •-12	MH-SM-737 TO MH-SM-728	1151	8"	VCP	7400	1951	PARTIALLY ABANDONED, SEE 31373
13	• •-13	SM-102 TO MH-SM-730	720	6"	VCP	20673	1956	
14	• •-14	SM-16 TO MH-SM-737	100	8"	VCP	31373	1964	
15	• •-15	SM-65 TO MH-SM-720	55	4"	VCP	15194	1953	
16	• •-16	SM-16 TO SEPTIC TANK SM-15	180	3"		1890	1952	ABANDONED SEE 31373
17	• •-17	SM-154 TO MH-SM-726	564	6"	VCP	31105	1961	
17-A	• •-18	SM-29, WING 9 LOW LEVEL WASTE TO SM-154	177	6"	CIP	31105 31106	1961	ENCASED IN CONCRETE TRENCH
17-B	• •-19	SM-29, WING 9, HIGH LEVEL WASTE TO SM-154	190	4"	SST	31105; 06 & 31110	1961	ENCASED IN CONCRETE TRENCH
18	• •-20	SM-32 TO MH-SM-708	704	4"	VCP	11922	1952	
19	• •-21	SM-34 TO MH-SM-711	90	4"	VCP	17610; 14	1955	
19-A	• •-22	MH-711 TO MH-SM-710	163	8"	VCP	17610	1955	
20	• •-23	SM-66 TO MH-SM-732	730	6"	VCP	24163; 68	1959	
21	• •-24	SM-35 TO MH-SM-734	100	4"	VCP	4697	1961	
22	• •-25	SM-141 TO SM-66	280	2"		23535	1959	
23	• •-26	SM-700 TO MH-SM-736	3455	6"	CI	30780, 81	1963	FORCE MAIN
24	R-00-40	MH-SM-727 TO MH-ULR 149	3970	3"	CI	20801, 02	1957	ABANDONED
25	• •-41	MH-SM-736 TO CLEAN OUT STATION 70+78	70 158	6" 6"	CI VCP	ENG-C-30784	1963	PARTIALLY ABANDONED, 1ST. SECTION OF LINE USED FOR LINE NO. 31
26	• •-42	CLEAN OUT STATION 70+78 TO CLEAN OUT STATION 55+30	1548	6"	VCP	30784	1963	ABANDONED REPLACED BY LINE NO. 31
27	• •-43	CLEAN OUT STATION 55+30 TO ULR-149	2036	6"	VCP	30783; 84	1963	ABANDONED. REPLACED BY LINE NO. 31
28	R-03-27	SM-184 TO LINE NO. 31	225	4"	CIP	35244	1966	ORIGINALLY CONNECTED TO LINE NO. 26 SEE 42600 FOR CHANGE.
29	• •-28	SM-39 TO SM-102	110	4"	CIP	26738	1962	
30	• •-29	MH-SM-736 TO MH-SM-727	139	6"	CIP	42718	1973	
31	R-00-44	DIAMOND DRIVE TO CLEAN OUT STATION 31+66, (DWG-30783)	3776	8 1/8"	NIPAK POLYETHYLENE	42660	1974	
32	• •-45	MH-ULR-149 TO CLEAN OUT STATION 31+66	334	6"	VCP	30783	1963	ABANDONED

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TECH AREA

LINE NUMBER

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LASL UNDERGROUND LINES CONTAMINATED AND INDUSTRIAL WASTE

LINE DESCRIPTION

ENG-E 378

NO	IDENTIFICATION NUMBER	DESCRIPTION FROM – TO	FEET LENGTH	SIZE	MATERIAL	ENGINEERING CONSTRUCTION DRAWING @	DATE INST	STATUS
33	R-00-46	CLEAN OUT STATION 31+66 TO MH-RC-10 (37716)	291	5 3/8"	NIPAK-POLYETHYLENE	42660	1974	ENCASED BY OLD CIP AND VCP LINE
34	R-48-60	TA-48 TO LINE NO 33	300	3"	CIP	20801	1957	
35	" " -61	LINE NO 34, (DISCONNECTED) TO MH ULR 149	330	3"	CIP	20801	1957	ABANDONED
36	" " -62	HIGH LEVEL CHEMISTRY TA-48 TO LINE NO 34	330	3"		27443	1963	
37	" " -63	HIGH LEVEL CHEMISTRY TA-48 TO CANYON	56	2"		27443	1963	
38	" " -64	CORE PROCESSING TA-48 TO LINE NO 33 AT MH RC-10	55	3"	CIP	37716	1968	
39	R-00-47	MH RC-10, (PI-13) TO (PI-14) (DWG 42660)	630	8"	VCP	30782	1963	ABANDONED
40	R-00-48	MH-RC-10 (PI 13) TO PI 14	631	5 3/8"	NIPAK POLYETHYLENE	42660	1974	
41	R-48-65	CORE PROCESSING TA-48 TO TA-50 (SECTION AT TA 48)	630	1 1/2"	SST 304-L	35008	1969	ABANDONED-SEE LA-KY-A5100
42	" " -66	OLD TA-48 TO TA 50 LINE (SECTION AT TA-50)	40	1 1/2"	SST 304-L	35011	1969	REMOVED FROM LINE No 41 TO FENCE AT TA-50
43	R-00-49	PI-14 TO PECOS DRIVE TIE IN POINT	1628	8"	CIP	LA-KY-A5101 LA-KY-A5100	1974	
44	R-50-80	LINE NO 43 TO LD-6 - TA-50	40	6"	VCP	30782	1963	REMOVED TO FENCE IN 1975
45	" " -81	LINE NO 43 TO LD-6 TA-50	688	5 3/8"	NIPAK POLYETHYLENE	42660	1974	LAST 50 FEET AT TA-50 IS 6" CIP INSTALLED AS LINE NO 44
46	" " -82	LD-6 TO LD-1	50	6"	CIP	30779	1963	
47	" " -83	SOIL LAB TO LD-6	40	4"	CIP	30779	1963	
48	" " -84	LD-3 TO LD-6 VIA LD-7	112	6"	CIP	30779	1963	
49	R-35-120	TA-35 TO LD-3 (TA-50)	2667	3"	CIP	30795; 30786	1963	
50	R-50-85	LD-3 TO LD-1	100	1"	SST	30779	1963	
51	"-50-86	LD-1 TO LD-2	42	4"	CIP	30779	1963	
52	"-50-87	LD-1 TO LD-2	38	3"	CIP	30779	1963	
53	"-50-88	LD-1 TO LD-2	36	4"	CIP	30779	1963	
54	"-50-89	LD-2 TO LINE NO. 49	75	3"	CIP	30779	1963	
55	"-50-90	LD-1 AND LD-2 TO DITCH	392	6"	VCP	30779	1963	
56	"-50-91	LD-1 TO LINE NO. 58	29	4"	CIP	30779	1963	
57	"-50-92	LD-1 TO LINE NO. 58	5	4"	CIP	30779	1963	
58	"-50-93	LD-1 TO LD-2	112	10"	CIP	30779	1963	
59	"-50-94	LD-1 TO LD-2	127	6"	CIP	30779	1963	
60	"-50-95	LD-2 TO LD-1	102	8"	CIP	30779	1963	
61	"-50-96	LD-1 TO LD-2	102	8"	CIP	30779	1963	
62	"-50-97	LD-2 TO LD-1	102	2"	CIP	30779	1963	
63	"-50-98	LD-2 TO LD-1	102	2"	CIP	30779	1963	
64	"-50-99	LD-2 TO MORTANDAD CANYON	1515	6"	CIP & ST	30785	1963	
65	"-52-110	TA-52 TO LD-3, (TA-50)	3120	3"	CIP	31834; 31837	1961	
66	"52-111	RD-1 TO RD-2	247	3"	CIP	31385	1961	

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Los Alamos Scientific Laboratory

LASL UNDERGROUND LINES CONTAMINATED AND INDUSTRIAL WASTE

LINE DESCRIPTION

ENG-E 378 D 10

NO.	IDENTIFICATION NUMBER	DESCRIPTION FROM - TO	FEET LENGTH	SIZE	MATERIAL	ENGINEERING CONSTRUCTION DRAWING #	DATE INST	STATUS
67	R-50-100	EMERGENCY DRAIN FROM LD-2 PUMP ROOM	36' 250'	6" 6"	CIP VCP	21914	1963	
68	R-35-121	TSL-29 TO CAUSTIC TREATER BLDG.	150'	3"	SS	29306	1961	
69	" " -122	TSL-41 TO TSL-31	20'	4"	SS	29306	1961	
70	" " -123	TSL-26 TO TSL-41	346' 23'	4" 4"	SS BS	29303 29309	1961	
71	" " -124	LINE No 70 TO CANYON	193'	6"	VCP	29306	1961	
72	" " -125	TSL-31 TO TSL-9	125'	4"	SS	29306	1961	
73	" " -126	DISCHARGE FROM PUMP-1 TO TANK-3	17'	2"	CS	14264, 14266	1951	
74	" " -127	SAMPLE FROM P-1 TO TK-3	17'	1"	CS	14264, 14265	1951	
75	" " -128	SUCTION FROM P-1 TO TK-3	17'	3"	CS	14264	1951	
76	" " -129	DISCHARGE CAUSTIC TREATER TO TK-3	17'	2"	CS	14264	"	
77	" " -130	DISCHARGE FROM P-1 TO TK-4	17'	2"	CS	14264	"	
78	" " -131	SAMPLE FROM P-1 TO TK-4	17'	1"	CS	"	"	
79	" " -132	DISCHARGE FROM CAUSTIC TREATER TO TK-4	17"	2"	CS	"	"	
80	" " -133	SUCTION TO P-1 FROM TK-4	17"	3"	316 SS	"	"	
81	" " -134	DISCHARGE FROM P-1 TO TK-5	17"	2"	CS	"	"	
82	" " -135	DISCHARGE FROM CAUSTIC TREATER TO TK-5	17"	2"	CS	"	"	
83	" " -136	SUCTION TO P-1 FROM TK-5	17"	3"	316 SS	"	"	
84	" " -137	SAMPLE FROM P-1 TO TK-5	17"	1"	CS	"	"	
85	" " -138	SUCTION TO P-1 FROM TK-6	17"	3"	CS	"	"	
86	" " -139	SUCTION TO P-2 FROM TK-6	17"	3"	316 SS	"	"	
87	" " -140	DISCHARGE FROM P-1 TO TK-6	17"	2"	CS	"	"	
88	" " -141	SAMPLE FROM P-2 TO TK-6	17"	1"	CS	"	"	
89	" " -142	SAMPLE FROM P-1 TO TK-6	17"	1"	CS	"	"	
90	" " -143	TSL-3 TO TSL-9	258"	3"	SS	14004	"	
91	" " -144	TSL-9 TO TSL-7 DECAYED WATER RETURN	210"	3"	BS	"	"	
92	" " -145	TSL-7 TO TSL-9 DECAYED WATER SUPPLY	210"	2"	BS	"	"	
93	" " -146	TSL-7 TO TSL-9	223"	1 1/2"	GALVANIZED STEEL	10858	1955	
94	" " -147	TSL-7 TO SLUDGE PIT TSL-22	35"	2	" "	10858 10476	"	
95	" " -148	TSL-7 TO SWALE TO CANYON	82"	2"	DURIRON	10858	"	
96	" " -149	TSL-7 CLEAN OUT STATION AT SOUTHWEST CORNER OF TSL-7	12"	2"	SS	22853	1960	
97	" " -150	LINE No 96 TO TSL-36	144"	3"	SS	"	"	
98	" " -151	TSL-36 TO TSL-7	126"	2"	SS	"	"	
99	" " -152	TSL-9 TO TSL-7	192"	2"	SS	"	"	
100	" " -153	TSL-4 TO TSL-3	10"	2"	316 SS	14263	1951	
101	" " -154	TSL-3 TO TSL-4	8"	2"	"	"	"	
102	" " -155	TSL-5 TO TSL-3	10"	2"	"	"	"	
103	" " -156	TSL-3 TO TSL-5	8"	2"	"	"	"	

