1

UNITED STATES ATOMIC ENERGY COMMISSION

LRL-120

WASTE DISPOSAL — DECONTAMINATION AND
DECONTAMINATION LAUNDRY FACILITIES

By
W. A. Clark

May 1954

Livermore Research Laboratory
California Research and Development Company
Livermore, California

Technical Information Service, Oak Ridge, Tennessee

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Subject Category, CHEMISTRY.

Work performed under Contract No. AT(11-1)-74.

Issuance of this document does not constitute authority for declassification of classified material of the same or similar content and title by the same author.

This report has been reproduced with minimum alteration directly from manuscript provided the Technical Information Service in an effort to expedite availability of the information contained herein.

Reproduction of this information is encouraged by the United States Atomic Energy Commission. Arrangements for your republication of this document in whole or in part should be made with the author and the organization he represents.

Printed in USA, Price 25 cents. Available from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

Operated by
California Research and Development Company
for the U. S. Atomic Energy Commission

IRL-120

WASTE DISPOSAL - DECONTAMINATION AND
DECONTAMINATION LAUNDRY FACILITIES

By W. A. Clark

May 1954

TABLE OF CONTENTS

	<u>Page No.</u>
ABSTRACT	5
INTRODUCTION	6
BUILDING FACILITIES	6
OPERATIONS -- WASTE DISPOSAL	9
OPERATIONS -- DECONTAMINATION LAUNDRY	13
OPERATIONS -- DECONTAMINATION	16
ESTIMATED COSTS	20
CONCLUSION	25

LIST OF FIGURES

<u>Fig. No.</u>	<u>Title</u>	<u>Page No.</u>
1	California Research and Development Company Waste Disposal, Decontamination, and Decontamination Laundry Facilities	7
2	Original Navy Floor Plan	8
3	Decontamination Facility Floor Plan	8
4	Component Parts of the Liquid Waste Container	10
5	Barrel Lifter and Waste Drum	12
	Weighing Drums	12
	Decontamination Laundry	14
8	Retention Tanks	15
9	Decontamination Glove Box	17
10	Decontamination Box Exhaust Fans	18
11	Part of Decontamination Glove Box Showing Two Center Cells	19
12	View Through Decontamination Box With Connecting Doors Raised	19
13	Decontaminant Control Valves	21
14	Contaminated Article Entering Decontamination Glove Box	22
15	Dis-Assembly Cell	23
16	Decontamination Cell	24

ABSTRACT

This report describes the waste disposal, decontamination, and decontamination laundry facilities at the Livermore Research Laboratory, operated for the U. S. Atomic Energy Commission by the California Research & Development Company. Photographs of the facilities and some of the procedures are included.

WASTE DISPOSAL - DECONTAMINATION AND DECONTAMINATION LAUNDRY FACILITIES

INTRODUCTION

The design of waste disposal, decontamination and laundry facilities at the Livermore Research Laboratory was complicated by the following factors:

- (1) A rapidly changing program, both in the amounts and types of materials involved made planning difficult.
- (2) No burial, cribbing or underground storage of wastes could be allowed because of the high water table in the valley, and
- (3) Economics dictated the use of pre-existing buildings left from the war when the plant site was a U. S. Navy secondary flight training base.

The actual volume of waste and materials to be decontaminated was expected to peak after about two years of operation; then the volume would decrease until the volume to be disposed would be only a few gallons a month. This type of operation required an extremely flexible disposal and decontamination unit capable of being used continuously or only occasionally and capable of expanding rapidly under emergencies. Lack of underground burial facilities necessitated transportation of the waste by truck to the Naval Shipyard, Hunters Point, San Francisco. Small shielded leakproof disposal packages were required for ease of handling and safety in the event of a highway accident.

The disposal system chosen was a barreling plant that could use commercial pre-mix facilities under heavy loads or a small cement mixer during sporadic operation.

The design and operation of the final units are described.

BUILDING FACILITIES

The engine test building for the former facility lent itself readily to re-habilitation as the laboratory waste disposal and decontamination facility. The building, of concrete construction, is 59 ft by 37 ft and has a 12 foot ceiling. (See Fig 1.)

