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HAZARDOUS-WASTE OPERATIONAL PLAN FOR SITE 300

H. S. Roberts

February 12, 1982

Lawrence
Livermore
Laboratory

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HAZARDOUS-WASTE OPERATIONAL PLAN FOR SITE 300

R. S. Roberts
Toxic Waste Control Group

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OPERATIONAL PLAN FOR SITE 300

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ABSTRACT

This plan outlines the procedures and operations used at LLNL's Site 300 for the management of the hazardous waste generated. This waste consists primarily of depleted uranium (a by-product of U-235 enrichment), beryllium, small quantities of analytical chemicals, industrial type waste such as solvents, cleaning acids, photographic chemicals, etc., and explosives. This Plan details the operations generating this waste, the proper handling of this material and the procedures used to treat or dispose of the hazardous waste. A considerable amount of information found in this plan was extracted from the Site 300 Safety and Operational Manual written by Site 300 Facility personnel and the Hazards Control Department.

I. INTRODUCTION

The Lawrence Livermore National Laboratory Site 300 is located about 80 Km east of San Francisco, California and about 16 Km southeast of Livermore. The Site is used for materials testing and high-explosives diagnostic work. It is located in the sparsely populated hills of the Diablo Range and covers an area of 27 Km². Figure 1 shows the location of both LLNL and Site 300 with respect to the city of Livermore and surrounding areas.

Site 300 was established in the late 1950's and currently has approximately 300 employees permanently assigned to the area. The topography of the Site is characterized by areas having rolling hills with relatively flat benches and valleys and also steep hills with rugged canyons.

II. FACILITY IDENTIFICATION

The following is the identification of Site 300:

Landowner: United States Government
Department of Energy
San Francisco Operations
1333 Broadway
Oakland, California 94612

Operator: University of California
Lawrence Livermore National Laboratory
P. O. Box 208
Livermore, California 94550

Site

Operator: Roy K. Mullins, Resident Manager
Lawrence Livermore National Laboratory
P. O. Box L-871
Livermore, California 94550

Hazardous

Waste

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Lawrence Livermore National Laboratory
P. O. Box L-520
Livermore, California 94550

A. Site Identification

Figure 1 shows the relative location of Site 300. The topography of the area is shown on the folded map attached to this report. The general services provided to the Site for its operational support will be described.

Potable water is supplied to the site from two wells (Wells #7 and #8) with four wells inactive. The currently used wells have capacities of 80 gpm (Well #7) and 11 gpm (Well #8). Water from the wells is pumped into eight storage tanks which have capacities ranging from 63,000 gallons to 126,000 gallons. The water is gravity fed to the distribution mains and then to buildings, fire protection systems, etc. Backflow into the wells is prevented by backflow check valves.

The sewage from the General Service Area (GSA) (See Figure 3) is discharged into an oxidation pond servicing approximately 3,500 gallons of waste per day. The oxidation pond has a surface area of approximately one acre and is five feet deep. The pond is lined with an impervious plastic liner and can accommodate 7,000 gallons of waste per day or twice its present usage. Domestic waste from the outlying facilities is discharged into septic tanks for later treatment. The areas and buildings supported by septic tanks are listed in Table II-I.

The perimeter of the 27 Km² Site is secured with a four foot high barbed wire fence and is posted "Keepout, Trespassing and Loitering Forbidden by Law, Explosive Test Area." The University of California Protective Service Officers also patrol the areas routinely.

Major support buildings are equipped with evaporative type cooling towers. There are 33 cooling towers which discharge approximately 30,000 liters of blowdown per day. The blowdown is directed toward the nearest drainage ravine where evaporation or percolation occurs without ponding. The cooling tower water is treated with approximately 500 grams of chlorine and 2,000 grams of Nalco 8GW-439 per month.

8. Facility Locations

The locations of the various facilities within Site 300 are shown on Figure 3. Details of the operations which generate hazardous waste are covered in Section IV of this report.

TABLE 11-1

SEPTIC TANK LOCATION - SITE 300

1. Building 801	16. Building 830
2. Building 802	17. Building 831-B
3. Building 805	18. Building 832
4. Building 806	19. Building 833
5. Building 807	20. Building 834
6. Building 809	21. Building 835
7. Building 810	22. Building 840
8. Building 812	23. Building 841
9. Building 813	24. Building 850
10. Building 814	25. Building 851
11. Building 816	26. Building 854
12. Building 817	27. Building 855
13. Building 818	28. East Control Point - Bldg. 895
14. Building 820	29. West Control Point - Bldg. 897
15. Building 827	30. Waste Stabilization Pond - GSA

III. Waste Characterization

The Hazardous wastes generated at Site 300 can be broken down into four major categories:

1. Explosives
2. Uranium-238 and Beryllium
3. Laboratory Chemicals
4. Industrial Waste Streams

These waste types will be covered in the following sections in as much detail as necessary to characterize the nature of the hazardous waste. The waste streams are well defined because of the nature of the Site's work which is primarily the testing of classified systems with a minimal amount of developmental work. This latter work is done at LLNL which generates much more diversified waste streams.

A. EXPLOSIVES

Explosives developed and used are classified according to their physical and chemical behavior, handling classification, machining characteristics and their storage groups.

The handling classification is used to designate the type of explosives that are permitted in an approved explosives work area. A Type O, A, B or C explosive must be listed in Table III-1 or assigned to one of these types by the Hazards Control Explosive Safety Office and listed on a "LLL Data on Explosives" form LL-4294. An explosive is classified as Type D, E or X if it fits the description below:

Type O - Materials or systems which need not be handled, stored or labeled as explosives unless they are in close proximity to other explosives which could initiate them. They then become Type A unless otherwise indicated.

Type A - High explosive materials which meet allowable criteria for sensitivity and stability and have sufficient handling history to reveal any idiosyncrasies or special characteristics affecting their safe use.

Type B - Propellant-type materials and perchlorate explosives which meet allowable criteria for sensitivity and stability whose characteristics are well established.

Type C - Explosive systems which have known performance and are used for the purpose for which they were designed. Detonators assigned to this type are called allowable detonators. These are the exploding bridgewire type which require a high firing current and do not contain any primary explosives.

Type D - All flame-producing explosive systems or low-firing current fragmenting explosive systems.

Type E - All primary explosives and other static spark sensitive explosives.

Machining classification is a safety criteria which designates the manner (REMOTE or CONTACT) in which explosives may be machined. A complete listing of this safety criteria can be found in Reference 3.

Explosive materials and wastes are also segregated for storage based on compatibility. Any storage plan not specifically covered in Reference 3 must have a special Operational Safety Procedure issued by the Hazards Control Department. Each storage group is stored in a separate magazine or cubicle.

New explosive materials or LLNL compositions with little or no information on sensitivity, stability or handling history are given the initial classification of TYPE X REMOTE HANDLING. Acceptable data from hazard analysis tests permits reclassification. This reclassification is made by knowledgeable people and the Explosive Safety Office based on the interrelated properties of the explosive. The method of classification is not made simply by a compilation of individual properties but rather by a minimum test scheme as well as optional tests which may be used to further characterize a new explosive.

The following tests are run to characterize new explosive materials:

1. Required Tests

- a. Impact Sensitivity (Drop Hammer)
- b. Spark Sensitivity
- c. Differential Thermal Analysis (DTA)

2. Optional Tests

- a. Friction Sensitivity-Small Scale test
- b. Shock Sensitivity-Gap Test

- c. Susan Projectile Impact
- d. LLNL Chemical Reactivity Test (CRT)
- e. One Dimensional Time to Explosion Test (ODTX)

While the above tests are used to characterize new or reclassified explosive materials, they provide a useful characterization when the material becomes hazardous waste. Therefore, a reclassification of an explosive waste is not required since its properties were well defined in its manufacture and/or usage. These characterization tests are as follows.(4)

IMPACT SENSITIVITY

A 2.5 or 5 Kg weight is dropped from a pre-set height onto a small sample of explosive (about 35 mg.). A series of drops is made from different heights, and explosion or nonexplosion is recorded. The criterion for "explosion" is an arbitrary set level of sound produced by the explosive on impact. The test results are summarized as H_{50} , the height in meters at which the probability of explosion is 50%.