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LASL UNDERGROUND LINES, CONTAMINATED AND INDUSTRIAL WASTE

LINE DESCRIPTION

ENG-E 378 D 11

NO	IDENTIFICATION NUMBER	DESCRIPTION FROM - TO	FEET LENGTH	SIZE	MATERIAL	ENGINEERING CONSTRUCTION DRAWING ⊕	DATE INST	STATUS
104	R-35-157	TSL-6 TO TSL-3	10'	2"	316 SS	14263	1951	
105	R-35-158	T6L-3 TO TSL-6	8'	2"	•	•	•	
106	V-35-159	AIR DUCT GAS & LIQUID FROM "A" LAB	105'	18"	SS COLUMBIAN STABILIZED	14263, 14620	•	
107	• • -160	• • • • • "C" •	275'	24"	•	14263, 14260	•	
108	• • -161	• • • • • "H" •	18'	12"	SS	14263, 14261	•	
109	R • -162	LIQUID FROM "H" LAB	18'	2"	SS	14263	•	
110	V • -163	GAS & LIQUID FROM "K" & "L" DECONTAMINATION CELLS	18'	8"	SS	14263, 14261	•	
111	R • -164	LIQUID FROM "J" LAB	18'	2"	SS	14263	•	
112	V • -165	AIR DUCT GAS & LIQUID FROM "J" LAB	18'	12"	SS	14263, 14261	•	
113	• • -166	• • • • • "B" •	105'	18"	SS COLUMBIA STABILIZED	14263, 14260	•	
114	R • -167	TSL-27 TO TSL-41	185'	3"		35314	1966	
115	V-02-180	OMEGA-1 TO OMEGA 44 VENT	130'	2"	BLACK STEEL	14930, 14931	1956	
116	• • -181	LINE No 115 TO LINE No 119 EXHAUST LINE	570'	4"	BLACK STEEL	10473	1957	
117	• • -182	WATER BOILER EFFLUENT GAS LINE	135'	1/2"	SST	R-394, 1686	1944	ENCASED IN 3" CONDUIT
118	• • -183	• • • • • •	250'	1/2"	SST	R-394, R-396	1944	ABANDONED 1947
119	• • -184	• • • • • •	1110'	2"	SST	1716 P-2 DWG- 2Y 50650	1947	
120	• • -185	OMEGA-8 TO OMEGA-9 BLOWER LINE	55'	8"	STEEL & TRANSITE	1717	1947	
121	R-02-186	OMEGA-44 TO OMEGA-53	66'	4"	BLACK IRON	29861	1963	
122	• • -187	OMEGA-56 TO OMEGA-53 TANK OUTLET	6'	2"	304 SST	•	•	
123	• • -188	OMEGA-53 TO OMEGA-56 TANK INLET	10'	4"	BLACK IRON	•	•	
124	• • -189	OMEGA-53 TO OMEGA-55 TANK INLET	7'	4"	BLACK IRON	•	•	
125	• • -190	OMEGA-55 TO OMEGA-53 TANK OUTLET	4'	2"	304 SST	•	•	
126	• • -191	OMEGA-53 TO OMEGA-54 TANK INLET	10'	4"	BLACK IRON	•	•	
127	• • -192	OMEGA-54 TO OMEGA-53 TANK OUTLET	6'	2"	304 SST	•	•	
128	• • -193	OMEGA-53 TO TRUCK LOADOUT	30'	2"	316 SST	•	•	ABANDONED
129	• • -194	OMEGA-53 DRAIN LINE TO CREEK	17'	4"	BLACK IRON	•	•	
130	• • -195	OMEGA-53 SUMP PIT DRAIN LINE TO CREEK	15'	1 1/2"	BLACK IRON	•	•	
131	V • -196	WATER BOILER EFFLUENT DELAY LINE	40'	12"	316-SS	27396, 27397	1964	
132	R-21-210	DPW-20 (REMOVED), TO SEEPAGE PIT	90'	6"	JENNITE COATED BLACK IRON	2218	1945	
133	R-• -211	SEEPAGE PIT OVERFLOW PIPING	775'	4"	•	•	•	
134	I-• -212	ETHER WASTE FROM DPW-2 TO DPW-118	200'	3"	JENNITE COATED CAST IRON	2219	•	
135	V-21-213	VAPOR VENT DPW-118 TO CANYON	90'	2"	•	•	•	
136	R-21-214	DPW-2 TO DPW-257, FORMERLY TO DPW-35 (REMOVED)	455' 307'	1 1/2"	SST	2563 2564 36380	1952 1967	SECTION TO DPW-35 REMOVED
137	R-21-215	EHCL WASTE LINE DPW-81, 84, 87, 89 DPW-3 TO DPW-93 AND TO DPW 257	725'	4"	CAST IRON	2563, 2564, 2466, 2467	1952	SECTION FROM CORNER OF DPW-5 TO DPW 93 REMOVED ~ 60 FEET
138	• • -216	DPW-3 TO DPW-257, FORMERLY TO DPW-35, (REMOVED)	313' 328'	1 1/2"	SST	2563, 2564 36380	1952 1967	SECTION TO DPW-35 REMOVED
139	• • -217	DPW-2, 3, 4 TO SEEPAGE PIT VIA DPW-81, 84, 87, 89	670'	8"	JENNITE COATED BLACK IRON	2215, 2217	1945	ABANDONED
140	• • -218	SEEPAGE PIT OVERFLOW PIPING	120'	6"	•	•	•	

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LASL UNDERGROUND LINES, CONTAMINATED AND INDUSTRIAL WASTE

LINE DESCRIPTION

ENG E 378 D 12

NO	IDENTIFICATION NUMBER	DESCRIPTION FROM - TO	FEET LENGTH	SIZE	MATERIAL	ENGINEERING CONSTRUCTION DRAWING *	DATE INST	STATUS
141	R-21-219	DPW-12, (REMOVED), TO SEEPAGE PIT	125	6"	JENNITE COATED BLACK IRON	2217	1945	
142	• •-220	ACID WASTE SUMP DPE-173 TO ACID WASTE SUMP DPE-223	220	6"		27024	1965	
143	• •-221	ACID WASTE SUMP DPE 223 TO DPW-257 AND DPW-35, (REMOVED)	1445	3"		27024, 27025, 36385	1965	
144	• •-222	ACID WASTE SUMP DPE 223 OVERFLOW TO CANYON	61	6"		27024	•	
145	I-21-223	DPE-155 FLOOR DRAINS TO CANYON	116	4"	CAST IRON	30978	1964	
146	R-•-224	DPE-155 ACID DRAIN TO DPE-222 FORMERLY TO DAYLIGHT	200	4"	• •	30978, 27024	•	116 FEET ABANDONED
147	R-•-225	DPE-152 TO SEEPAGE PIT	86	6"	JENNITE COATED BLACK IRON	2216	1945	
148	•-•-226	DPE-153 TO SEEPAGE PIT	45	6"	• •	•	•	
149	•-•-227	DPE-209 TO DPE-221	75	6"		31964	1965	
150	I-•-228	INDUSTRIAL WASTE DPE-209 TO CANYON	112	8"	VCP	•	•	
151	•-•-229	INDUSTRIAL WASTE DPE-166, DPE-167 TO CANYON	345	4"	•	•	•	
152	•-•-230	INDUSTRIAL WASTE DPW-150 TO CANYON	150	6"		29986	1962	
153	R-•-231	DPW-35, (REMOVED), SEEPAGE PIT VIA DPW-121	35	2"		27026		
154	•-•-232	DPW-35, (REMOVED) TO SEEPAGE PIT	30 50	6" 4"	STEEL CAST IRON	8439	1952	
155	•-•-233	PIPING BETWEEN DPW-110, 111, (RELOCATED AND DPW-35, (REMOVED)	10 110	3" 4"	• •	•	•	
156	•-•-234	DPW-110, 111, (RELOCATED) DPW-35 (REMOVED) TO SEEPAGE PIT	120	4"	• •	•	•	
157	•-•-235	DPW-35, (REMOVED) TO EFFLUENT HOLDING TANKS DPW-112, 113	250	6"	• •	•	•	
158	•-•-236	DPW-257 TO LINE No 157	61	6"	• •	36385, 36364	1967	
159	•-•-237	DPW-257 TO OUTFALL LINE No 162	138	4"	• •	• , 36380	•	
160	•-•-238	DPW-257 TO LINE No 161	200	4"	• •	• •	•	
161	•-•-239	DPW-112, 113, EFFLUENT HOLDING TANKS TO SEEPAGE PITS	65	4"	CAST IRON & VCP	8449	1952	
162	•-•-240	EFFLUENT HOLDING TANK TO OUTFALL DITCH	75	4"	VCP	8439	•	
163	•-•-241	EFFLUENT HOLDING TANKS TO LINES 161 AND 162	80	4"	CAST IRON	•	•	
164	•-•-242	DPW-5 TO DPW-257 FORMERLY TO DPW-35 (REMOVED)	175 300	1½" 	SST	2563 36380	1952 1967	
165	•-•-243	DPW-35 (REMOVED) TO SEEPAGE PIT	9 12	1" 4"	316 SST VCP	2585	1952	
166	•-•-244	DPW-150 TO LINE No. 137	180	4"	CAST IRON	29986	1962	
167	R-00-50	SM-700 TO STATION 33 + 14	1750	3"	• •	6033, 6035, 6036	1952	
168	•-•-51	STATION 33+14 TO STATION 39+37 MANHOLE ULR-35	623	4"	• •	• • •	•	
169	•-•-52	MANHOLE ULR-35 TO LINE No. 171	125	6"	VCP	• • •	•	
170	R-43-260	MEDICAL RESEARCH LABORATORY TO MANHOLE ULR-60	240	6"	•	11336, 11339	1953	
171	R-43-261	MANHOLE ULR-60 TO LINE No 169	420	6"	•		•	

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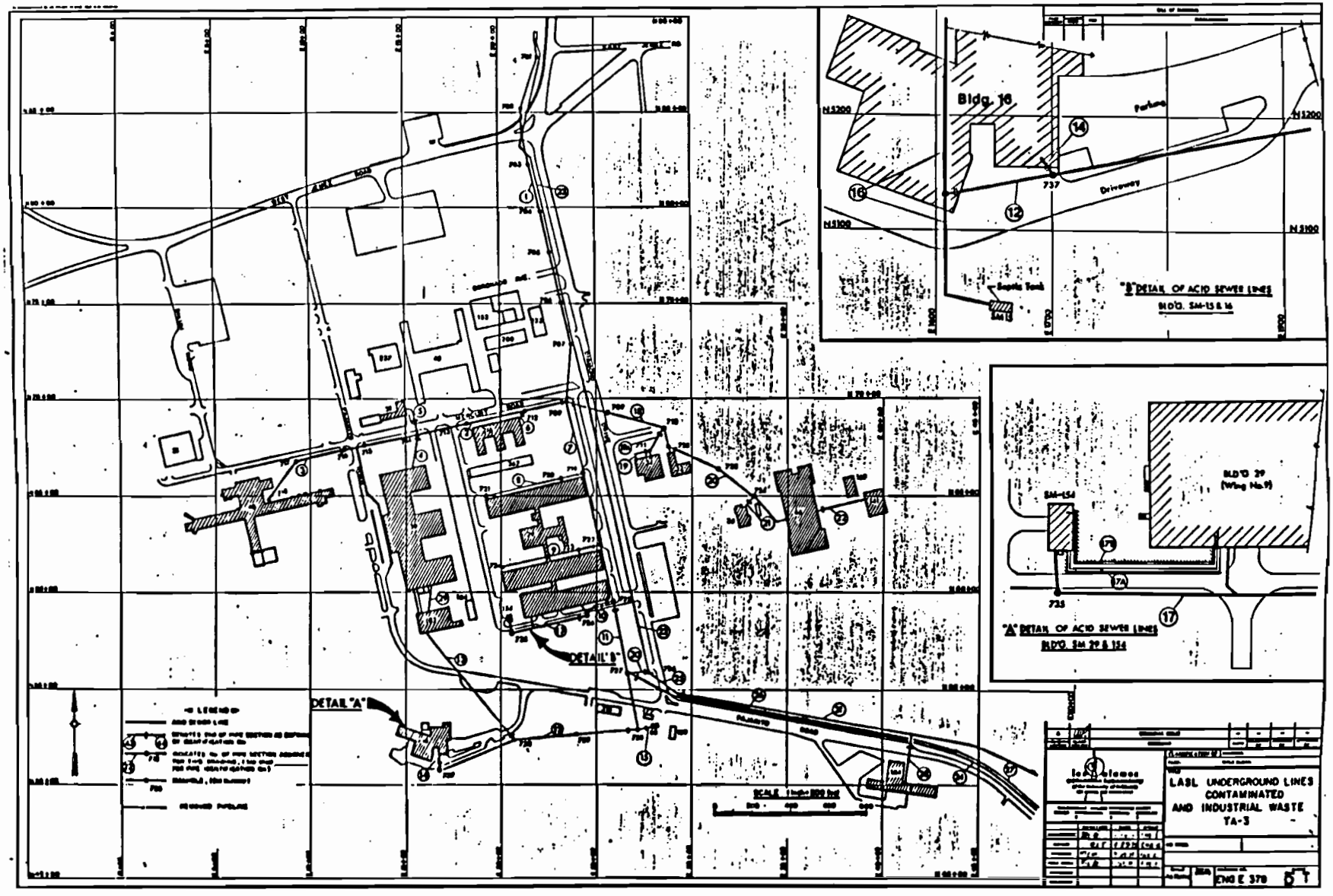
* ALL DRAWING NUMBERS REFER TO ENG-C PREFIX UNLESS OTHERWISE NOTED.