The original floor plan, (see Fig. 2), was adaptable to present needs with minimum of expense and labor, (see Fig. 3). The former control room and the south storage room were utilized as supply storage and "hot" storage rooms. Engine test cell No. 2 was divided into a small office and a decontamination room, engine test cell No. 1 was modified for a decontamination laundry and the cement mixing facilities. Waste disposal facilities were located outside the south end of the building, the aggregate and cement storage

7

FIG. 1 - CALIFORNIA RESEARCH AND DEVELOPMENT COMPANY WASTE DISPOSAL, DECONTAMINATION, AND DECONTAMINATION LAUNDRY FACILITIES

FIG. 2 - ORIGINAL NAVY FLOOR PLAN

FIG. 3 - DECONTAMINATION FACILITY FLOOR PLAN

space being recessed into the east side. Rest room facilities were added to the building in such a way that each half, i. e. , the decontamination room and the laundry room, were separate units requiring no cross access. A system of sampling (retention) tanks was added in keeping with the CR&D policy of sampling all suspected waste before discharge into a sanitary sewer system. These facilities handle both radioactive and hazardous chemical waste, and are sufficiently flexible to economically handle from one to one hundred barrels of waste per day.

OPERATIONS

Waste Disposal

Waste is gathered at the various sites of the laboratory in two types of standard disposable containers designed for this purpose.

Dry waste is collected in 26-gal galvanized iron cans in which a four ply paper cement sack has been placed as a primary container. This can is painted with radiation warning colors, (Roman violet and light blue), and is equipped with a tight fitting cover. When full, the open top of the sack is sealed with masking tape. When removed from the laboratory for transporting to the Waste Disposal Facility the entire can is taken, being replaced with a clean empty can. At the disposal facility the paper sack is removed from the can and placed in a 55-gal drum. The can is then monitored and, if not contaminated, returned to the laboratory. If contaminated, the can is either decontaminated or disposed of, depending on the type and quantity of the contamination.

Liquid waste is collected in a 5-gal steel paint can containing a polyethylene bag liner. The sealed top of the can is furnished with a Flex-Spout opening for admitting the liquid waste. The component parts of this container are purchased separately from various manufacturers and are assembled at the Waste Disposal Facility, (see Fig. 4).

At the Waste Disposal Facility, 55-gal steel oil drums with the tops removed and four inches of concrete poured in the bottoms are used for both storage and disposal. Metal covers, painted with radiation warning colors, are placed over the drums while they are being used for storage. When enough drums, (approximately 20), are filled with waste, they are capped and sealed with concrete. Each drum is filled according to the chart in Table I so as to meet the average density requirements of 70 pounds per cubic foot, thus assuring the drums sinking to a sufficient depth when they are disposed of at sea. Drums are marked with paint for identification purposes and stored at the facility pending final disposal.

FIG. 4 - COMPONENT PARTS OF THE LIQUID WASTE CONTAINER

TABLE I

Drum Filling Calculations		
Gallons in a cubic foot	7.5	
Cu ft per 55-gal drum	7.3	
Average density of concrete	145 lbs/cu ft	
Cu ft concrete per drum	Avg density of drum per cu ft	Space left for waste (cu ft)
4.3	85.3	3.0
4.0	79.4	3.3
3.7	73.4	3.6
3.5	69.4	3.8
3.3	65.4	4.0
3.0	59.5	4.3

According to these calculations 3.5 cu ft of concrete would be sufficient to meet average density requirements of 70 lbs/cu ft. This figure is exclusive of the weight of the waste, so actually the density requirement could be achieved using something less than 3.5 cu ft of concrete.

Heavy barrels are handled with the help of a portable barrel lifter, designed and built at CR&D, (see Fig. 5). Contaminated articles which cannot be barreled because of size are disposed of in concrete blocks, using scrap metal for reinforcement. A plywood form of the necessary dimensions is built and at least six inches of concrete poured in the bottom. The contaminated article is then placed in the form which in turn is filled with concrete to meet the specifications listed in Table I. Three-quarter inch wire rope securely embedded in the concrete is used as a lifting eye.

On instruction from the San Francisco AEC Field Office, the drums of waste are transported by CR&D trucks to the U. S. Naval Radiological Defense Laboratory at the Naval Shipyard, Hunters Point in San Francisco. There are no state or local regulations specifically applicable to movement of radioactive waste providing the San Francisco Bay bridges are not transversed, therefore, the waste is trucked around the bay rather than across it.