SPARK SENSITIVITY

This test is useful mainly for primary explosives which are more easily initiated by accidental electrical stimuli than are secondary explosives. An explosive sample is placed between an electrostatic discharge source and a voltage is applied to produce a spark across the sample. The voltage is increased until detonation occurs.

DIFFERENTIAL THERMAL ANALYSIS (DTA)

In the DTA analysis, identical containers are set up (one containing the sample and the other containing a standard reference) in identical thermal geometries with temperature sensors arranged to give both the temperature of each container and the differential temperatures for the containers. A standard reference material is chosen for the stability of its thermal behavior. Excursions above or below a background line result from endo- or exothermic changes. The DTA analyses permit interpretation for phase changes, decomposition and kinetic information, melting points, and thermal stability.

FRICTION SENSITIVITY

The explosive material is supported on a pendulum device and is allowed to swing down from preset heights and strike at an angle on a sand-coated steel target plate. The pendulum arrangement gives the impact of a sliding and

vertical component. Results of the test are expressed in terms of the type of chemical event produced by the impact as a function of impact angle and vertical drop. The chemical events are defined as follows:

- 0 No reaction.
- 1 Burn or scorch marks on HE or target.
- 2 Puff of smoke, but no flame or light visible in high-speed photography.
- 3 Mild low-order reaction with flame or light; sample broken up and scattered.
- 4 Medium low-order reaction with flame or light; major part of sample consumed.
- 5 Violent deflagation; virtually all of the sample consumed.
- 6 Detonation.

SHOCK SENSITIVITY-GAP TEST

The values are reported as the thickness of an inert spacer material that has a 50% probability of allowing detonation when placed between the test material and a standard detonating charge. In general, the larger the spacer thickness (gap), the more shock-sensitive the sample is. The values depend on test size and geometry and on the sample. Therefore, the gap test results are only approximate indications of relative shock sensitivities.

SUSAN PROJECTILE IMPACT

The Susan Sensitivity Test is a projectile impact test. The projectile head contains about 0.45 Kg of explosive and the target is armor-plate steel. The results of the tests are expressed as a "sensitivity" curve in which the relative point-source detonation energy released by the explosive on impact is plotted as a function of the projectile's velocity. The energy scale ranges from zero (no chemical reaction) to about 100 for the most violent detonation-like reactions (all explosives consumed).

LLNL CHEMICAL REACTIVITY TEST (CRT)

The sample is heated at 120°C for 22 hours. A two-stage chromatography unit is used to measure the individual volumes of N₂, NO, CO, N₂O and CO₂ evolved per 0.25g of explosive during this period.

ONE DIMENSIONAL TIME TO EXPLOSION TEST (ODTX)

This test involves placing 2.2g samples (12.7mm diameter spheres) between two preheated anvil faces which are sealed to confine the detonation product gases. The anvils are heated electrically, and the temperature is controlled by thermocouple feedback. Times to explosion are measured as a function of temperature.

Through the procedures outlined, the explosive materials and organic binders are well characterized before the materials are used at Site 300. Consequently, the hazardous waste streams produced from these materials are also known due to the strict adherence to the procedures outlined in Sections IV and VI of this report.

Tables II-II and II-III summarize the solubilities of explosives and additives and binders, respectively.

B. URANIUM AND BERYLLIUM WASTE TYPES

Uranium and beryllium waste are generated at Site 300 in the following forms:

1. Contaminated equipment and laboratory waste such as paper and cloth wipes, plastic shoe covers, gloves, setup apparatus, laboratory ware, etc.
2. Firing table debris such as dirt, gravel, concrete, metal, etc. contaminated with uranium and beryllium.
3. Metallic parts of uranium and/or beryllium. On rare occasions, thorium is also used.

Uranium and beryllium are used in testing to ascertain the characteristics of new nuclear explosive designs. The predominant uranium isotope used is depleted uranium known as D-38 (a byproduct of U-235 enrichment). The specific activity of U-238 is 3.33×10^{-7} Ci/gm⁽⁵⁾. However, because of the U-233 and U-234 impurities, the specific activity for D-38 is 4.37×10^{-7} Ci/gm⁽⁶⁾.

The metallic beryllium is usually associated with the D-38 metallic parts and are tested in conjunction. The contaminated equipment generated with the D-38 and beryllium parts consists of materials used in the preparatory work such as cleaning waste (paper wipes, rags, etc.), support structures used to mount the parts, etc.

Work areas where these materials are handled are routinely surveyed by the Hazards Control Department and include weekly air samples and floor swipes and monitoring of work areas during handling operations. Contamination control measures are strictly enforced by the Hazards Control Department.

Firing table debris is generated primarily in two areas, Buildings 850 and 851, with the latter being the predominant area where the D-38 and beryllium hazardous waste is generated. However, all firing bunkers do, at times, generate firing table debris but to a lesser degree than Buildings 850 and 851. The firing table debris is very similar to general construction debris except for the presence of the two hazardous materials. The operations and procedures followed in these areas will be covered in detail in Sections IV, V and VI of this report.

The experiments in the Firing areas involve setting up the equipment on a firing table comprised of dirt covered with aggregate gravel, diagnostic equipment and support structures (concrete, wood and steel). The experimental parts consist of explosives and D-38 and beryllium if the experiment calls for these latter materials. After the experiment is over, the parts have been destroyed through detonation with approximately 1/2 of the D-38 and beryllium vaporized, 1/4 remaining in the debris and 1/4 in the gravel. (These values were experimentally determined by the Hazards Control Department).⁽⁷⁾ The debris from the firing table is collected and disposed of in the west burial pit (Pit #7) by the Plant Engineering Department. Hazards Control surveys the firing table monthly to determine when the gravel should be removed and replaced with fresh aggregate. The gravel contamination level which requires

that the gravel be changed is called the "Derived Working Limit." it has been established as follows:*

Beryllium	500 Micrograms/gram
Radioactivity	5,000 picocuries/gram

These values were established based on safety guidelines for workers if the material was resuspended in air. A value of 0.1 TLV for beryllium was used and a factor of 0.1 RCG (controlled area) was used for the radioactivity.(8)

* The Health and Safety Technician samples the gravel to 5 cm in depth and submits the gravel to the Hazards Control Analytical Facility.

The amount of firing table debris disposed of in the burial pit varies radically but averages approximately 850 Kg of D-38 and 125 Kg of beryllium per year. This material is contained in debris which occupies 1600 M³ and weighs 7.1×10^7 Kg. Therefore, the average D-38 concentration is about 5 picocuries per gram (0.12 micrograms per gram), and the average Beryllium concentration is 1.8 microgram per gram in the landfill debris. These concentrations assume that the hazardous material has been uniformly distributed throughout the debris. However, the metallic parts are often found intact which would decrease the average concentration of the hazardous waste component in the debris.

C. ANALYTICAL CHEMICALS

A small amount of laboratory type chemicals are used in the work done in the chemistry process areas. The chemical waste generated is very small in volume and consists of off-specification reagents, spent chemical solutions such as inorganic and organic acids, solvents and aromatic compounds. The total quantity of waste generated per year is approximately 70 liters. These chemicals are shipped to LLNL for processing. The shipment occurs via the Toxic Waste Control Group according to applicable State and Federal Regulations (DOT, California Department of Health Services, and DOE).

Chemicals that are either reactive (friction or shock sensitive) or contaminated with explosives are disposed of on-site (see Section VI). As with the analytical waste chemicals, the volume of this waste type is small and amounts to approximately 100 liters per year.