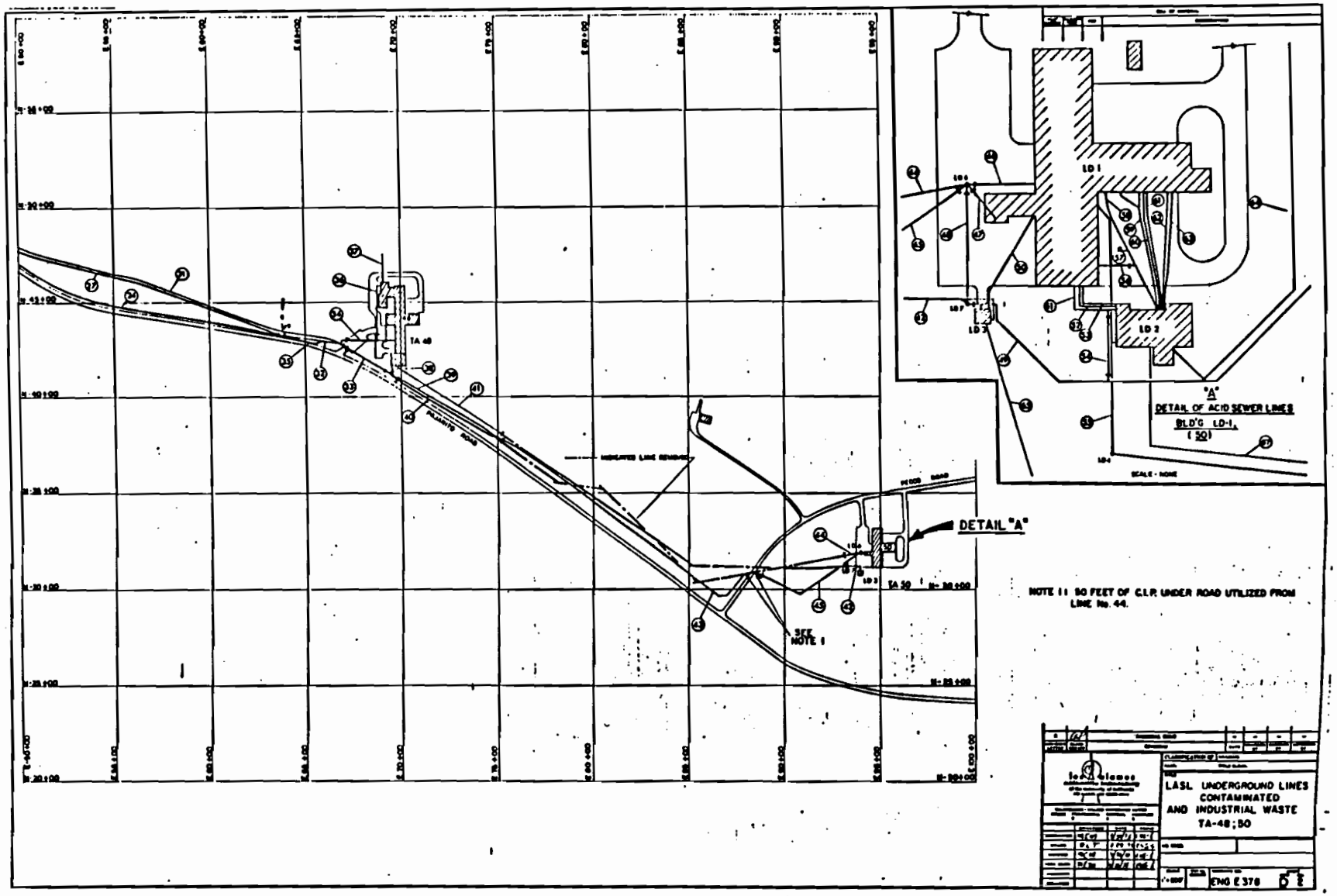
los alamos

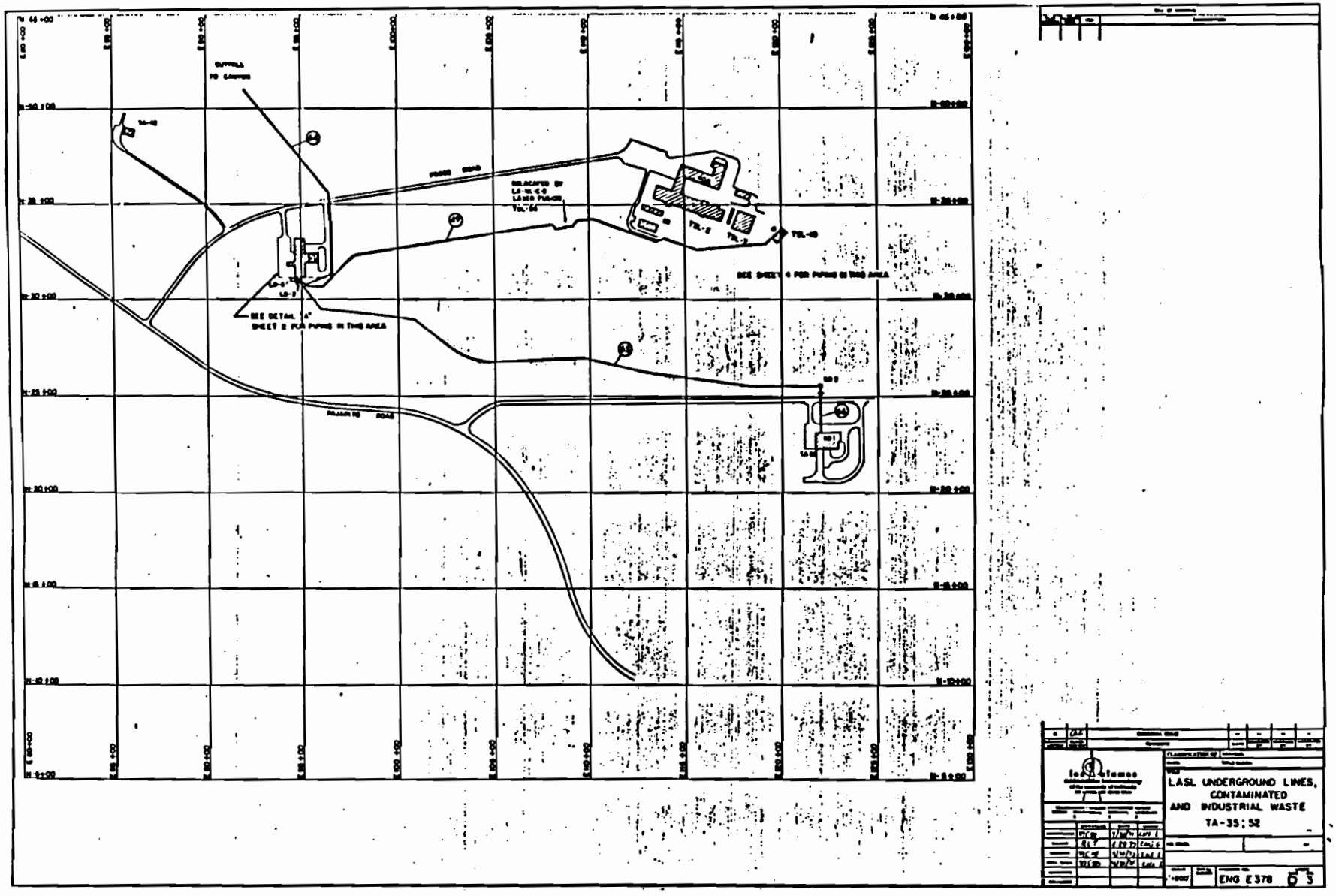
LASL UNDERGROUND LINES CONTAMINATED AND INDUSTRIAL WASTE

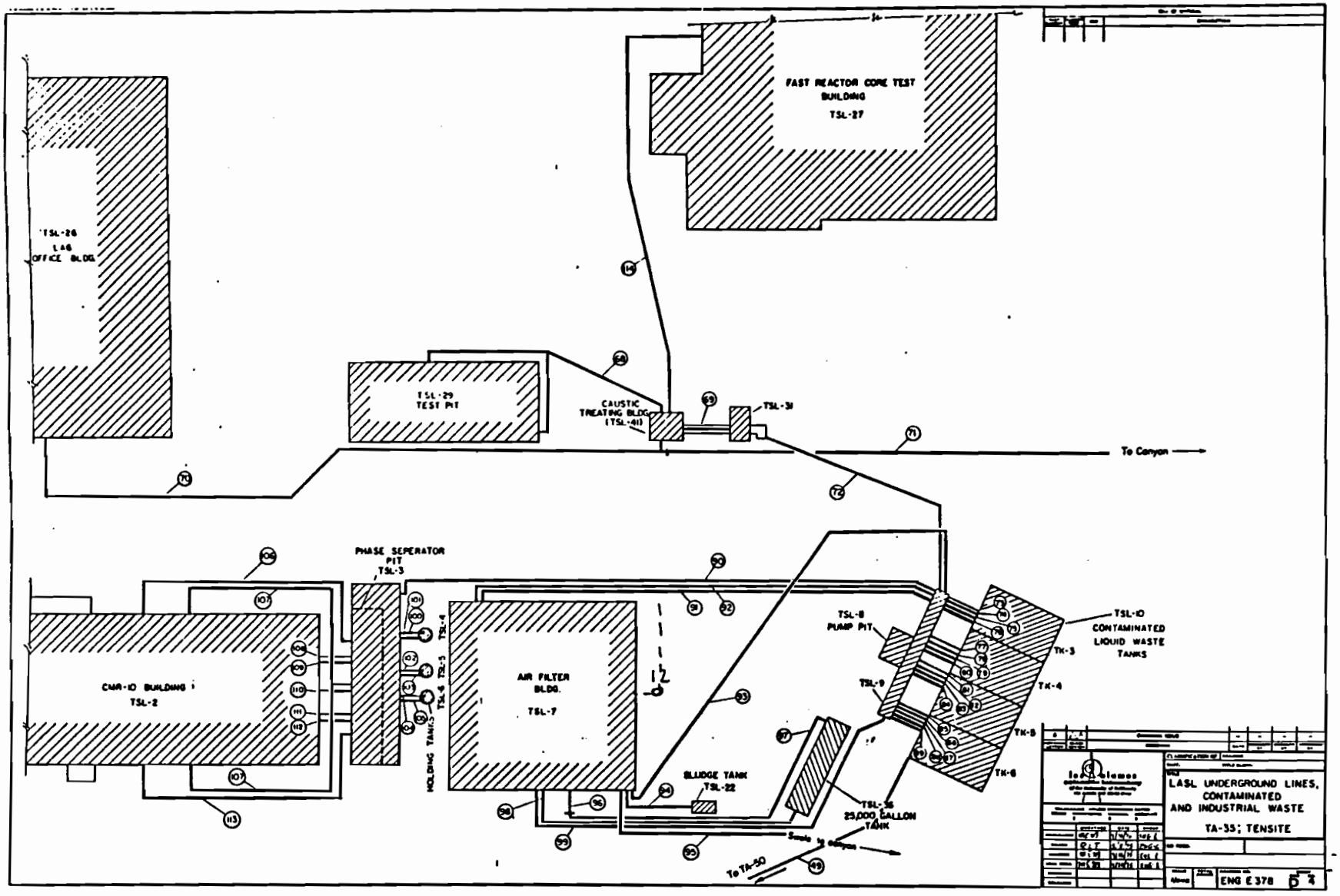
LINE DESCRIPTION

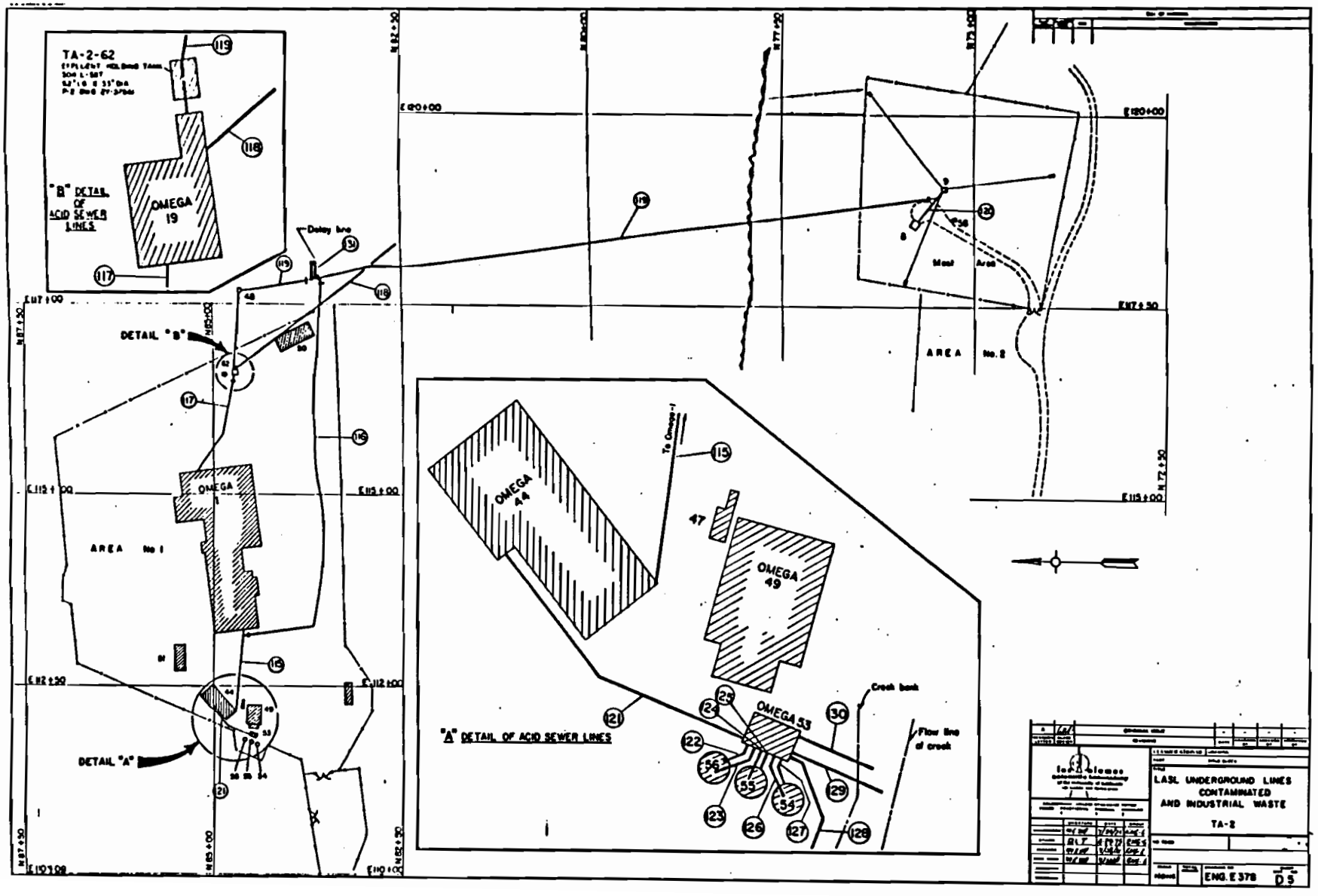
ENG. E 376 D15

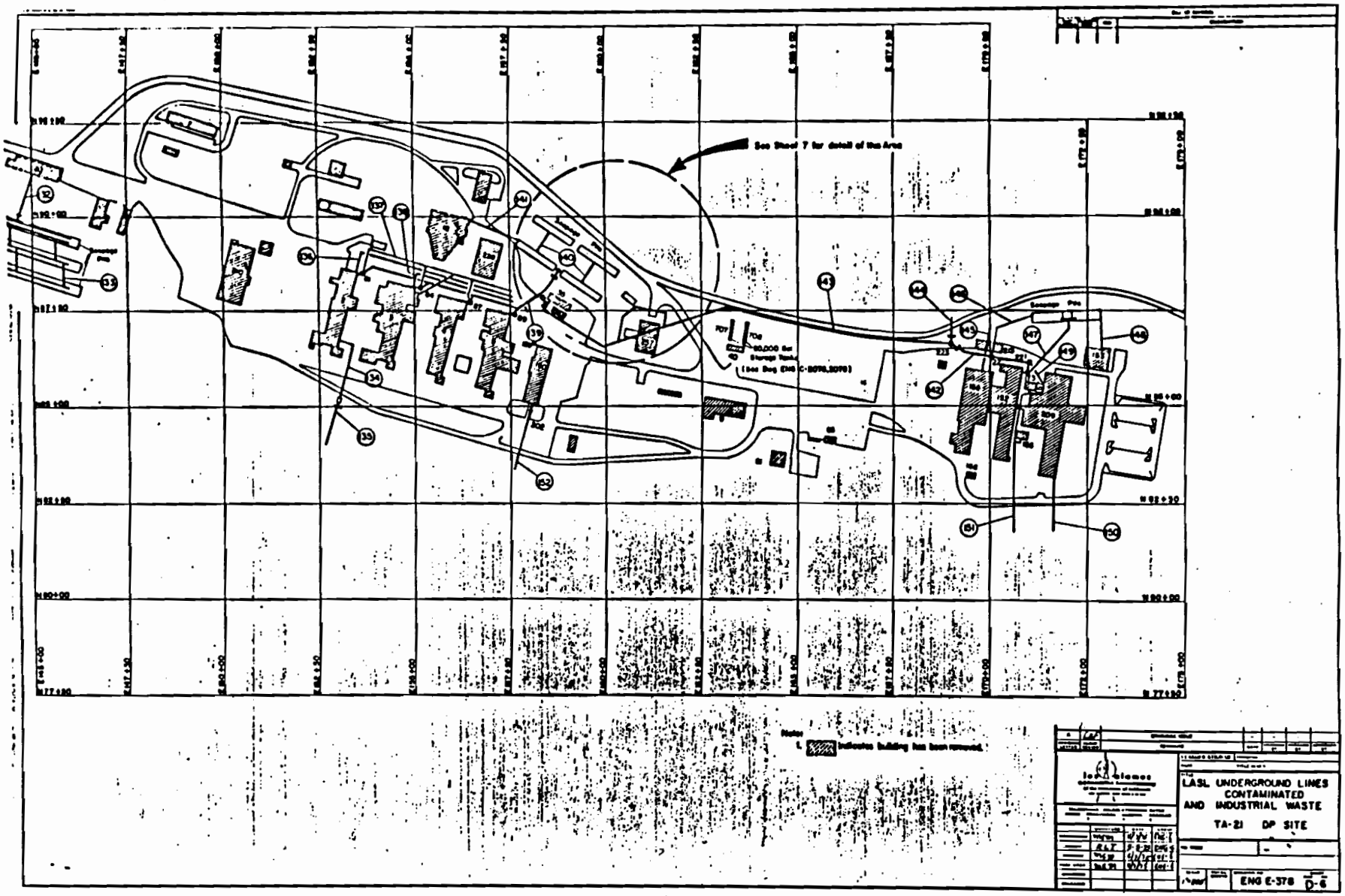

Bldg. 16
Parking
Driveway
Septic Tank
"B" DETAIL OF ACID SEWER LINES
BLD'G. SM-15 & 16
BLD'G 39
(Wing No.9)
SM-154
"A" DETAIL OF ACID SEWER LINES
BLD'G. SM 39 & 154
DETAIL "A"
DETAIL "B"
LASL UNDERGROUND LINES
CONTAMINATED