In lieu of specific statutory standards the general rules applicable to the conduct of other hazardous activities are followed. The trucks are marked on each side and the rear with signs reading "DANGER-KEEP CLEAR" in six-inch orange letters on a black background. A member of the Safety Group, familiar with current ICC regulations accompanies the trucks during the entire trip. It is his responsibility to keep a log identifying any persons who come into close proximity to the vehicles for any considerable periods of time, (wreck, breakdown, etc.).

FIG. 5 - BARREL LIFTER AND WASTE DRUM

FIG. 6 - WEIGHING DRUMS

At the U. S. N. R. D. L. the drums of waste are loaded, by gantry crane, on a Navy barge, for disposal at sea. When unloading of the trucks is completed they are thoroughly monitored before being allowed to return to CR&D.

Decontamination Laundry

The Livermore Research Laboratory Decontamination Laundry was established to wash any protective clothing that has been, or may possibly be contaminated with radioactive materials.

The laundry (see Fig. 7) equipment includes a 100-gal water heater, one 25 lb capacity washer, one extractor, and two tumble action driers, all of which, with the exception of the extractor and the washer, operate on low pressure "bottled" gas, i. e., "Flamo". Two 1000-gal retention tanks are utilized to retain the laundry water pending analysis by the Analytical Laboratory to determine whether or not the level of activity is low enough to be admitted to the sewer, (see Fig. 8). The actual work of laundering is done by the CR&D labor pool personnel under the supervision of the Safety Group.

Laundry is collected, at the various buildings, in large canvas laundry bags, which are mounted on appropriate frames and conveniently placed in the laboratories. A weekly pick-up and delivery schedule is maintained.

On delivery to the laundry facility, all articles are thoroughly monitored by a member of the Safety Group before being washed and are placed in one of three categories: (1) No activity detectable; (2) Low-level contaminated articles, that is, all articles exhibiting 5 mr/hr or less beta-gamma or 500c/m/100cm² or less alpha; and (3) High-level contaminated articles, that is, all articles exhibiting greater than 5 mr/hr beta-gamma or 500 c/m/100cm² alpha.

Articles determined to be non-active are laundered with no further controls.

All low-level contaminated articles are washed, using standard mild detergents, and rough dried, the wash water being retained pending the above mentioned analysis. After washing, the articles are again monitored and, if any contamination remains, they are re-washed. In the event any article cannot be decontaminated it is disposed of as active waste.

High-level contaminated articles are soaked in a mild decontamination solution, (a 3 percent solution of citric acid), two 55-gal steel drums painted with Amercoat #33 being used as soaking vats. After soaking, the articles are removed from the vats, allowed to dry, and carefully

14

FIG. 7 - DECONTAMINATION LAUNDRY

15

FIG. 8 - RETENTION TANKS

monitored. If the article has dropped below the limit for low-level laundry, it is laundered as such, if not, it is disposed of as active waste.

Decontamination

Decontamination is handled at the California Research & Development Company in one of three ways: (1) Permanent or stationary equipment is decontaminated in place by the line organization with the assistance and advice of the Safety Group; (2) Portable equipment on which the activity is slight, or is well controlled and the cleaning operation does not require a closed system, an open bench and hood, located in the Decontamination Facility, are used; and (3) Any object that is contaminated with a significant amount of radioactivity is cleaned in a Decontamination Glove Box, (see Fig. 9). (See also Figs. 11 and 12 for additional details.)

The Decontamination Glove Box was designed by the Safety Group of the California Research & Development Company and built by a commercial concern. It is 21 ft long and has cells 4 ft - 3-1/2 inches wide and 4 ft high. The box consists of four of these cells and a loading platform 3 ft long. The two end compartments are 3 ft 4-inches long and are used as air locks. One center compartment, used for dis-assembling, is 4 ft long, the other, used for decontaminating, is 5 ft 4 inches long. Each compartment is fitted with a series of glove ports, (6 inches), in such a way that, using 27-inch neoprene gloves, complete accessibility to any part of the cell is possible.

A negative air pressure is maintained in the box by utilizing an Ilg type 10P, volume fan which exhausts approximately 100 cfm. Two such fans are mounted on the roof of the building. These fans, controlled by Mercoid switches, are installed for single operation in such a way that, should one fan fail, the other will take over immediately, thereby maintaining a constant flow, (negative pressure), in each cell of the box of approximately 25 cfm, (see Fig. 10).