On rare occasions, LLNL sends reactive chemicals to Site 300 for disposal in the Building 829 area, or some other designated area significantly remote to minimize environmental or health and safety injury. On an average, this occurs about once every two years with a total volume of 50 liters. Table II-4 lists typical chemicals and quantities that can be expected in such a disposal operation. All such operations require a special Operational Procedure that is subject to approval by the Hazards Control Department, the Site 300 Facility Supervisor and the Toxic Waste Control Group. Unusual disposal operations such as remotely opening containers with explosives, will usually require the LLNL Fire Department to be present at the operation.

The other waste stream that Site 300 becomes involved with is the Firing Tank Debris that is generated by LLNL. An experiment at LLNL involves testing materials (explosives, D-38 and beryllium) very much in the same manner that occurs at Site 300. The hazardous waste characterization is the same as was covered in Section III-A and B. However, the quantity of waste generated is very much smaller--approximately 300 Kg per year. Two disposal methods are used at Site 300 for this material. Machine turnings of explosives, contaminated solvents and scrap consisting only of burnable secondary explosives are dried and burned in the Building 829 area. Primary explosives (explosives that might detonate during burning), assemblies, classified parts and large pieces of explosives are destroyed by detonation at a firing area (usually Building 851).

D. INDUSTRIAL WASTE TYPES

The industrial waste types are generated by the support functions of the Site 300 facility--primarily by maintenance groups. These wastes consist of spent dip tanks (nitric and chromic acid solutions), photographic chemicals (developer, stop bath and fixer solutions), paint solvents, kerosene, oils, degreasers (trichloroethane), heat transfer liquids (trichloroethylene and tetraethylbutyl-ortho-silicate), PCB transformer oils and pesticide wastes.

The nitric and chromic acid solutions from dip tanks are well characterized by their use and are transferred to LLNL for processing by the Toxic Waste Control (TWC) Group. This waste amounts to approximately 300 liters per year. Rinse water from these operations discharge into dry wells as outlined in Sections IV and VI.

Spent photographic solutions are also transferred to LLNL for processing by the Toxic Waste Control Group. These photographic solutions are generated in processing X-ray film as part of the diagnostic work performed on experiments. Table II-5 describes the typical composition of this waste. Photographic rinse solutions are either discharged to septic tanks or to the ground. The paint solvents are typically aliphatic compounds such as petroleum benzine, petroleum naphtha, light ligroin and petroleum ethers. This waste stream typically has a flash point of less 00F. The other typical

solvent used is Stoddard Solvent (85% nonane and 15% trimethyl benzene) with a flash point of 100° - 110°F. The total waste volume for solvents and kerosene generated amounts to approximately 1000 liters per year. The Toxic Waste Control Group at LLNL coordinates the transportation and processing of this material to the Livermore site for disposal or reclamation.

The oils and degreasers are packaged separately and amount to approximately 4500 liters and 100 liters, respectively. As before, the TWC group receives and processes this material.

Heat transfer systems rarely generate waste except when the system is flushed out or decommissioned. It would be impossible to state the volume of waste generated in such a system because of such a non-routine nature. However, the waste would be processed by the TWC group when such an operation began.

Polychlorinated Biphenyl (PCB) oils are present in electrical transformers and capacitors at Site 300. The actual volume of oils is unknown. However, the Hazards Control Department has put forth much effort to identify and mark all PCB items (see reference 10). Any PCB item that is to be disposed is coordinated through the TWC group and transferred to LLNL for storage before disposal. The Laboratory also has a policy that new items purchased will not contain PCB's.

The pesticides operations at Site 300 generate very little waste. Any waste is transported and processed by the TWC group. All mixed pesticides and rinse water is used in the field. Empty pesticide containers are disposed of at the Corral Hollow landfill after inspection by the County Agricultural Inspector at Site 300.

TABLE III-1

LLNL CLASSIFICATION OF EXPLOSIVES

Type 0

Ammonium Nitrate

Ammonium Perchlorate - Particle size greater than 15u treat as type X when mixed with other explosives or fuels which could initiate them.

Ex-38 Detonator (inert) - Treat as Type C when used with other explosives.

Ethyl 4,4-Dinitropentanoate (EDNP).

FEFO/SOL - 35 wt% or less 1,1' - [Methylenebis(oxy)]bis

[2-fluoro-2,2-Dinitroethane]FEFO in ethyl acetate.

Fuse - Safety; Treat as Type D when greater than 1000 feet.

Nitromethane - 55 gallons or less.

Nitropropane

DNPA - polymer form of 2,2- Dinitropropyl acrylate (DNPA).

Pitric Acid - Containing 10 wt% water and in less than 11 Kg lots.

Propellant Cartridge Actuated Devices which yield a nonfragmenting, nonflame-producing controlled reaction. These remain as Type 0 when with other explosives.

Small Arms Ammunition - .38 cal. or smaller and shotgun shells packaged in 2000 rounds or less. Treat as Type D when with other explosives or if a larger caliber or quantity.

Smoke Pots - or similar smoke devices - Treat as Type D in groups of 50 or more.

Type A Explosives in Inert Solvents at concentrations not exceeding 25 wt%.

Type A

Baratol (24 wt% TNT, 76 wt% Ba(NO₃)(2)

Comp A-3 (91 wt% RDX, 9 wt% wax)

Comp B Grade A (63 wt% RDX, 36 wt% TNT, 1 wt% wax)

Comp B-3 (60 wt% RDX, 40 wt% TNT)

Comp C-3 (77 wt% RDX, 4 wt% TNT, 10 wt% DNT, 5 wt% MNT, 1 wt% NC, 3 wt% tetryl)

Type A (Con't)

Comp C-4 (91 wt% RDX, 5.3 wt% Di (2-ethylhexyl) sebacate, 2.1 wt% Polyisobutylene, 1.6 wt% motor oil)
Cycloto1 (up to 75 wt% RDX, remaining is TNT)
DATB-2,4,6-Trinitro-1,3-Benzendiamine
Detasheet
Detonating Cord (Primacord)
H-6 (45 wt% RDX, 30 wt% TNT, 20 wt% Al, 5 wt% wax)
Linear Shaped Charge
LX-02 (73.5 wt% PETN, 17.6 wt% Butyl rubber, 6.9 wt% Acetyltributyl citrate, 2.0 wt% cab-O-sil)
LX-04 (85 wt% HMX, 15 wt% Viton A)
LX-07 (90 wt% HMX, 10 wt% viton A)
LX-08 (63.7 wt% PETN, 34.3 wt% Sylgard, 2.0 wt% Cab-O-sil)
LX-09 (93 wt% HMX, 4.6 wt% pDNPA, 2.4 wt% FEFO)
LX-10 (95 wt% HMX, 5 wt% Viton A)
LX-11 (80 wt% HMX, 20 wt% Viton A)
LX-13
LX-14 (95.5 wt% HMX, 4.5 wt% Estane 5702-FI)
LX-15 (95 wt% HNS-I, 5 wt% Kel-F 800)
Milg detonating fuse
Nitroguanidine
Octol (75 wt% HMX, 25 wt% TNT)
PBX-9007 (90 wt% RDX, 9.1 wt% polystyrene, 0.5 wt% DOP, 0.4 wt% Rosin)
PBX-9010 (90 wt% RDX, 10 wt% Kel-F)
PBX-9011 (90 wt% HMX, 10 wt% Estane)
PBX 9404 (94 wt% HMX, 3 wt% NC, 3 wt% CEF)
PBX 9407 (94 wt% RDX, 6 wt% exon 461)
PETN 2,2-Bis [(nitroxy)methyl] -1,3-propanediol, dinitrate Booster Pellets, 2 grams or less
Pentolite (50 wt% PETN, 50% TNT)
*RX-03-BB
*RX-03-DI
*RX-03-DM
*RX-08-AZ through bd
TATB-2,4,6-Trinitro-1,3,5-Benzenetriamine