AND INDUSTRIAL WASTE
TA-3
ENG E 378

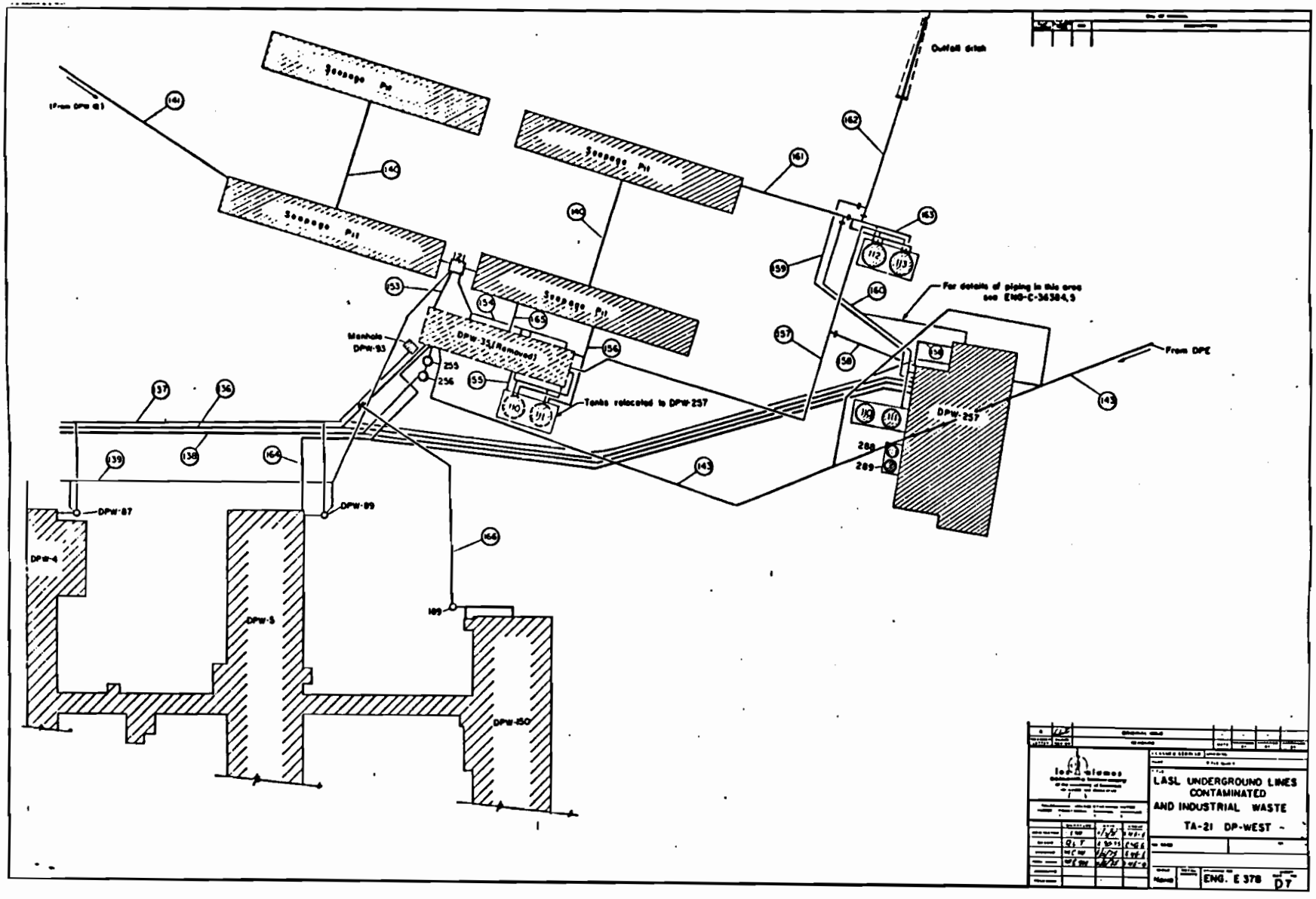

TA 48
TA 50
DETAIL "A"
SEE NOTE 1
LD 1
LD 2
LD 3
"A"
DETAIL OF ACID SEWER LINES
BLD'G LD-1,
(50)
SCALE - NONE
NOTE 1: 50 FEET OF C.I.P. UNDER ROAD UTILIZED FROM LINE No. 44.
LASL UNDERGROUND LINES
CONTAMINATED
AND INDUSTRIAL WASTE
TA-48; 50
ENG E 378

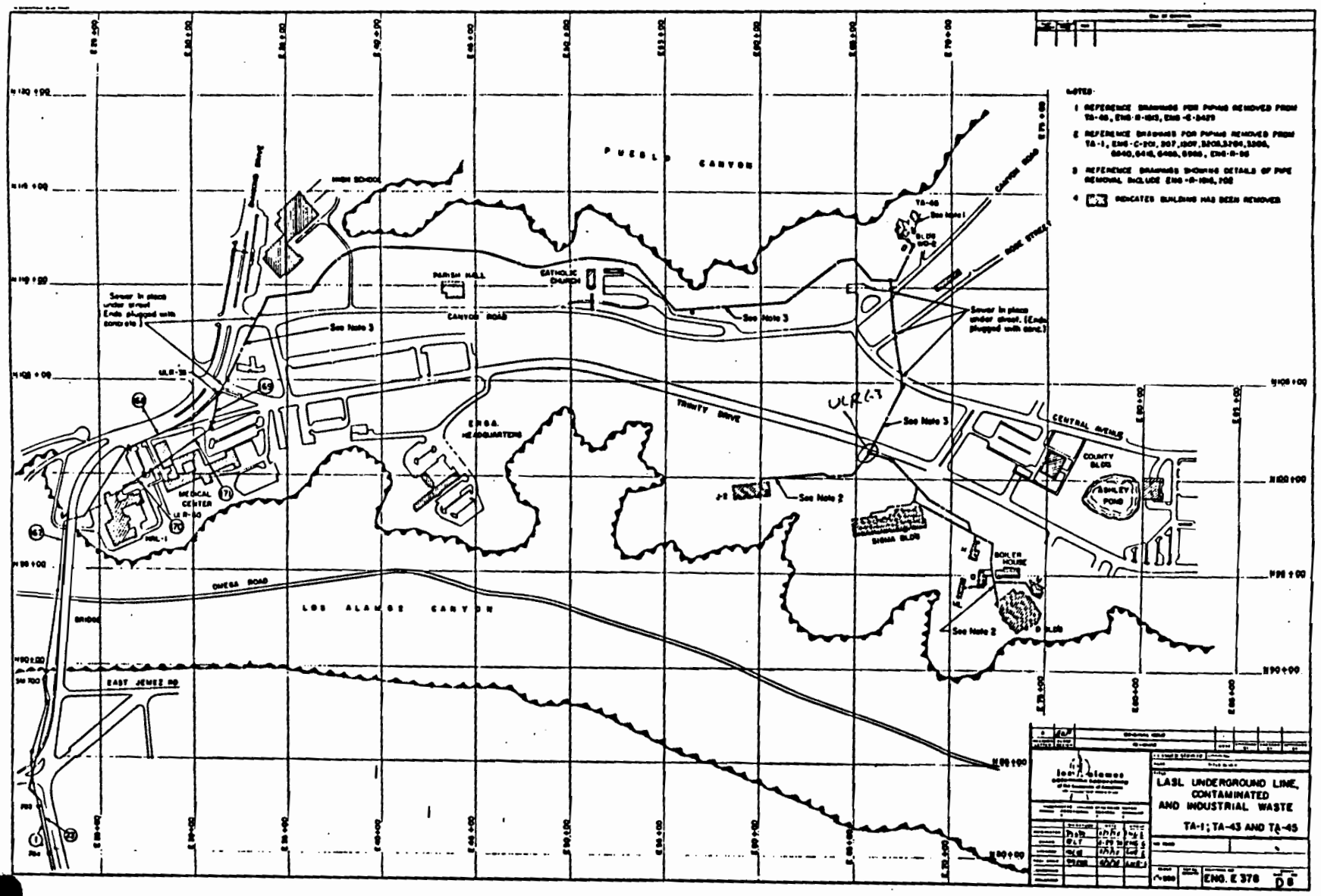

LASL UNDERGROUND LINES, CONTAMINATED AND INDUSTRIAL WASTE
TA-35; 52
ENG E378
SEE DETAIL "A" SHEET 2 FOR PIPING IN THIS AREA
SEE SHEET 4 FOR PIPING IN THIS AREA
TSL-40