Air enters the cells at the bottom of the box through AA type glass fiber filters and is exhausted from the top of each cell through an 8 in. x 8 in. x 5-7/8 in. CWS 6 equivalent filter. The effluent air then passes through a header pipe in which a 24 in. x 24 in. x 5-7/8 in. CWS 6 equivalent filter is mounted, and is then exhausted to the atmosphere through a 10 ft stack. Air leaving the stack is monitored by means of a Millipore-type air sampler mounted just below the blowers.

"Kim-Pac" absorbent paper is placed on the floor of all four cells and is changed whenever necessary. A large steel catch pan is used in the decontamination cell, (see Fig. 16). Prior to use, all necessary equipment, i.e., shelves, saw horses, jigs, tools, etc., is placed in the center cells. Distilled water and the principal decontaminant, (nitric acid), are placed on top of the decontamination cell and connected with Tygon tubing, to two stainless steel, solenoid controlled valves. These valves, also located on top of

FIG. 9 - DECONTAMINATION GLOVE BOX

FIG. 10 - DECONTAMINATION BOX EXHAUST FANS

FIG. 11 - PART OF DECONTAMINATION GLOVE BOX SHOWING TWO CENTER CELLS

FIG. 12 - VIEW THROUGH DECONTAMINATION BOX WITH CONNECTING DOORS RAISED

the decontamination cell, admit the water and the acid solution to the cell. Both valves are controlled by a double foot switch, placed so as to be within easy reach of the operator at all times, (see Fig. 13).

A small dolly is kept on the loading platform and is used for carrying heavy articles through the various compartments of the box. Articles to be decontaminated are placed on the dolly, (see Fig. 14), and enter the box through the airlock, then proceed to the dis-assembly cell, (see Fig. 15). If dis-assembling is possible, it is completely done in this cell, the various parts being passed into the decontamination cell for processing. If dis-assembly is not possible the entire article is rolled, on the dolly, into the decontamination cell, (see Fig. 16).

After the decontamination process is completed, the article, or the parts, as the case may be, are passed into the exit airlock, thoroughly monitored and if clean, removed and re-assembled. If the article is not completely decontaminated, it is passed back into the decontamination cell and re-processed.

When decontamination is completed, solutions and other waste are placed in proper disposable containers, removed through the exit air-lock, and disposed of as active waste.

A sump pump is installed in the slightly sloping floor of the room housing the Decontamination Glove Box so that, in an emergency, the entire floor area can be safely washed down. All standard safety devices, i.e., emergency shower, eye wash fountain, etc., are provided in the area. Of course all drainage is directed to the retention tanks mentioned on page 13.

COST SUMMARY

Facility Cost

Rehabilitation of building including paving, fencing, tanks, etc.	\$20,000
Laundry equipment	7,500
Decontamination equipment	
Glove box	8,740
Other	4,000
Waste Disposal equipment	2,500
Total	<u>\$42,740</u>

Waste Disposal Operating Cost (Estimate)

Liquid waste @ 9 gal/drum	\$ 1.50/gal
	or 13.50/drum
Solid waste @ 3.5 cu ft/drum	\$ 3.10/cu ft
and 5 lb/cu ft bulk density	or 10.85/drum

FIG. 13 - DECONTAMINANT CONTROL VALVES

FIG. 14 - CONTAMINATED ARTICLE ENTERING DECONTAMINATION
GLOVE BOX

FIG. 15 - DISASSEMBLY CELL

FIG. 16 - DECONTAMINATION CELL

CONCLUSION

Waste disposal facilities at the California Research & Development Company were constructed to efficiently and economically handle from 10 to several hundred barrels of waste per month.

The Decontamination Glove Box has solved numerous problems inherent to the decontamination of many types of surfaces. It is easily operated and being a closed system, adequately confines acid vapors and activity. It is also a very flexible system and in case it becomes too highly contaminated for further use a new section can be fabricated. By means of the dividing doors, the old section can be closed off and removed. The new section can then be installed with a minimum of lost time.

The Decontamination Laundry will handle 25 lbs of dry laundry per hour and is efficiently operated by one man.

Housing all three facilities in the same building has tended to decrease the required amount of supervision and upkeep.

1-25