*Classified

Type A (Con't)

TATB/kel-F

TATB/Viton

TATB/Estane

TATB/Phenoxy

TATB/Kraton

Tetryl - N-Methyl-N,2,4,6-Tetranitro benzenamine

TNT - 1,3,5 Trinitrotoulene

XTX-8003 (80 wt% PETN, 20 wt% Silicone rubber)

Type B

CYH Propellant

M-6 Smokeless Powder

DDP Propellant

M-12 Smokeless Powder

DNPA Monomer

M-17 Smokeless Powder

HPC-95 Propellant

Pistol and Rifle Smokeless Powders

Type C

The devices in this category are determined by the explosives they contain

- they are primarily detonators

Type D

Blasting Caps

Pressure Cartridges

Explosive Bolts

Primers

Fragmenting Actuators

Squibs

Ignite

Type E

Black Powder

Mercury Fulminate

Lead Azide

Nitrocellulose (dry powder)

Lead Styphnate

Triazidotrinitrobenzene (TNTNB)

Type X

All explosive propellants and pyrotechnics not otherwise defined are Type X. A list of materials for which storage review dates have been established is kept by the Organic Materials Division.

Storage classifications for some Type X explosives are listed below. If the Type X explosive is not listed, the Explosive Safety Office should be contacted for guidance.

Explosive (Type X)

Ammonium Perchlorate

Blasting Agents and Nitro-Carbonitrates not otherwise Listed

HMX-octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

HNS-1,1'-(1,2-ethenediyl)bis-(2,4,6-trinitrobenzene)

Nitrocellulose (wet)

Perchlorate-containing explosives

RX-11,-18,-21,-25,-26,-27, and -30

Petric Acid (dry)

PETN-2,2-bis [(nitroxy)methyl] -1,3-Propanediol, dinitrate

RDX-hexahydro-1,3,5-trinitro-1,3,5-triazine

TACOT-2,4,8,10-tetranitro-51H-Benzotriazolo-

2,1-a -Benzotriazol-6-IUM, Hydroxide, Inner Salt

Tetranitromethane

Trichlorotrinitrobenzene

TABLE III-2
SOLUBILITIES OF EXPLOSIVES (REF. 4)

Solvent	EXPLOSIVES													
	BTf	DATB*	DNPA	EDNP	FEFO	HMX*	NC*	PETN*	RDX*	TACOT*	TATB*	TETRYL*	TNM*	TNT*
Acetone	S	S1	S	S	S	S1	S	S	S	-	i	S	-	S
Benzene	S	i	-	-	-	-	-	S1	i	-	i	S	S	S
Carbon Tetra- Chloride	i	i	-	S	i	i	i	i	i	-	i	i	-	S1
Chloroform	-	-	-	S	S	i	i	i	i	i	i	S1	-	S
DMSO	S	S1	-	S	S	b	-	S	S	S	i	-	-	-
Ethanol	S	i	-	S	S	-	S1	i	S1	i	i	S1	S	S1
Ethyl Acetate	S	-	-	S	S	-	S	S	i	-	i	S	-	S
Ethyl Ether	S	-	-	S	S	i	i	S1	i	-	i	S1	S	S1
Pyridine	S	-	-	S	S	S1	-	S	S1	S1	i	-	-	S
Water	i	i	-	i	i	i	i	i	i	i	i	i	S1	i

Solubilities are expressed as follows, in terms of weight of substance dissolved at room temperature per 100 ml of solvent i = insoluble (<0.1g), S1 = slightly soluble (0.1g to 5g), S = soluble (>5g) b solvate.

*Commonly used LLNL explosives.

TABLE III-3

SOLUBILITIES OF ADDITIVES AND BINDERS (REF. 4)

Solvent	Cab-O-Sil	CEF	DOP	Estane 5702-F1	KEL-F	Poly- Styrene	Sybard 182	Viton A
Acetone	i	-	-	S	S	-	-	S
Benzene	i	S	-	-	-	S	-	-
DMSO	i	-	-	S	-	-	-	-
MEK	i	S	-	S	S	-	-	S
Toulene	i	S	-	-	i	S	-	-
Water	i	i	i	-	-	-	-	-
Xylene	i	S	-	-	-	-	-	-

Solubilities are expressed as follows, in terms of weight of substance dissolved at room temperature per 100 ml of solvent:
i = insoluble (<0.1g), sl = slightly soluble (0.1 to 5g),
S = soluble (>5g).

TABLE III-4LLNL HAZARDOUS WASTE DISPOSAL AT SITE 300

<u>Chemical</u>	<u>Quantity(1)</u>
Acetyl benzoyl peroxide	5.0 Kg
Acetyl peroxide	0.2 Kg
Acetylides	0.2 Kg
Aluminum hydride	0.5 Kg
Azobenzene	0.1 Kg
Benzoyl peroxide	5.0 Kg
Butadiene	0.5 Kg
t-Butyl peroxybenzoate	0.1 Kg
Calcium hydride	1.0 Kg
Calcium metal	15.0 Kg
Cesium metal	0.5 Kg
Chloroperoxy benzoic acid	0.1 Kg
Cyclohexene	0.1 Kg
Dicanyl peroxide	0.1 Kg
Diazomethane	0.1 Kg
Di-t-butyl peroxide	0.2 Kg
Diethylene oxide	0.1 Kg
Diethyl ether	10.0 Kg
Diethyl zinc	0.2 Kg
Dioxane	30.0 Kg
Ethyl ether	0.5 Kg
Fulminates	0.1 Kg
Heavy metal azides	0.1 Kg
Hydrazoic acids	0.2 Kg
Hydrogen peroxide (over 60%)	0.5 Kg
Isopropyl ether	0.1 Kg
Lead Azide	0.1 Kg
Methyl ethyl ketone peroxide	0.2 Kg
Organometallics	3.0 Kg
Organic peroxides	10.0 Kg
Phosphorus	2.0 Kg

(1) Quantities are approximate for a two year period. The nature of LLNL research will change the types and quantities.

TABLE III-4 (Con't

<u>Chemical</u>	<u>Quantity</u>
Picric Acid (dry)	1.0 Kg
Potassium metal	1.0 Kg
Rubidium metal	0.1 Kg
Sodium hydride	0.1 Kg
Sodium metal	0.2 kg
Sodium potassium alloy	5.0 Kg
Styrene	0.1 Kg
Succinic acid peroxide	0.1 Kg
Tetrahydrofuran	5.0 Kg
Titanium dichloride	0.1 Kg
Titanium trichloride	0.1 Kg
Vinyl acetate	0.1 Kg
Vinyl ether	0.1 Kg
Zirconium hydride	0.2 Kg
Zirconium metal	0.5 Kg
Sodium azide	0.5 Kg
Dicumyl peroxide	5.0 kg
Sodium peroxide	1.0 Kg

TABLE III-5

CHEMICAL COMPOSITION OF SITE 300 PHOTOGRAPHIC CHEMICALS

<u>Solution Type</u>	<u>pH</u>	<u>Conc. Range 1-10 gm/l</u>	<u>Conc. Range 10-100 gm/l</u>
Developers	9-12	Acetate	Aminoethanol
		Bromide	Carbonate
		Catechol	Chloride
		Citrate	Diaminopropanol
		Ethylenediamine	Ethyleneglycol
		Glutaraldehyde	Formaldehyde
		Metacresol	Hydroquinone
		Phosphates	Methylaminoethanol
		Polyglycols	Polyethylene glycols
		p-Methylaminophenol	Sulfite
		Sulfate	Imino diethanol
		Thiocyanate	Tetramethylammonium
			Borate
Stop Bath	2-4	Aluminum	Acetate
		Borate	Diethylene Glycol
		Citrate	Phosphate
			Sulfate
Fixer	4-8		Benzyl Alcohol
		Bicarbonate	Acetate
		Bisulfite	Aluminum
		Formalin	Ammonium
		Silver Thiosulfate	Borate
		Complex	
		Sulfate	Bromide
			Chloride
			Citrate
			Sulfite
			Thiocyanate
			Thiosulfate

II. FACILITY OPERATIONS

The Site 300 operations can be broken in the following areas as shown in Figure 2: West Firing Area, East Firing Area, Process Area and Administration and Support. Hazardous waste is generated in every area with the major contribution originating in the West Firing Area.