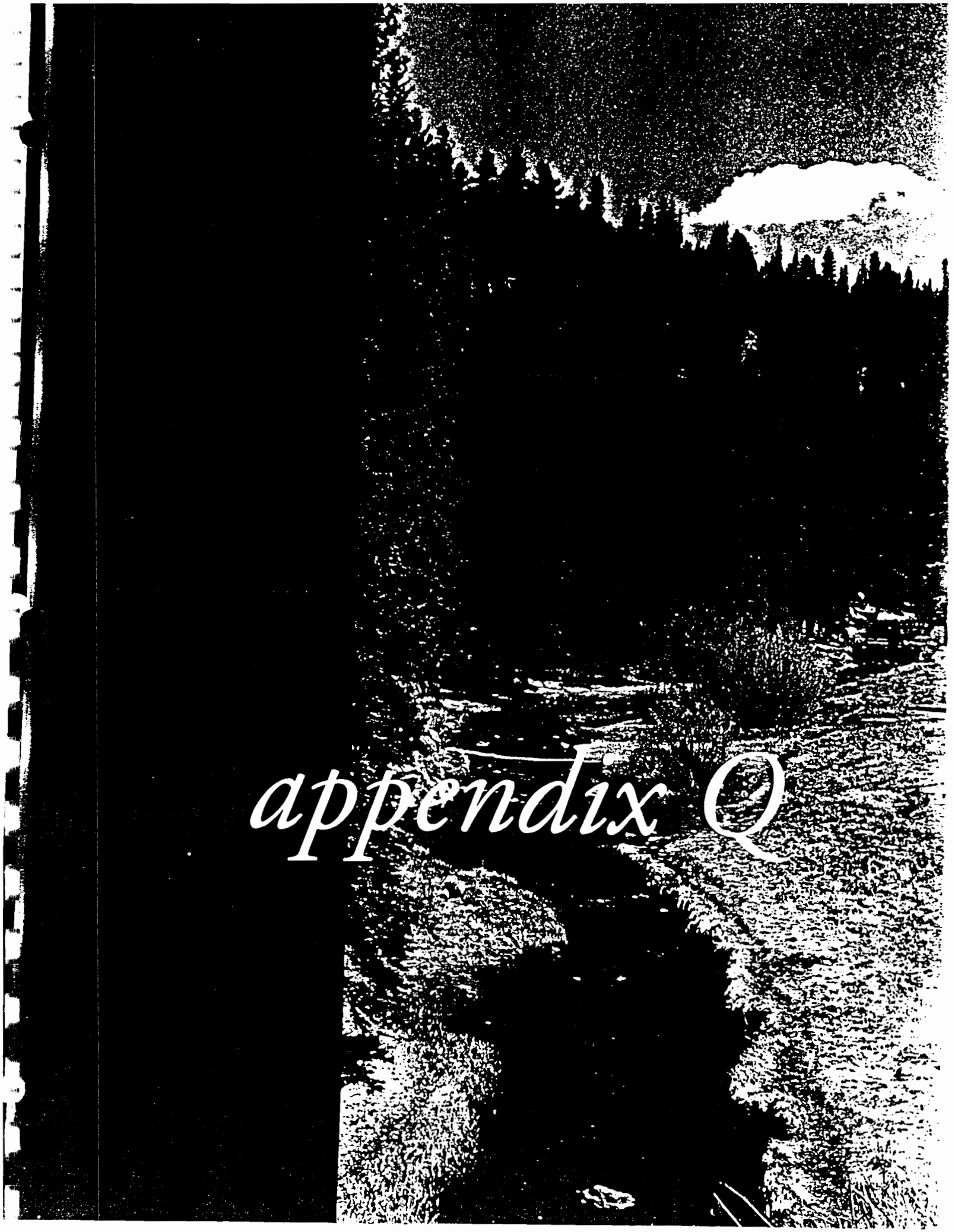

FAST REACTOR CORE TEST BUILDING
TSL-27
TSL-26
LAB
OFFICE BLDG.
TSL-29
TEST PIT
CAUSTIC
TREATING BLDG.
(TSL-41)
TSL-31
To Canyon
PHASE SEPERATOR
PIT
TSL-3
CMR-10 BUILDING
TSL-2
HOLDING TANKS
TSL-4
TSL-5
TSL-6
AIR FILTER
BLDG.
TSL-7
TSL-8
PUMP PIT
TSL-9
TSL-10
CONTAMINATED
LIQUID WASTE
TANKS
TK-3
TK-4
TK-5
TK-6
SLUDGE TANK
TSL-22
TSL-36
25,000 GALLON
TANK
To TA-50
LASL UNDERGROUND LINES,
CONTAMINATED
AND INDUSTRIAL WASTE
TA-35; TENSITE
ENG E 378


TA-2-62
"B" DETAIL OF ACID SEWER LINES
OMEGA 19
Delay line
DETAIL "B"
OMEGA
AREA No 1
DETAIL "A"
E 120+00
E 117+00
E 115+00
E 112+00
E 110+00
N 87+50
N 85+00
N 82+50
N 80+00
N 77+50
N 75+00
N 72+50
Meat Area
AREA No. 2
OMEGA 44
To Omega-1
OMEGA 49
OMEGA 53
Creek bank
Flow line of creek
"A" DETAIL OF ACID SEWER LINES
LASL UNDERGROUND LINES CONTAMINATED AND INDUSTRIAL WASTE
TA-2
ENG. E 378
D 5


See Sheet 7 for detail of this Area
Storage Tanks
Sewage Plant
Note
1. indicates building has been removed.
LASL UNDERGROUND LINES
CONTAMINATED
AND INDUSTRIAL WASTE
TA-21 DP SITE
ENG E-378
D-6


Seepage Pit
Seepage Pit
Seepage Pit
Seepage Pit
Outfall ditch
From DPE
For details of piping in this area see ENG-C-36384,5
Manhole DPW-93
DPW-33 (Removed)
Tanks relocated to DPW-257
DPW-257
DPW-87
DPW-99
DPW-4
DPW-5
DPW-150
LASL UNDERGROUND LINES CONTAMINATED AND INDUSTRIAL WASTE
TA-21 DP-WEST
ENG. E 378


NOTES:
1 REFERENCE DRAWINGS FOR PIPING REMOVED FROM TA-46, ENG-E-1813, ENG-E-2429
2 REFERENCE DRAWINGS FOR PIPING REMOVED FROM TA-1, ENG-C-701, 707, 1007, 3203, 3204, 3206, 6040, 6410, 6406, 6966, ENG-E-96
3 REFERENCE DRAWINGS SHOWING DETAILS OF PIPE REMOVAL INCLUDE ENG-E-1016, 702
4 INDICATES BUILDING HAS BEEN REMOVED
PUEBLO CANYON
HIGH SCHOOL
PARISH HALL
CATHOLIC CHURCH
CANYON ROAD
TRINITY DRIVE
CENTRAL AVENUE
COUNTY BLDG
ASHLEY POND
SIGMA BLDG
BOILER HOUSE
MEDICAL CENTER
E.R.D.A. HEADQUARTERS
OMEGA ROAD
LOS ALAMOS CANYON
EAST JEMEZ RD
BRIDGE
Sewer in place under street. (Ends plugged with conc.)
See Note 1
See Note 2
See Note 3
ULR-17
LASL UNDERGROUND LINE, CONTAMINATED AND INDUSTRIAL WASTE
TA-1; TA-43 AND TA-45
ENG. E 378 D8



appendix Q

1. INSERT ABOVE, CLASSIFICATION, UNCLASSIFIED, OR OFFICIAL USE ONLY

☐ YES

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

OUTGOING TELECOMMUNICATION MESSAGE

(See reverse side for instructions.)

2. USE WHERE REQUIRED

THIS DOCUMENT CONSISTS OF 3 PAGES
NO. OF COPIES, SERIES

PRECEDENCE DESIGNATION (Enter R, P, O, or Z in appropriate

	FOR NORMAL USE		EMERGENCY USE ONLY	
ION:	[X] Routine	[ ] Priority	[ ] Immediate	[ ] FLASH
O:	[R] (4 Hrs.)	[ ] (2 Hrs.)	[ ] (1 Hr.)	[ ] (ASAP)

5. TYPE OF MESSAGE (Enter S, M, T, or B)

[ ] Single Address
[M] Multiple Address
[ ] Title Address
[ ] Broadcast

FOR COMMUNICATION CENTER USE

MESSAGE IDENTIFICATION

NR: DTG: Z

FROM USDOE
J. E. BRATTON
MILITARY APPLICATION
GERMANTOWN, MARYLAND

7. OFFICIAL BUSINESS

(Signature of certifying officer)

8. DATE 4/7/78

TIME) A.M. P.M.

TO H. E. ROSER, USDOE, AL, ALBUQUERQUE, NMEX

H. M. ACNEW, LASL, LOS ALAMOS, NMEX

UNCLASSIFIED/N O N W D/N A R R

COMMUNICATION CENTER ROUTING

SUBJECT: RADIOACTIVE WASTE TREATMENT PLANT IMPROVEMENTS, LASL

0055-2013

PARA WE HAVE REVIEWED THE LASL MARCH 1, 1978, CONSTRUCTION PROJECT DATA SHEET FOR THE ABOVE PROJECT AND DISCUSSED THE PROJECT IN DETAIL WITH REPRESENTATIVES OF ALBUQUERQUE AND LASL ON MARCH 28, 1978. WE ARE INTERESTED IN PROCEEDING WITH MEANINGFUL IMPROVEMENTS TO THE EFFLUENT FROM TA-50 AND TA-21; HOWEVER, MILITARY APPLICATION AND THE OFFICE OF ENVIRONMENTAL SAFETY AGREE THAT THE PROPOSED REDUNDANCY IN THE PROJECT IS NOT JUSTIFIED. THEREFORE, I AM REQUESTING THAT THE PROJECT BE REEVALUATED AND RESUBMITTED.

(CONTINUED)

1978 APR 7 PM 5 08

APR 7 4 35 PM 1978
U.S. DEPT OF ENERGY

BE BRIEF-ELIMINATE UNNECESSARY WORDS

10. ORIGINATOR (On separate lines, Enter Name, Mail Sta., & Tel. Ext.)
Pack/Lep
A-362
x33374

11. CLASSIFIED BY (If different from Originator)

12. DOWNGRADING/DECLASSIFICATION STAMP (If Required)

13. STAMP CLASSIFICATION, UNCLASSIFIED OR OUO

14. RESTRICTED DATA, FRD, or NSI STAMP (If Required)

PARA TWO ACCEPTABLE ALTERNATIVES ARE APPARENT: (1) EVAPORATE EFFLUENT FROM THE EXISTING PLANTS OR (2) UPGRADE THE EXISTING PLANTS AND CONTINUE TO RELEASE UPGRADED EFFLUENT ONSITE. EITHER ALTERNATIVE CAN BE SELECTED FOR FY 1980 FUNDING WITHOUT PREJUDICE TO FUTURE REQUESTS FOR ADDITIONAL SCOPE.

PARA THE OFFICE OF ENVIRONMENTAL SAFETY FINDS THAT THE AVAILABLE DETAILS AND JUSTIFICATION SUPPORT EITHER ALTERNATIVE, BUT NOT BOTH. THEY ALSO FEEL THAT THE JUSTIFICATION PROVIDED TO DATE FAVORS DISPOSAL TO EVAPORATING PONDS FROM WHICH THERE WILL BE NO EFFLUENTS.

PARA MILITARY APPLICATION REQUIRES INFORMATION ON THE LONG-RANGE COST EFFECTIVENESS OF PONDS VERSUS PLANT UPGRADE. IN ORDER TO SUPPORT THE POND OPTION, INFORMATION ON POND OPERATING AND MAINTENANCE COSTS, WASTE DISPOSAL COSTS, AND DECONTAMINATION AND DECOMMISSIONING COSTS WILL BE REQUIRED, TOGETHER WITH COMPARATIVE DETAILS ON PLANT OPERATING AND MAINTENANCE COST INCREASES.

PARA MILITARY APPLICATION IS ALSO CONCERNED ABOUT TRITIUM OXIDE WASTE. OUR RECENT DISCUSSIONS REVEALED THAT TRITIUM OXIDE IN THE 1976 RADIOACTIVE WASTE (WHICH IS UNEFFECTED BY THE TREATMENT PLANTS) WAS APPROXIMATELY 190 CURIES PER YEAR AND THAT A RAPID AND CONTINUING INCREASE IN TRITIUM OXIDE WASTE IS PROJECTED. WE BELIEVE THAT THIS IS AN APPROPRIATE TIME TO INITIATE CONTROLS ON TRITIUM OXIDE WASTE SOURCES, TO PROVIDE SEPARATE COLLECTION AND DISPOSAL MEANS, AND TO TERMINATE THE PRACTICE OF MIXING IT WITH THE LARGE

(CONTINUED)

LIQUID FLOW CONVEYING OTHER RADIOACTIVE WASTES TO THE TREATMENT PLANTS. SEPARATE FACILITIES FOR TRITIUM OXIDE WASTE SHOULD BE CONSIDERED FOR SUBMITTAL AFTER FY 1980. THE PRESENCE OF TRITIUM OXIDE IN THE PRESENT PLANT EFFLUENT SHOULD NOT SIGNIFICANTLY INFLUENCE SELECTION OF THE FY 1980 ALTERNATIVE DISCUSSED ABOVE.

PARA THE OPERATIONAL HEALTH LABORATORY AND OFFICE ADDITIONS SHOULD BE SUBMITTED AND JUSTIFIED AS A SEPARATE FY 1980 PROJECT.

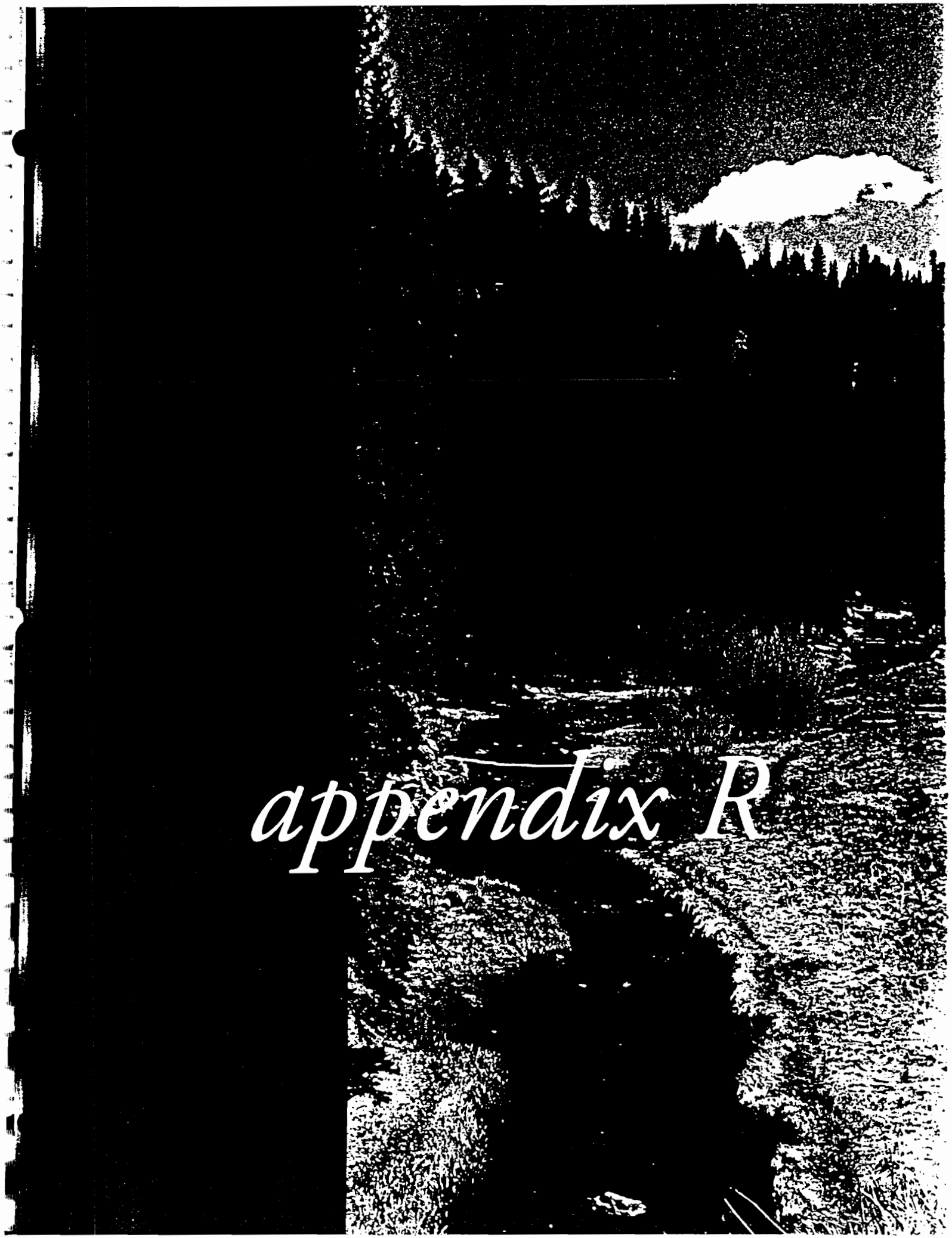
PARA REVISED FY 1980 CONSTRUCTION PROJECT DATA SHEETS SHOULD BE IN THIS OFFICE NO LATER THAN APRIL 19, 1978. MA:FM:PP:32.