Site 300's primary function is to actively research, develop and test new and existing explosives and systems used in conjunction with nuclear weapon design work. Because of the hazards associated with this type of work, the Safety Department (Hazards Control) has implemented strict handling and operational procedures contained in Reference 3. They also provide on-site safety support through a team of safety professionals and technicians. Support is provided in the areas of Explosive Safety, Health Physics, Industrial Safety, Industrial Hygiene, Environmental Analysis, Fire Safety and Hazardous Waste. At least one professional whose expertise is in one of these fields is assigned to Site 300.

A. PROCESS AREA

Several building process areas are generally operated by the Chemistry Department and are used for the developing of new explosives, testing, fabrication of explosives (machining operations), etc.

Other process area buildings are operated by Supply and Distribution and the Mechanical Engineering Department. Weapon components are fabricated and tested in this area.

Figure 3 shows the layout of Site 300 and the locations of the buildings. All explosive operations are performed in designated buildings and must have approved operational safety procedures before work commences. Flame-producing maintenance equipment is not allowed in the areas except as permitted by a hazardous Work Permit approved by Hazards Control.

The general procedure for entry into these areas are:

Personnel entering the area must be checked in and out at the Process Area Police Post. All visitors are required to check in with the Facility Supervisor immediately upon arrival.

All matches and cigarette lighters are surrendered to the police post before entering the Process Area.

Parking at each facility is only in designated areas except during pickup or delivery of materials. Explosives, including waste, is not permitted at Buildings 822A, B, C, D, 808 or 815 areas.

Smoking is not allowed in the Process Area except as permitted by each building operating procedure.

The areas which generate hazardous waste in the process are shown in Figure 3 in circles 1 through 6 which correspond to Figures 4 through 9 of this report.

1. Buildings 806 and 807 (Figure 4)

These buildings form a complex for the machining, fabrication, disassembly and inspection of explosives and inert material. The more sensitive explosives are machined REMOTELY. The authorized explosives handled in this complex are LLNL Type A, B, C and, with special approval, X. (See Section III.A).

Cleanup and Waste Collection

- a. Routine cleanup is done at the end of each day's work and complete cleanup, including the waste trench system, is done once a week or at the direction of the Explosive Machining Supervisor.
- b. The explosive waste collector and trenches are inspected at the end of each day's work and cleaned out as needed.
- c. The following waste containers are available for use in the operating bay:

- (1) Explosive Contaminated Materials - Non-Combustible
- (2) Explosive Contaminated Materials - Combustible
- (3) Explosives

- d. A dust collector system is used while machining MOCK H.E. When not in use, the dust collector pickup is capped or directed away from any explosive work in progress.
- e. The floor in the processing bay is kept clean and as dry as possible during explosive operations.
- f. All machine tools are fitted with wet boxes that will catch and divert water and explosive fines to the explosive waste collector and trench system. At the completion of machining, the wet box is to be washed out, and any visible contamination wiped clean.
- g. Machining fines and pieces of explosives up to a 50mm cube in size may be deposited in the orange stainless steel cans designed for wet scrap. Incompatible explosives (different LLNL storage groups) shall not be placed in the same container.
- h. Any waste generated from explosives containing perchlorates shall be collected, shipped and burned separately from all other explosive wastes.

Figures 10, 11 and 12 give details of the High Explosive (H.E.) trench and collection system for this complex. The solubility for H.E. and the adhesives and binders in water are covered in Tables III-2 and III-3. These materials are essentially insoluble in water and only the fines would be carried away in the water. The trenches are very effective in setting out the fines and are backed up by the H.E. clarifier with a bag filter as shown in Figure 4. The Hazards Control Department has further sampled the lagoon water(11) and found no explosives present.

The drainage troughs for wet explosives from the machining operations in Buildings 806 and 807 are constructed in compliance with DOE prescribed Standard AMCR 385-100 with the single exception of sections under the road adjoining these facilities. This exception involves Paragraph 5-17.C which requires that drains between the source of explosives and sumps shall have removable, ventilated covers to facilitate inspection for accumulation of explosives. The sections under the roads are straight stainless steel pipes connected to troughs. Because of the topography and the need to provide adequate separation between the explosive operations and the clarifier, the trenches at Buildings 806 and 807 were run under the road. Other methods such as a trench with a loose cover would be a danger to road traffic. The trench flows into a 7 inch diameter straight pipe that is sloped to provide adequate flow to prevent settling of explosives. The intent of the standard is met because the pipe is large enough in diameter to allow for inspection with a flashlight for explosive buildup and, since it is straight with more than adequate slope, it is easily cleaned if contamination does build up in it. The operational procedures involve (1) The pipes are visually inspected weekly for explosive buildup, and (2) Explosives that settle in the pipe are removed with a hose and only moderate water pressure.

Building 805 shown in Figure 10 is used for chemical lens loading and experimental detonator fabrication which does not require any machining activities. Therefore, the H.E. trenches have not been used for years.

The volume of waste generated in all of these H.E. trench system varies depending on the programmatic requirements, but generally is about 20,000 liters/month. The lagoons are unlined and depend upon percolation and evaporation for water removal.

Hazardous waste collected in the waste containers described above is generated at approximately 2m³ per month and is disposed as outlined Section VI of this report.

2. Building 810

This building is used for preparing explosive charges in various configurations, assembling explosive charges, metal parts and detonators into devices for hydrodynamic studies. In order to minimize accidental events such as dropping explosives, etc., the work benches and concrete floors are covered with energy absorbing materials, and bare explosives are handled in special containers. Figure 13 shows the details of this building.

The materials authorized in this facility which later become waste are: Depleted uranium (D-38), thorium (metallic form and their alloys), beryllium (Metallic form and its alloys), LLNL Type A, B, and C explosives (Types D and X may be allowed with special procedures).

Waste materials contaminated with explosives and waste explosives are handled in the same manner as described in Section IV.A.1. The trenches in the rooms are used for wash down purposes only and are strictly prohibited for explosives or explosive contaminated waste. Waste materials contaminated with uranium, thorium or beryllium are packaged separately and disposed of according to Section VI.

3. Building 817 Complex (Figure 5)

This complex is used for the preparing and isostatic pressing of bulk explosives and MOCK H.E. Specifically, Building 817-A is a control room and office, Building 817-B is the H.E. pressing facility, Building 817-C is a service magazine, Building 817-F is the oven facility used for heating and annealing explosives, and Building 817-E is a cold storage facility.

This complex is only authorized to handle LLNL Type A explosives with a special procedure. The limited nature of the materials handled in this facility allows an easy determination of the hazardous waste generated. However, since explosive powders are handled in this area, if they are not adequately contained, they can collect on the floor and other surfaces, presenting a serious hazard. Therefore, strict housekeeping rules are enforced which minimizes this risk. The operational procedures followed are:

- a. Vehicles are parked in designated areas.
- b. All general safety regulations, such as posted personnel, explosive weight limits and security requirements are observed.
- c. The floors in the pressing buildings and oven building are cleaned as often as necessary to maintain a clean work area. The wash water is discharged to the clarifier via the H.E. trenches as shown in Figure 5. The volume of wash water averages approximately 15,000 liters per month.