WE ARE, HOWEVER, ASSUMING SOME RELIEF IN FY 1983. PENDING AN IN-DEPTH REVIEW, THE FOLLOWING ARE TENTATIVE IMPACTS ON THE PROJECT.

IN FY 1982:

- ALL OLD ACTIVE LINES THAT ARE STILL IN PLACE THAT WOULD HAVE BEEN REMOVED WHEN THE NEW LINES ARE INSTALLED WILL NOT BE REMOVED. ALL PROPOSED REMOVAL ACTIVITIES WILL BE DEFERRED UNTIL FY 1983.
- ALL LINES IN THE TOWNSITE WILL ALSO REMAIN IN PLACE UNTIL FY 1983.
- ALL CURRENT INACTIVE LINES SLATED FOR REMOVAL IN FY 1982 WILL ALSO REMAIN IN PLACE.
- THE DIAMOND/JEMEZ INTERSECTION WILL BE COMPLETED.
- THE LABORATORY AND CONSTRUCTION CONTRACT ON THE INSTALLATION OF THE NEW LINES WILL CONTINUE AND THE LABORATORY CONSTRUCTION TO INSTALL/MONITOR THE NEW LINES WILL CONTINUE IN FY 1982.
- PART OF THE LINE REMOVAL CURRENTLY UNDERWAY WILL CONTINUE. ADDITIONAL URGENT LINE PROBLEMS WILL BE CONTINUED WITH THE USE OF A LIMITED AMOUNT OF CONTINGENCY.
- THE LABORATORY INDICATES THAT THE POSSIBILITY OF SOME RIFs EXISTS AND ANTICIPATES THAT SOME 26 PEOPLE MAY BE RELEASED. THESE ARE PRIMARILY TECHNICIANS AT THE LABORATORY WHO PERFORM MONITORING SERVICES AND ZIA WORKERS WHO PERFORM THE REMOVAL WORK ON OLD LINES.

IN THE ABOVE MODE OF OPERATION, THE POSSIBLE $500K REMAINING WILL BE UTILIZED DURING FY 1982 TO CONTINUE ESSENTIAL REQUIREMENTS. ADDITIONAL INFORMATION WILL BE PROVIDED AFTER OUR DETAILED REVIEW.



appendix R

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

Robert Bradshaw, ENG-DO, LANSL (MS-624)

SOLAR FEDERAL DEMONSTRATION PROGRAM

The Albuquerque Operations Office has been awarded approximately $2.3 million for the subject program. The three Los Alamos projects, along with the other ALO funded projects, are listed on the enclosed attachment.

The funds for these projects will be forthcoming shortly and, therefore, it is requested that you begin immediately to prepare advertisements for the Commerce Business Daily, and a Request for Directive and Design Criteria. For the Solar Evaporation of Low Level Radioactive Waste Water Project, it is intended that LANSL perform the engineering efforts in conjunction with acquired services of outside consultants. The engineering efforts of the two other projects are to be accomplished in the normal manner with A-E firms.

There are going to be some special reporting requirements on these projects which are not identified at the present time. As soon as more information is available on these requests they will be detailed to you.

Please inform this office if you have any questions regarding this correspondence.

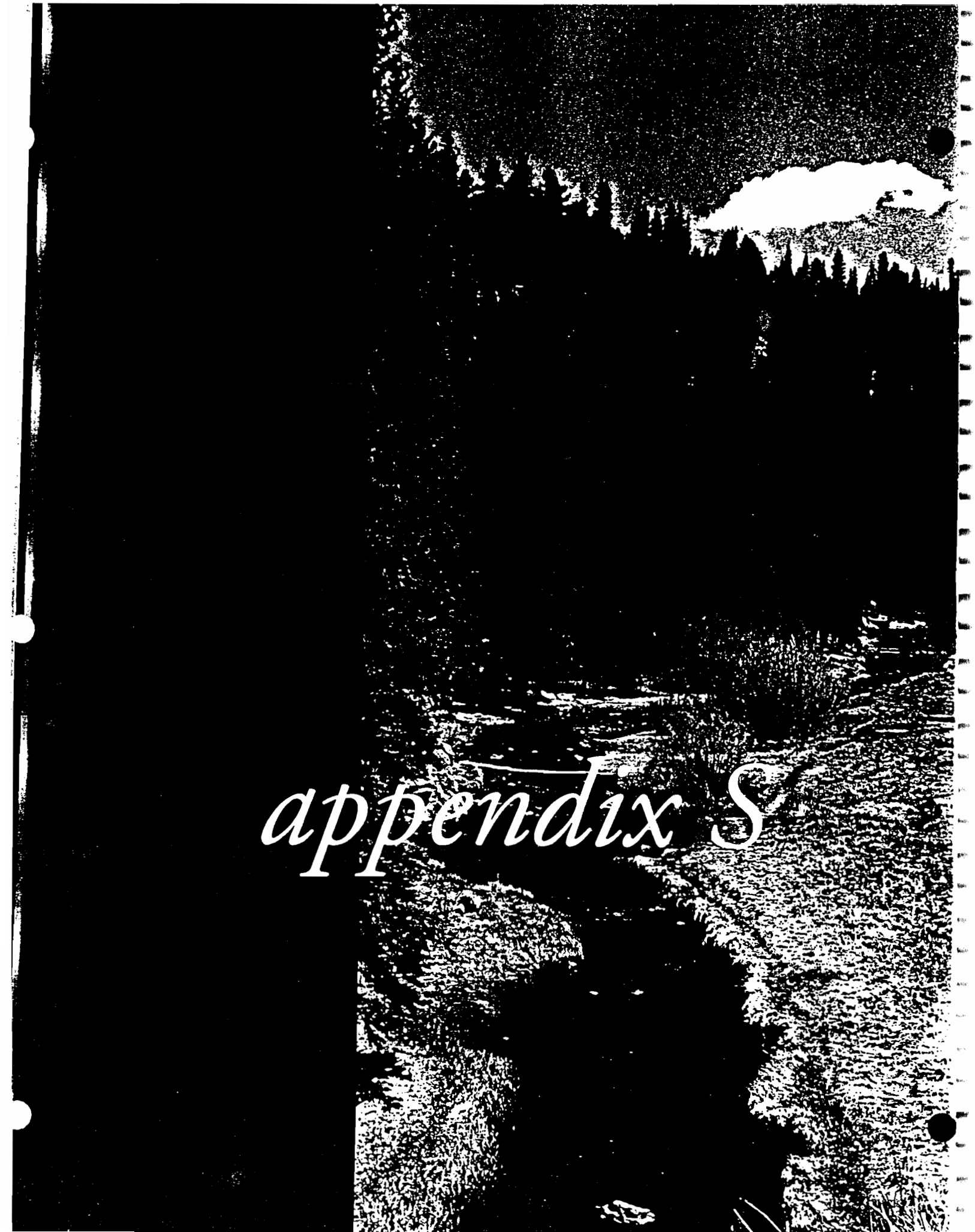
Harry F. Althaus, Chief
Project and Facility Management Branch

LAE:RIF

Encl:
As Stated

cc: L. Warren, FM&C, LAAO, w/encl.
P. McConnell, FMO, LANSL, (MS-124), w/encl.
B. Hunn, WX-4, LANSL, (MS-985), w/encl.
R. Velasco, Zia U/E, w/encl.

LOCATION	TITLE	COST
1. ITRI	Solar Process Hot Water System	$ 382,000
2. Rocky Flats	Wind Energy Systems Test Center Building	178,000
3. Bendix	Solar Heating of Fuel Oil at the Federal Complex	465,405
4. Los Alamos	Solar Retrofit Occupational Health Laboratory	295,500
5. Los Alamos	Solar Evaporation of Low-Level Radioactive Waste Water	696,400
6. Los Alamos	Passive Solar Retrofit of Building SM-200	120,000
7. Mound	Solar Heating Demonstration Project, DS Building, East Addition	182,110
		$2,319,415



appendix S

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545
Telephone Ext: 4301

OFFICE MEMORANDUM

TO G. Kestell, ENG-DO, MS 624 DATE 18 September 1980

THRU : H. S. Jordan, Asst. H-Div Leader, MS 400

THRU : T. K. Keenan, H-7 Group Leader TKK

FROM L. A. Emelity, H-7 LAE

SUBJECT EFFECTS OF TA-55 PROCESS WASTES ON TA-50 OPERATIONS

SYMBOL H7-80-543

MAIL STOP 518

In the 1977 "Title I" plans of Ralph M. Parsons Co. for upgrading waste treatment facilities, room 60 of TA-50, a storage room at that time, was designated to be used for a new 10,000-gal spent regenerant treatment tank. TA-55 was under construction and it was believed that there would be little, if any, ^{241}Am in waste discharges. In late 1978, early 1979, changes in recovery operations at TA-55 resulted in relatively high levels of ^{241}Am in both acid and caustic process waste lines connecting TA-55 and TA-50. ^{241}Am levels in the caustic process waste exceeded 10^9 c/m-L at one time and plans to treat these wastes through the main TA-50 chemical precipitation/ion exchange system had to be revised immediately. Wastes of this level in the open (uncovered) main plant would require covering of all open tanks and placement of all pumps in gloveboxes. Inadequate precautions would result in closing all offices in the building and requiring wearing of masks by operators.

In the meetings called to meet the emergency, the following steps were planned:

1) Proceed immediately to provide a cement mixing operation for the caustic process wastes. Locate the equipment in Rm 60-A.

2) Design a chemical precipitation operation based on use of a package plant to treat both the acid and the caustic process wastes. Proceed with design, purchase of equipment and construction as rapidly as possible. Locate the plant in Rm 60.

3) Upon completion of the plant upgrading line item project, treat the acid and caustic process wastes by evaporation.

University of California
LOS ALAMOS SCIENTIFIC LABORATORY
Los Alamos, New Mexico 87545

TO: G. Kestell
H7-80-543

DATE: 18 September 1980

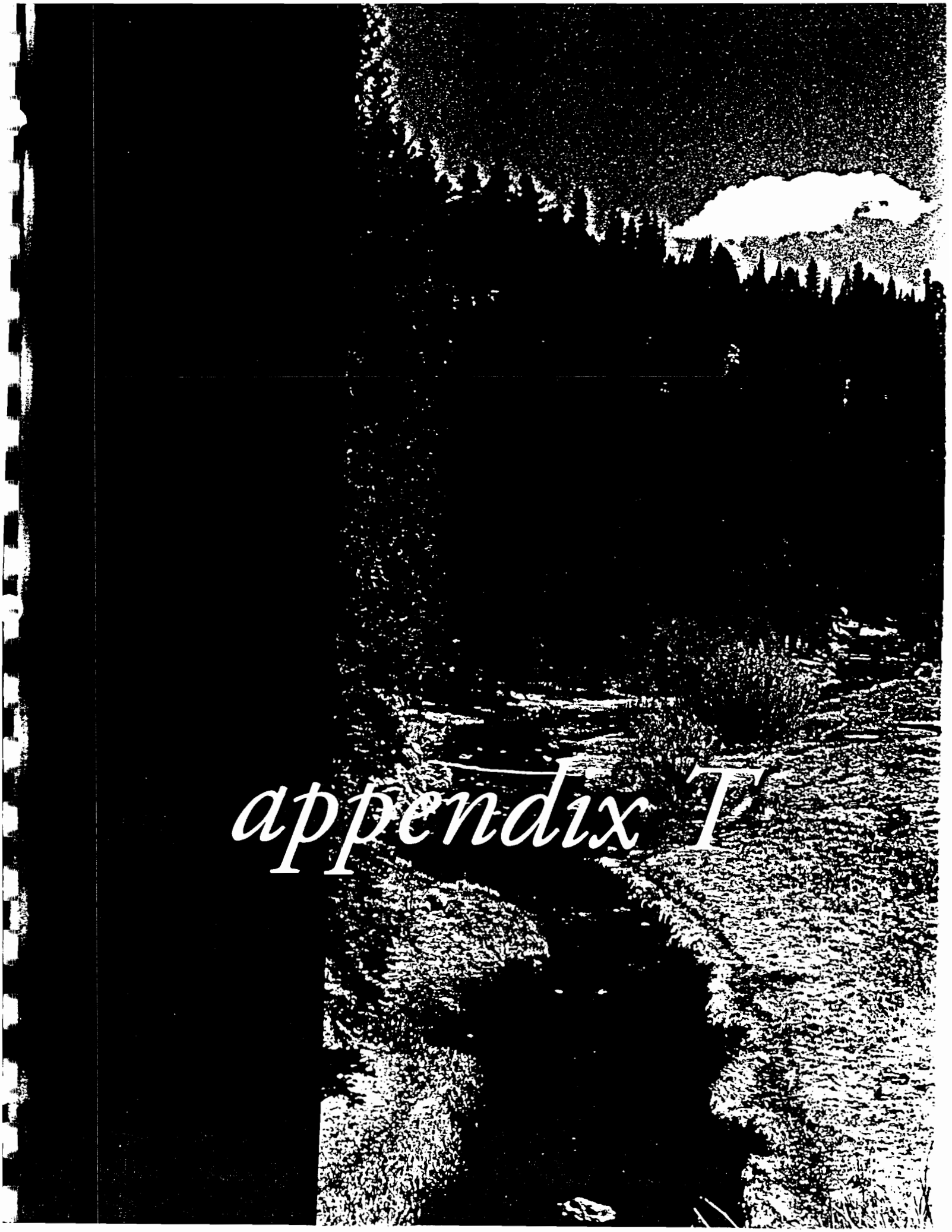
The cement-mixing operation was constructed and placed in operation in a very short time; no additional caustic process wastes were run through the plant. Plans have been completed for installation of the chemical precipitation plant and the package plant plus much of the other required equipment is on hand.