The H.E. lagoon that receives this wash water after it has gone through the clarifier is unlined and relies on percolation and evaporation for water removal.

Solid hazardous waste (explosive contaminated) is collected in standard containers as stated in Section IV.1.C. The disposal operational procedures are outlined in Section VI.

4. Building 827C, 827D Complex (Figure 6)

This complex is used for the machining, fabrication, disassembly and inspection of explosives and inert materials. The only material authorized in these facilities are LLNL Type A, B, C and X (with a special procedure) explosives. Radioactive material (D-38) and beryllium are not authorized without special operating procedures and controls. The quantity of explosive waste generated is approximately 3 m³ per month and is disposed of according to Section VI.A of this report.

The operational procedures for cleanup and waste collection are identical to that covered in Section IV.A.1. The personnel controls are as follows:

- a. All non-resident personnel arriving at this complex will notify the Explosive Machinist Supervisor or his alternate of his arrival before entry to the operating areas. This notification is accomplished through the facility intercom system at Building 827-A.
- b. Explosives are located in the bay so that personnel are between explosives and an exit. An unobstructed path of exit shall be maintained at all times.
- c. LLNL approved safety shoes or shoe covers are worn in the bays except when no contamination is present as determined by the Explosives Machining Supervisor.
- d. Smoking and the consumption of food and beverages are permitted in the REMOTE Control Room only.

- a. Operations in Cell 2 are not allowed if a remote operation is being conducted in Cell 1.
- b. Operations in Cell 2 are allowed while a contact operation is being conducted in Cell 1.
- c. If a torch is being used in Cell 2, no operations are allowed in Cell 1 and water shall be flowing in the waste trenches in both cells.
- d. Simultaneous operations with explosives and propellants in Cell 2 are prohibited.
- e. Separate waste cans shall be used for propellants and explosives.
- f. The entire building waste trench system, including filters, shall be kept clean. Waste will not be allowed to accumulate in these systems.

Flammable solvents are brought into the cell for cleaning purposes, but the following conditions must be met:

- a. Solvents are restricted to work areas that are connected to the exhaust system.
- b. Only the required amount of solvent is brought into the cell. Solvents are to be kept in safety cans unless high purity is a requirement. Solvents in glass containers are to be protected from breakage.
- c. The torch is not to be used if any solvents are present in Cell 2.
- d. All spilled or residual solvents shall be immediately cleaned by absorption on cloth, paper, etc. The area should then be washed with water into the waste trench. The material used to absorb the spill is to be disposed of as contaminated high explosive

waste in accordance with Section VI of this report. Before operations are to continue, the operators must clean the waste trench to verify that all solvents are no longer in the building's drain systems.

The volume of solid hazardous waste generated by this facility is approximately 2 m³ per month and is disposed of as outlined in Section VI. The H.E. drain collection system is designed according to Figure 16 and is shown in detail in Figure 17. Because of this facility's unique safety procedures, the wash water volume generated per month is approximately 25,000 liters.

6. Building 828 Complex (Figure 8)

This building is for the machining, fabrication, disassembly and inspection of explosives and inert materials. The authorized materials in this facility are LLNL Type A, B, C and X (with special operational procedure) explosives. Radioactive materials and beryllium are not authorized without a special operating procedure. Personnel controls, handling procedures and cleaning and waste collection procedures are standard LLNL procedures found in Reference 3. The waste operating procedures have been covered in the previous sections with the standard format stated in Section IV A.1 of this report.

Approximately 1 m³ of solid hazardous waste is collected and disposed of each month as outlined in Section VI. The H.E. drain system generates about 10,000 liters of waste per month. As with all the other H.E. lagoons, the waste water is removed through percolation and evaporation. Since this facility performs machining operations on explosives, the waste water is cleaned by a clarifier as shown in Figure 8.

7. Building 829 Complex (Figure 9)

This area is used for the disposal of explosives contaminated with combustible waste, the disposal of explosive materials and parts by burning and the disposal of pressure and/or shock-sensitive chemicals. Destruction by intentional detonation is not permitted in this area.

Material Controls

1. Allowable explosive wastes for disposal:

- a. LLNL Type A explosives single piece under 1.5Kg weight, noncased.
- b. Machine cuttings from LLNL Types A, B or X explosives.
- c. An Operational Safety Procedure shall be written before burning Type B explosives in quantities greater than 2 Kg.
- d. Wet explosives chemistry waste which will burn without detonation in small quantities in the dried form.
- e. Explosive contaminated combustible wastes.
- f. Chemical lens with XTX, LX-13, PBX-9007 or -9407 only. Fifteen lens or less may be destroyed by burning in the furnace. (See Figure 9 for areas allowed to burn each waste type).
- g. Disposal of materials which cannot be handled as outlined because of reactivity or sensitivity must be covered by a Chemistry Job Summary or a Special Operational Safety Procedure.

All Livermore generated waste explosives and reactive chemicals received at Site 300 for disposal must be received at Building 818. A maximum of 90 Kg of explosives are allowed to be burned in Pit #3 at one time. Pits #1 and #2 are used for burning contaminated waste and small quantities of experimental explosives. Waste contaminated with depleted uranium or beryllium are prohibited in this area.

General Operations *

- a. The burn pit compound shall be kept free of dry grass, paper and other combustible materials. All noncombustible material that has been exposed to the explosives burn shall be removed from the burn pit and transported to the designated burial trench.

*Specific operational procedures are covered in Section VI.

- b. Safety glasses shall be worn by personnel handling electric squibs.
- c. A log book shall be kept in the personnel shelter. The following information is to be kept in the book:
 - Name of Technician-in-Charge
 - Date and approximate time of ignition
 - Type of explosives and the quantity to be burned
 - The burn pit used
 - Any unusual circumstances
- d. Reentry to the burning area may be made after eight hours have elapsed from the previous operation. The Technician-in-Charge will inspect the pits for residual embers, hot spots, etc., prior to bringing any explosive into the area. No explosive may be placed in the area of a previous burn unless 24 hours have elapsed or the area is thoroughly wet down with water.
- e. Prior to entering the burn area containing explosives or delivering additional explosives, the Technician-in-Charge will short and lock out squib firing lines and/or the furnace control switch and shall retain the key(s).
- f. If explosives are in place for burning in Pit #3, the transport truck may not be driven into the burn pit compound. If need dictates delivery by truck, it will be removed from the vehicle prior to opening and spreading of explosives.
- g. Prior to ignition of the waste materials by the approved method (See Section VI), the following steps will be taken:
 - (1) Outer entry gate shall be closed and the sign "Explosive Burning in Process" positioned.

- (2) The burn pit compound gate shall be locked.
 - (3) The general area will be checked for transients and all vehicles moved into the exit road opposite the control shelter.
 - (4) Personnel will take cover in the control shelter.
 - (5) The TV camera will be focused on the burn area.
 - (6) The rotating red beacon at the outer gate activated and the timer set for an eight hour operation.
 - (7) The squib firing lines will be checked using appropriate meters.
- h. After observing through the TV camera that the explosives are lighted and burning normally, personnel may proceed directly to their vehicles and leave the area.
- i. Any failure or malfunction of critical safety devices will be reason to delay burning until repairs are made.

Malfunctions

If explosives in the burn pit do not ignite, these procedures shall be followed:

1. Recheck continuity of squib firing lines and refire if no open circuits are detected.
2. If circuits are open indicating squibs functioned without igniting explosives, observe closely for ten minutes through TV camera.
3. If oil burner fails to ignite or function, check power supply to burner.
4. If a malfunction is verified, notify the Explosives Technician Supervisor and the Hazards Control Safety Team Leader for instructions.
5. Personnel may leave the area after instructions are received. The rotating red beacon will be left on and

the SYMBOL 4 and "Explosives Burning in process" signs left in position.

Specific operational procedures for Building 829 disposal operations are covered in Section VI of this report. The quantity of waste disposed of in this process area is typically 150 Kg per month and consists of explosives, reactive chemicals and explosive contaminated combustible waste. The following personnel controls are strictly followed:

1. The 829 burn area is normally an unmanned area and access to the area must be specifically authorized by the Process Area Supervisor or his alternate.
2. There must be at least two but not more than three persons present for a burning operation. At least one of these persons must be qualified in the explosives disposal operations.
3. LLNL issued safety shoes or shoe covers shall be worn in the area except as approved by the Building 820 Supervisor.
4. All matches, lighters and spark-producing instruments shall be deposited in the box provided at the entrance gate prior to entering the area.
5. Smoking, eating and the consumption of beverages shall not be allowed in the 829 area.
6. When explosives are in the Building 829 disposal area, the road barricade must be in place and the SYMBOL 4* sign displayed with one of the following signs: H.E. Drying or Explosives Burning in Process.
7. No entry past the control shelter shall be made within eight hours after burning. The rotating red beacon will be on the gate during this period.

*SYMBOL 4 is used to indicate that explosives are open and not secured in their storage area. It is used to alert the LLNL Fire Department of the degree of hazard.

8. Building 823 and T-48 Trailer

This facility and associated trailers are operated for the radiographic inspection of explosives, fissile material and other materials of high density or large size. T-48 is a trailer set up to provide office space and also houses a film processor for developing radiographs. This film processor is the only unit which generates waste in this area. The photochemicals used have the typical composition as stated in section III of this report (Table III-5). These chemicals are collected in DOT approved containers (DOT 6D/2S) and shipped to Livermore for processing at LLNL.

Rinse water generated from the film processor operations in T-48 are discharged to the ground surface approximately 20 feet from the south side of the trailer. This discharge is sporadic and varies with the programmatic needs. The rinse water discharge averages about 10,000 liters/month.

B. ADMINISTRATION AND SUPPORT AREAS

This is a general support area located at the southeast corner of Site 300. The waste generated in this area results from craft support (Paint, Shop, Machine Shop, etc.) and Photo Support. Building 872, 873 and 875 are operated by Plant Engineering. The general layout for this craft support area is shown in Figure 20.

1. Building 872 - Paint Shop

The layout of Building 872 is shown in Figure 18. The rinse water generated from washing water-soluble paint off of equipment is discharged into a drywell south of the building after the paint solids have been removed. Wash solvents used for cleaning equipment on oil based paints are collected separately and containerized in DOT17E 55-gallon drums. These petroleum derivative wash solvents are stored west (Figure 19) of this general area and shipped to LLNL for processing.

Efforts have been implemented to reduce the quantity of wash water used and discharged to the drywell. The current quantity of waste water generated and disposed of is approximately 1200 liters per month.

2. Building 875

Figure 18 also shows the location of the two drywells used in support of the maintenance operations in Building 875. The grease trap drywell is used to dispose of waste water used in cleaning equipment. No solvents are used in this system, and the waste consists of emulsified oil and grease (less than 5%). The water is discharged in a gravel well approximately 22 cubic feet in capacity. Approximately 1500 liters per month are discharged.

Another section of this building supports the maintenance mechanics who work to repair or modify equipment. Part of these operations require the use of an acid dip tank system to clean parts in the course of this repair work. Two tanks containing chromic and nitric acid solutions are available for this cleaning process. Parts are dipped in the tanks and then rinsed off with this water discharged to a drywell. When the acid solutions become exhausted, the LLNL Toxic Waste Control Group pumps out the tanks into DOT 6D/2S 55-gallon drums and processes the waste at LLNL. This dip tank operation is used infrequently and generates no more than 500 liters of rinse water per month.

3. Building 873 - General Shop

This is a general craft support facility and generates waste in an identical fashion as the mechanics do in Building 875. The only difference is that the dry well which receives the acid rinse water solution has been asphalted over and is physically not visible. The only evidence of a drywell is from the PVC drain which connects the rinse water basin inside the building to the drywell. The volume of the drywell is unknown. Less than 500 liters of rinse water is discharged per month.

C. FIRING AREAS

The firing areas are located in the north end of Site 300 and consist of the East and West areas as shown in Figure 2. These areas are used to test, often destructively, experimental apparatus and special materials or devices as part of LLNL's research activities. The East and West areas have two

active Class II-1 landfills: Pit #1 is located in the East area and Pit #7 is in the West (See Figure 3). The detail construction of these landfills are seen in Figures 21, 22, and 23.

Because of the relatively high hazard of operating areas which test high explosive systems, very rigid safety procedures have been established and are available in Reference 3. Central to the safety procedures is the Muster Control System used. The Muster Control System uses a number of methods to control access, but it essentially is an effective system based upon: (1) Limiting access and movement of people, and (2) Taking a headcount of everyone in the area and knowing where they are before a shot is fired.

In addition, safety procedures are strictly adhered to before, during and after the shots. As an example, if the Facility Supervisor feels that an experiment may create a grass fire, the Control Post (CP) Operator requests that the LLNL Fire Department stand by. While the CP Operator may permit Fire Department personnel in the Restricted Area after the shot (but before the "ALL CLEAR"), firemen must not go within 76m of the firing table until the "ALL CLEAR" is given.

The general operating procedures which are followed in the control of contaminants in the firing areas are as follows:

1. All facilities are maintained free of accumulations of dust through good housekeeping. Hazards Control provides a workplace monitoring program to assure that contamination levels are not a health hazard. This is done by surveying the air using air samplers and analyzing for contaminants that are known to be present in the work environment.
2. After each shot when debris is present, a water wash down of exterior bunker walls, docks, stairs and bottle racks is required.

3. Interior of facility boxes, flash X-ray houses, bunkerettes and mechanical equipment room(s) must be vacuumed when dusty.
4. The exterior of all facility vehicles are hosed off and the floor and seats vacuumed before it is sent in for repair or transferred out of the Firing Area.
5. All openings into the building must be closed so that dust will not enter after detonation.
6. Personnel are not allowed to leave the building after a detonation until the dust cloud has dissipated. The Control Point Operator keeps the firing point informed on dust cloud movement after detonation.
7. The firing table is washed down with water after each shot that disturbs the table gravel or has contained toxic (uranium and beryllium) material.

BURIAL SITES

The details of the West Landfill (Pit #7) are shown in Figures 22 and 23 and exclusively support buildings 850 and 851 (Hydrodynamic Diagnostics). The principal function of Building 850 is the operation of a 155mm gun modified by attaching the outriggers to a concrete pad on the firing table. Their work involves partial shots aimed at evaluating shot characteristics of new explosives. The experiments rarely involve Uranium (D-38) or beryllium. The Hazards Control Health and Safety Technician samples the shot debris monthly as stated in Section III-B. When the limits are reached the debris is disposed of in the West landfill. An adjacent bunker also contains two acid dip tanks for support of their operations. However, these tanks have not been used in the past three years. There is also a photoprocessor in Building 850. The chemicals are characterized according to Table III-5 and are changed when the solutions become exhausted. The chemicals are containerized in DOT 6D/2S 55-gallon drums and processed at LLNL. This work is coordinated by the Toxic Waste Control Group. The rinse water generated by this processor is

discharged to the building's septic tank. The quantity of rinse water waste is approximately 1200 liters per month. Figures 24 and 25 show Building 850's floor plan and plumbing details.

Building 851 is used for determining the characteristics of the experiment using radiography during the destructive testing. Over 50% of their shots are full which contain both D-38 and beryllium. The procedures followed in handling the firing table waste are covered in Section VI-B. Building 851 also contains two photoprocessors: one is automatic while the other one is hand operated. The automatic processor is used frequently with only a minimal amount of usage on the manual unit. The rinse water from the automatic processor is discharged directly on the ground surface east of Building 851 and amounts to approximately 20,000 liters per month. The hand processor is used infrequently with the rinse water discharged into the building's septic tank. The volume of rinse water is approximately 500 liters per month.