At the 30% completion meeting with Parson's representatives, the conflicting use of Rm 60 was pointed out. A solution that was suggested was to provide a new room for the package plant and to leave the Parson plans unchanged. This is not considered acceptable because of the delay necessary for design, etc. It appears that the best solution is to provide a new room for the spent regenerant tank, the new room to be located contiguous and to the west of RMP Rm #106 and to the south of RMP Rm #109 of a size similar to that of Rm #106. The new room would be of approximately 600 sq ft floor area and would be provided with water, electric power, heating, and HEPA-filtered exhaust air systems. Additional cost to the project, over and above what has been included for installation of the neutralization tank in Rm #60, is estimated to be about $100,000.

We understand that the TA-55 project is complete and that there are still some line item funds available. Because these changes are necessitated entirely by the revised requirements for treatment of TA-55 process wastes, it is recommended that some of these TA-55 funds, if available, be used for design and construction of the new facility. Possible construction of the room immediately, outside of the Upgrading Project contract, should be considered.

LAE:lw

XC: H. S. Jordan, H-DO, MS 400
P. Stanley, H-7, MS 518
J. Buchholz, H-7, MS 518



appendix T

IN REPLY REFER TO:
See TA-21 Disposal P.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Room 115, Federal Building
Santa Fe, New Mexico 87501

August 19, 1969

Mr. C. W. Christenson, Group Leader
Group H-7
Los Alamos Scientific Laboratory
Los Alamos, New Mexico 87544

Subject: Geology at disposal area near Bldg. 257, TA-21.

Dear Chris:

At your request I have compiled data related to the geology at the disposal area near Bldg. 257 at TA-21. Two sketches showing sections of rock units from pit 3 to 27 and pit 2 to 27 are attached.

The lower unit is a light gray moderately welded tuff with an approximate thickness of 100 feet. It is overlain in part by a reworked tuff which is deposited in a channel or low relief cut into the lower light gray tuff unit. The upper unit forming the surface of the mesa at the disposal area is a light brownish gray moderately welded tuff (see sketch 1 and 2).

The unit that is giving us trouble in drilling additional pit is the reworked tuff and pumice which contains cobbles and boulders in the lower part. The reworked tuff was deposited by gaseous forces accompanying the emplacement of the upper ash flow. The cobbles and boulders occur in tabular shapes or if in mass show faceted sides as if deposited by sliding rather than rolling as one would expect with water-laid material. The blast caused by expanding gases accompanying the emplacement of the upper ash flow deposited the larger materials (cobbles and boulders) into areas of low relief in the upper surface of the lower unit. As the upper unit and reworked tuff were emplaced contemporaneously they have cooled as a single unit thus the contact between the two is gradiational and not very distinct. A sharp contact is found between the reworked tuff and lower light gray unit.

AUG
H-7
LOS ALAMOS N.M.

Pit 18 and 26 (sketch 2) were drilled in July 1969. Pit 18 went to a depth of 59 feet (pilot hole 64 ft) passed through the reworked tuff which evidently had few boulders in the lower part. The walls of the pit are rough and irregular in the reworked tuff from a depth of about 14 to 22 feet.

Pit 26 was drilled into a nest of boulders near the base of the reworked tuff and was abandoned at a depth of 15 feet (pilot hole 19 feet). The walls of the pit from the land surface (I was not able to get a ladder long enough to get to the bottom) showed no cobbles or boulders, fairly smooth walls. The only evidence of the reworked unit in the walls was a small patch of reworked sand and tuff at a depth of about 12 feet along the northwest wall of the pit. Evidently the pilot hole (dug with a 3 foot bucket auger to a depth of 19 feet) encountered cobbles and boulders too large to dislodge or pick up thus was probably abandoned several feet above the top of the lower unit of light gray tuff.

Inspection of pits when the rig is setting on the hole to allow access may be of value determining extent of the reworked tuff containing the cobbles and boulders. This would aid in location of future pits. If we can make the inspection for you or if you need additional information please feel free to give us a call.

Sincerely yours,

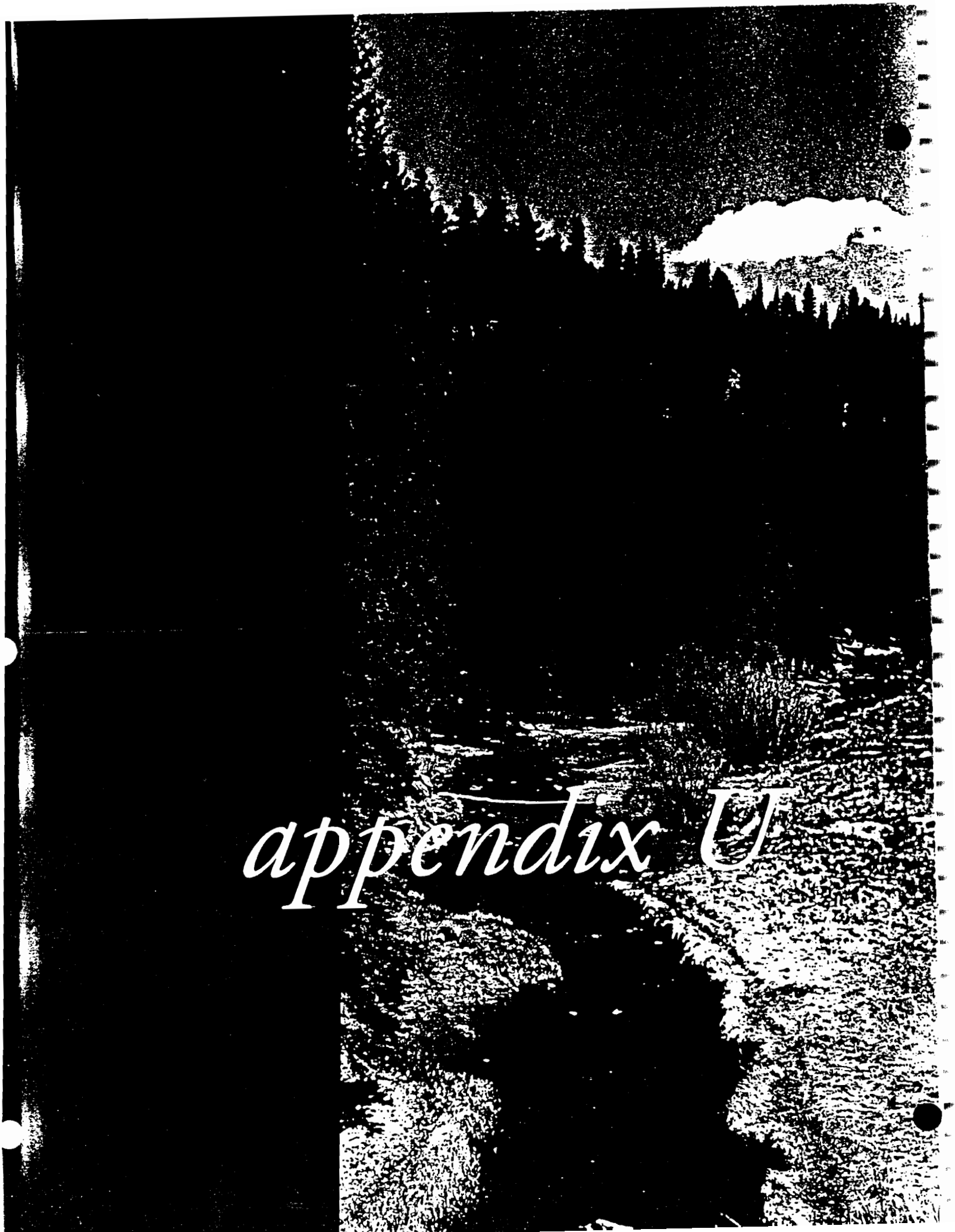
Bill

W. D. Purtymun
Hydrologist

For: W. E. Hale
District Chief, WRD

cc: Wm. Kennedy, H-6, LASL
Los Alamos, N.Mex.

F. C. Koopman, USGS
Albuquerque, N. Mex.



appendix U

Los Alamos
NATIONAL LABORATORY

Financial Operations
FIN-DO
Los Alamos, New Mexico 87545
(505) 667-4107/FAX 665-5061

Date: September 29, 1992
Refer to: FIN-DO:92-903

Frank A. Baca
Director, Budget and
Resources Management Division
Department of Energy
Albuquerque Field Office
P.O. Box 5400
Albuquerque, NM 87185-5400

SUBJECT: WASTE MANAGEMENT FISCAL YEAR (FY) 1996 LINE ITEMS

Dear Mr. Baca:

The attached responds to your Memo of September 24, 1992. Please call Doug Sankey at (505) 667-1270 if you have any questions.

Sincerely,

RButtrey for
Willard E. Lewis
Deputy Finance Officer

WEL:bt

Attachment: a/s

Cy: J. Bellows, Area Manager, LAAO
J. Tegtmeier, EM-7, MS E517
T. Drypolcher, EM-7, MS E517
D. Lee, EM-7, MS E517
M. Patterson, FIN-DO, MS P239
C. Sanchez, FIN-11, MS B244
D. Chavez, FIN-12, MS K498
D. Sankey, FIN-18, MS A107
G. Lujan, FIN-18, MS B244
CRM-4, MS A150
FIN-DO File

SHORT FORM SHEET
Fiscal Year 1996

Operations Office
Albuquerque

Program
Environmental Restoration/
Waste Management

Radioactive Liquid Waste Treatment Facilities Project

Los Alamos National Laboratory
Los Alamos, New Mexico

Design Start:
10/01/95
Construction Complete:
06/01/01

TECC: $134,500,000
Estimate Date: 07/92

1. Mission Requirements:

Nuclear materials programs that contribute to national security through nuclear deterrence, environmental programs that are necessary to correct the many problems caused by past waste management practices, and many R&D programs at the Laboratory require viable and reliable management of radioactive and industrial liquid wastes far into the future. Liquid waste streams from these programs must be collected and treated to remove and concentrate those constituents that are harmful to the public and environment while providing the maximum protection for the worker. The treated effluent stream must meet increasingly stringent discharge requirements and the concentrated harmful constituents must meet increasingly stringent stabilization, inspection and storage requirements. When constructed, a new Radioactive Liquid Waste Treatment Facility will provide needed reliable treatment of radioactive and industrial wastes well into the future while complying fully with increasingly stringent regulatory requirements for protecting employees, the public, and the environment. Complete justification for the project is included in the Mission Need Statement. The proposed project consists of seven related Waste Management construction activities:

- Siting, designing, constructing, and operating a Main Treatment Facility (MTF) that will replace the existing plant located in WM Technical Area (TA) 50. The new facility will be constructed to operate in full compliance with DOE Orders, Environmental Protection Agency (EPA), and New Mexico Environment Department (NMED) requirements,
- Extension of Radioactive Liquid Waste (RLW) pipelines from TA-50 to the MTF and effluent discharge pipelines from the MTF to the existing National Pollutant Discharge Elimination System (NPDES) permitted outfall 051,
- Equipment for sludge solidification,
- Siting, designing, constructing, and operating a Pretreatment Facility (PTF) at TA-50 for pretreating liquid Transuranic (TRU) process wastes from the Plutonium Facility (TA-55) and from WM operations at TA-50 and TA-54.
- Replacement of RLW lines between TA-55 and TA-50
- Decommissioning and decontamination (D&D) of the radioactive liquid waste treatment plant at TA-50 to levels required for reuse, and
- D&D of abandoned waste lines between TA-55 and TA-50.

2. Deficiencies:

Mission.
The Laboratory does not have the viable long range radioactive liquid waste management program that is needed for the Laboratory to reliably meet its mission requirements far into the twenty-first century.

Building (DOE Order 6430.1A and UBC).
The building housing the existing plant operations does not comply with several current requirements in DOE Order 6430.1A, Nuclear Criteria Division 1323, Radioactive Liquid Waste Facilities. The building was constructed to meet the 1963 Uniform Building Code and will not withstand a design basis earthquake or other natural phenomena; lacks safety class stack monitors and primary radiation control; and lacks proper confinement, ventilation, double containment for transfer lines, and inspectable storage tanks.

Public and Environment (DOE Orders 5400 Series, CWA, and RCRA).
The effluent produced, using 40 year old water treatment technology in the existing plant, contains levels of regulated constituents greater than is allowed by the Clean Water Act and by DOE Order 5400.5. This may cause higher than acceptable exposures to the public and wildlife. Underground tanks and pipes are in danger of leaking and contaminating the environment. Doors and windows provide numerous pathways for contaminated unmonitored and improperly filtered air to reach uncontrolled areas.

Workers (DOE Order 5480.11, OSHA, and RCRA).
The potential for unnecessary chemical and radiation exposures to workers exists from open and poorly ventilated treatment and storage tanks, lack of air locks to control movement of air between different control zones, and commingling of workers wearing protective clothing and those wearing normal work clothing in hallways and change rooms.

3. Consequences:

Approximately ten years will be required to design, construct and commission the proposed facility. The facility could be shut down or continue limited operation under a Federal Facilities Compliance Agreement (FFCA) because of DOE or EPA noncompliance. In either instance the Laboratory would be unable to fulfill its mission. Prolonged outages and problems related to working in contaminated areas, both associated with upgrading the existing plant, would be overly expensive and would severely interrupt management of radioactive and industrial liquid wastes needed for the Laboratory to meet its nuclear materials and environmental program missions.

4. Total Estimated Capital Cost (TECC): FY '00 dollars — $ 134,500,000

a. Engineering (Titles I through III)	$ 23,000,000	
b. Land & Land Rights	$ 0	
c. Construction	$ 60,200,000	
d. Equipment	$ 17,200,000	
e. Decontamination & Removal (FY '92 dollars)	$ 10,600,000	
f. Contingency	$ 23,500,000	

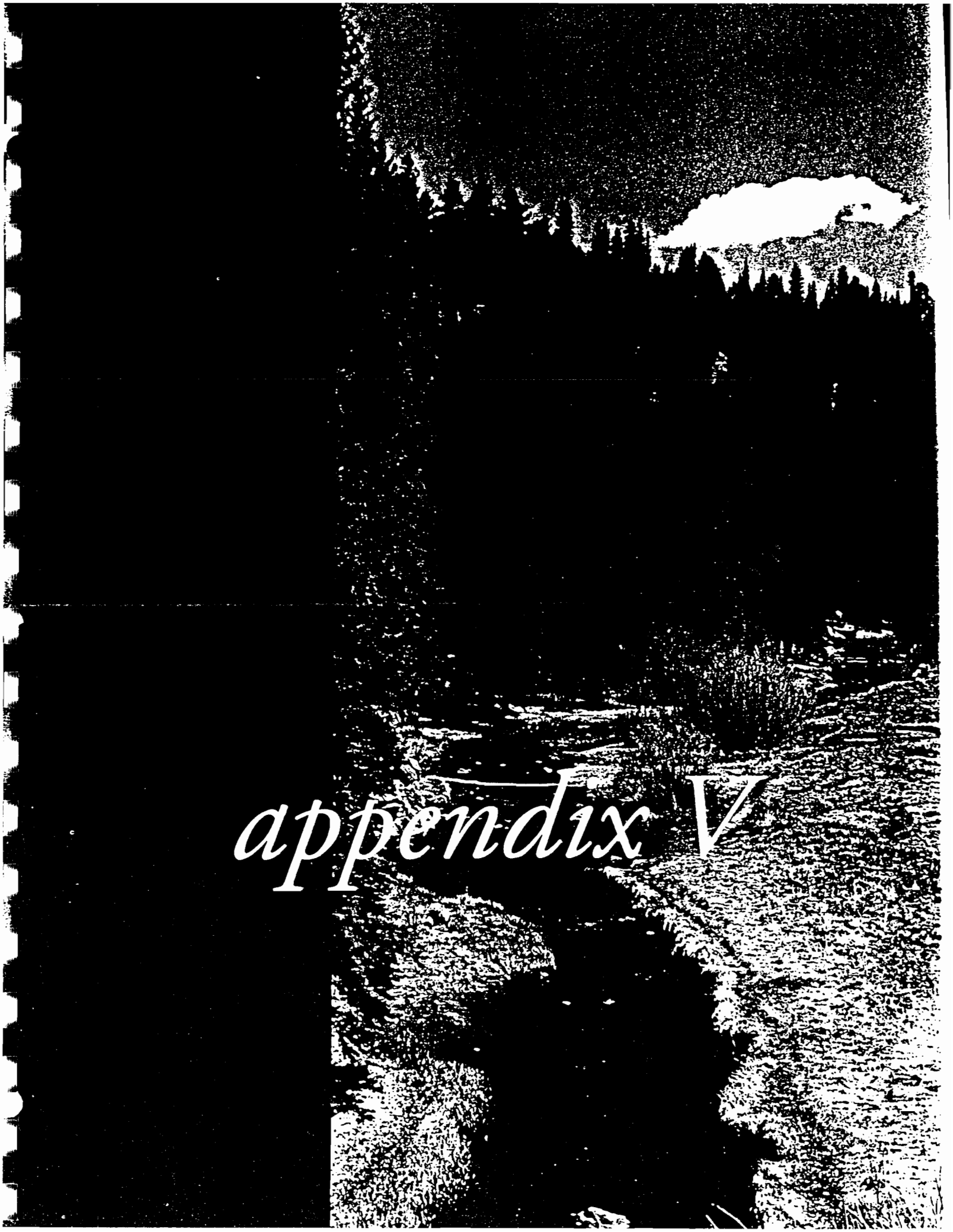
5. Other Costs: — $ 26,700,000

a. Engineering and Design Activities	$ 3,800,000	
b. Project Management Activities	$ 2,800,000	
c. Safety Related Activities	$ 1,100,000	
d. Environmental Documentation/Approvals	$ 3,200,000	
e. Los Alamos Project Support (Nondedicated)	$ 8,200,000	
f. Operations	$ 7,500,000	

6. Total Project Cost (TPC): — $ 161,200,000

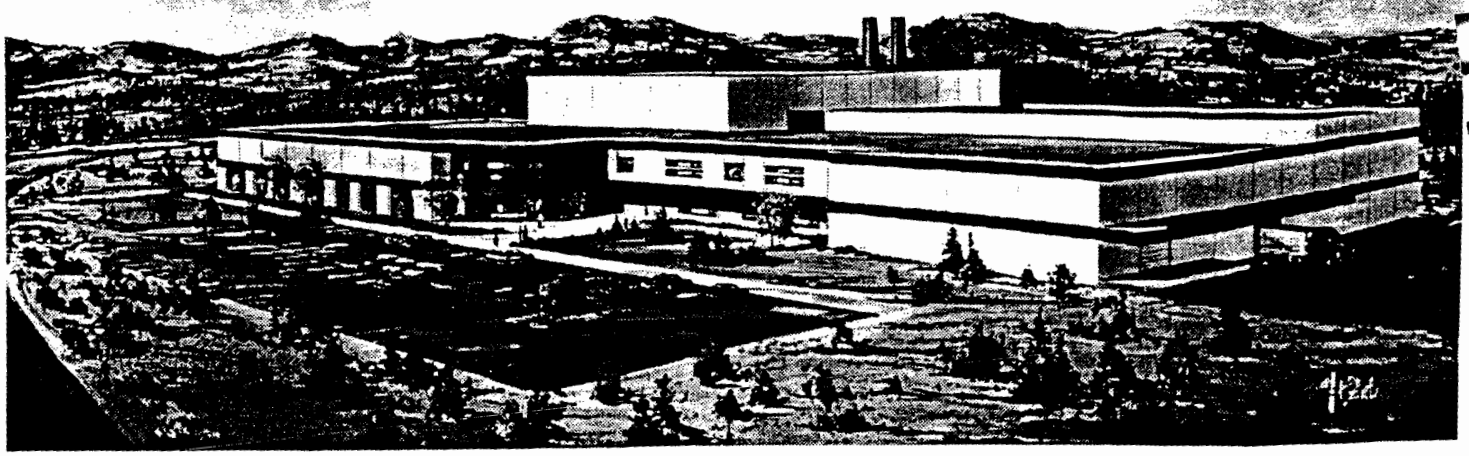
7. Tentative Schedule:

	Start	End
KD-0	03/93	03/93
Conceptual Design	04/93	12/93
KD-1	06/94	06/94
Title I	10/95	09/96
KD-2	09/96	09/96
Title II	10/96	06/98
KD-3	09/98	09/98
Construction	04/99	06/01
Start-up/ORR	06/01	04/02
KD-4	07/02	07/02
Operation	07/02	-----
D & D Old Facility	10/02	09/03
ES&H	10/91	-----



appendix V

Radioactive Liquid Waste Treatment Facility Project at Los Alamos National Laboratory



Background

The existing radioactive liquid waste treatment plant at the Waste Management Site has exceeded its design life. Therefore, the Laboratory lacks the long-range capability for reliably treating radioactive liquid waste that is required to meet current and projected mission requirements. The existing facility does not comply with current design requirements, including the following:

- it lacks proper confinement, adequate ventilation, and double-containment for transfer lines and storage tanks;
- it will not withstand a design-basis earthquake or extreme winds; and
- although the plant meets current NMED discharge requirements, process equipment cannot treat waste to meet the expected more stringent discharge requirements.

Deficiencies include the following:

- potential for chemical and radiation exposures to workers from open tanks and poor ventilation around treatment and storage tanks;
- underground tanks and pipes are in danger of leaking nd contaminating the environment;
- effluent produced from this facility contains dioactive constituents greater than those established in uidelines in DOE Order 5400.5, "Radiation Protection the Public and Environment";
- lack of airlocks to control movement of air between ferent control zones;
- workers wearing protective clothing and those wearing normal work clothing must commingle in hallways and change rooms; and
- lack of safety-class stack monitors.

The existing facility could be shut down at any time because of regulatory violations; shutdown would disrupt the following Laboratory activities:

- nuclear materials processing,
- R&D in support of the DOE complex,
- materials R&D,
- waste management and environmental restoration, and
- analytical chemistry and medical isotope production.

The Proposed New Radioactive Liquid Waste Treatment Facility (RLWTF) Project

A project office has been established at the Laboratory and is staffed with personnel from the Waste Management Group and Facilities Engineering. The office is responsible for planning, engineering, procurement, and construction.

The proposed RLWTF project will ensure that radioactive liquid waste will be treated with the best available technology to comply with environmental laws and regulations that support nuclear materials programs that in turn contribute to national security, environmental programs to clean up legacy wastes, and R&D programs at the Laboratory.

The treated effluent stream from the proposed new facility must meet increasingly stringent requirements for discharge, stabilization, inspection, and storage. When constructed, this facility will provide reliable treatment of radioactive and industrial wastes well into the future, comply with regulatory requirements, and protect the health and safety of employees, the public, and the environment.

The proposed RLWTF project consists of six related activities in waste management.

1. Siting, designing, constructing, and operating a new RLWTF that will replace the aging facility at the waste management site.

2. Extending the incoming pipelines for radioactive liquid waste to the RLWTF and extending the pipelines for effluent discharge from the RLWTF to the existing outfall already permitted under the Clean Water Act.

3. Siting, designing, and constructing pretreatment facilities for liquid transuranic process wastes from the plutonium facility and waste management operations.

4. Replacing radioactive liquid waste lines between the RLWTF and the plutonium facility.

5. Placing the existing plant in a safe-shutdown configuration for turnover to EM-40 for decontamination and decommissioning within that program as described in appropriate DOE guidance.

6. Decontaminating and decommissioning the abandoned waste lines between the existing treatment facility and the plutonium facility.

Current Project Status

In support of the proposed project, the following tasks have been completed as of September 1993:

- listing the RLWTF as a project in the Laboratory site development plan,
- preparation of the DOE environmental checklist,
- development of planning costs and schedules,
- submittal of a Short Form Data Sheet,
- preparation of the Mission Need Statement,
- inclusion of the RLWTF as a project in the Capital Assets Management Process (CAMP),
- preparation of a Conceptual Design Authorization Request (CDAR) plan,
- preparation of the Preconceptual Functional and Operating Requirements and Conceptual Design Criteria,
- identification of waste minimization opportunities,
- preparation of the Future Waste Streams Study,
- preparation of the Collection Systems Study (Phase I), and
- draft Conceptual Design Plan.

Funding and Schedule for the RLWTF Project

Preconceptual planning estimates for the RLWTF project that have determined costs, estimated to be greater than $100 million, classify the project as a major systems acquisition according to DOE Order 4700.1, "Project Management System."

Approximately $25 million of operating funds will be required for planning, conceptual design, NEPA documentation, safety analysis, environmental permits, and related startup activities.

Approval of Key Decision Zero will allow alternative solutions to RLW management to be evaluated and the best option selected. The baseline (scope, schedule, and cost) will be presented at Key Decision One. After Key Decision One, DOE will request that the project be funded by Congress.

Best Available Technology for the RLWTF

A review and investigation of the best available technology to be employed in the RLWTF is in place. Bench-scale tests will be completed to confirm candidate processes and sensitivity to contaminants in the waste streams. A systems engineering methodology is being employed to acquire the information necessary to comply with the regulations and ensure that dependable and cost-effective processes are incorporated in the project design for the RLWTF.

Environmental Impact Statement

The Laboratory and the DOE are developing a strategy for a project-specific environmental impact statement (EIS). The EIS would be coordinated with the EIS for environmental management for the entire DOE complex and the Laboratory-wide EIS.

Environment, Safety, and Health

The overall objective for environment, safety, and health is to ensure that the facility is constructed, operated, and ultimately decommissioned without undue risk to the workers, the public, or the environment. We will pursue this objective with a risk management system that ensures compliance with applicable state and federal requirements.

Safety analyses will be prepared to ensure compliance with these requirements and to achieve appropriate risk reduction in the design, construction, and operation of the facility.

Teams from the Health and Safety Division and the Environmental Management Division provide professional support. Team members are expert in health physics, industrial hygiene, safety and risk assessment, waste and environmental management, and construction safety.

The project is designed to minimize any effects on the environment by decreasing the amount of radioactive waste generated by treatment and by treating the waste with the best available technology.

Operations

Operations in the plant will include on-line real-time monitoring for contaminants and segregation and characterization tanks.

The following table summarizes proposed waste management steps.

Stage	Description
1	Establish waste acceptance criteria.
2	Liquid wastes from the generators arrive at the plant from the various sites.
3	The wastes are classified and stored.
4	Transuranic radionuclides are removed from the liquid waste.
5	Dissolved solids are removed from the radioactive liquid waste.
6	The liquid effluent receives a final purification ("polishing") and is analyzed.
7	The solid wastes are: • stabilized for storage before eventual shipment to the Waste Isolation Pilot Project (WIPP) or • disposed of if they are low-level radioactive.
8	The treated liquid wastes are disposed of by • evaporation, • discharge of the treated effluent to Mortandad Canyon, or • land disposal.