Building 851 is the primary area where special hazardous waste disposal operations take place. Primary explosives, classified parts, etc. are destroyed on the firing table using explosives. This process is referred to as FUBAR (Fouled Up Beyond Any Recognition). On rare occasions, Building 851 is also used to FUBAR an item.

The West Burial Site is located in a restricted controlled area, and the boundaries are marked by area posts, and a sign on the road leading to the landfill notifies personnel of its existence. The landfill is periodically covered with approximately 3 feet of soil.

The East Burial Site also has its boundaries marked by posts and a sign immediately in front describing the landfill. However, the buildings which use this landfill operate sporadically and usually with material that does not contain D-38 or beryllium. The buildings that use this landfill are Buildings 801, 802, 804, 812 and 845. All of these facilities are classified, but the waste generated is usually construction debris. Details of the East Firing Landfill (Pit #1) are shown in Figure 21.

V. FACILITY EQUIPMENT

Site 300 operations depend on a number of industrial type equipment located on-site and LLNL for support. Much of the explosive handling equipment and the hazardous waste handling equipment is the same because of the nature of the material. Other hazardous waste that is not explosives contaminated can be handled by equipment owned by the Toxic Waste Control Group or Plant Engineering. Handling explosive wastes with powered mechanical equipment is not normally considered a high risk operation, but operator or equipment failure can seriously reduce safety controls and introduce new and unknown conditions. In order to minimize operator failure, all operators must be trained and experienced on the equipment that they must operate (see Section VI.I on Training). In order to minimize equipment failure, the equipment is purchased or modified for use in the hazardous location and designed specifically for the intended job.

A. Waste Handling Equipment

Vehicles for Transporting Explosive Waste

The following equipment is required for all vehicles carrying explosive material:

1. Proper explosive signs for the front, rear and both sides.
2. Two fire extinguishers filled and ready for use; one mounted inside the cab and the other one outside the vehicle on the driver's side. Each extinguisher shall have an Underwriter's Laboratories rating of 10 B:C or more.
3. Emergency four-way flasher.
4. Back-up light.
5. Chock block.
6. Spark arrester for the engine's exhaust.
7. Tie down mechanism for securing containers.

8. Cargo space lined with non-sparking material; no sharp projections.
9. Rearview mirrors mounted on both sides of the cab or vehicle visible in the drivers position.
10. Quick disconnect switch on battery.
11. Covered cargo area or fire and water resistant tarpaulin.

All vehicles are required to be safety inspected daily by the responsible operator. When equipment is loaned to another building or operating group, the borrower is required to verify that the equipment is designed and rated for the job and that the inspection and maintenance records are current. In addition, the operator must be assured that:

1. Fire extinguishers are full and sealed.
2. Electrical wiring is in good condition.
3. All persons who are assigned vehicles are responsible to ensure that an inspection is made by the Motor Pool every 60 days.
4. Fuel tank and lines are not leaking.
5. Brakes, lights, horn, steering and other operating equipment are functioning properly.
6. Tires are in good condition and properly inflated. No recap tires are permitted on these vehicles.
7. Chassis and engine are reasonably clean and free of excess oil and grease.
8. The exhaust system is in good condition.

Any vehicle's defects shall be corrected immediately, and until such corrections are made, the vehicle shall not be used to transport explosives or explosive waste. No maintenance or adjustments (including refueling) shall be performed on any vehicle carrying explosive materials except as specifically approved by the Hazards Control Safety Team Leader or his alternate.

The Motor Pool shall correct vehicle defects as required and perform routine service and inspection of all vehicles at 60 day intervals.

The Motor Pool is responsible for a thorough steam cleaning of the engine, chassis and underbody of all vehicles every four months or as often as needed. If the cargo compartment requires cleaning, it shall be done in the Explosives Decontamination Area (Building 819).

All vehicles which have been newly equipped shall be inspected by both the Motor Pool and Hazards Control Explosive Safety prior to placing the vehicle in service.

When a vehicle is removed from service for transporting explosive materials, it shall be decontaminated. Hazards Control shall inspect the vehicle to verify that it is free from explosives.

Forklift Trucks Used for Moving Explosives

1. The forklift trucks are only to be used for lifting and moving explosive items a short distance.
2. Only trained and authorized operators shall be permitted to use fork trucks.
3. Fork trucks shall be marked with the approved lifting capacities and the words "Approved for Explosives" stenciled in plain view.
4. Ninety day inspections of gasoline powered trucks shall be made by a mechanic at the Motor Pool (Maintenance Machinists Shop for some diesel powered fork trucks) to see that the mechanical condition and safety

appliances are in good working order and that the engine and underbody are reasonably clean and free of excess oil and grease.

5. All fork trucks must be inspected by the driver to insure:

- (a) Fire extinguisher (10 B:C) is present and sealed.
- (b) Electrical wiring and exhaust system is in good condition.
- (c) Fuel tanks and lines are secure and not leaking.

6. Only fork trucks with specific ratings for use in hazardous locations may be used in explosives buildings.

7. Fork lifts shall be used to handle only explosives in substantial containers, such as fully cased explosives and explosives in DOT approved containers. The handling of palletized assemblies will be addressed in the Facilities Safety Procedure.

8. Gasoline or diesel powered equipment shall be equipped with a backfire deflector (air filter) securely attached on the throat of the carburetor. A tight fitting cap, properly vented, shall be in place on the fuel fill pipe. A flame arrestor shall be installed in the fill pipe of gasoline powered equipment. If necessary a deflector plate shall be installed to prevent any overflow from the fuel tank from reaching the motor or exhaust pipe. On gravity feed or pump systems where siphoning might occur, a shut-off valve shall be installed at the fuel tank or in the feed line to permit shutting off the fuel in the event of an emergency or break in the fuel line. The fuel lines shall be secured to prevent vibrational rupture. Fuel powered equipment will be refueled and stored at least 30m away from explosive facilities.

9. Decals shall be attached to forklifts maintained by the Motor Pool showing when maintenance is due. Records on the maintenance and services shall be kept on each unit. Neither maintenance repair or service shall be permitted in an explosives storage or operating building.

10. Annually, fork truck tines will be load tested to 100% of the rated capacity and followed by a nondestructive test method to detect any condition which might weaken the tines.

Requirements for Cranes and Hoists for Explosive Handling

1. Each crane or hoist shall have the words "approved for Lifting Explosives" stenciled on it in plain view.
2. Chain hoists shall be visually inspected by the operator prior to each use. Chain hoists shall be inspected annually and load tested to 100% of the rated capacity. Crane hooks shall be magnafluxed annually.
3. Exposed explosives shall not be lifted using either cranes or hoists unless an adequate lifting fixture is provided. The lifting fixture shall have a safety note prepared to outline the conditions of testing and use.
4. All slings and handling fixtures shall be of approved design and construction for the weight and configuration to be handled.

Requirements for Portable Cranes and Hoists for Explosive Handling

1. Mobile cranes and hoists shall be approved for lifting bare explosives only when the operation has been reviewed by Hazards Control.
2. Mobile cranes and hoists shall be inspected as prescribed by existing OSHA and LLNL standards and shall be stenciled to indicate that the specific item has been approved for lifting explosives.
3. The crane operator shall inspect the crane for proper operation and controls immediately prior to the job if it is used to lift explosives weighing less than 25 Kg and lifted less than 1.5m off the ground.
4. When greater than 25 Kg of explosives are lifted or the lift height exceeds 1.5m, the crane shall be checked for proper operation and control and the job shall be "dry run" using a weight at least 100% of the expected work load immediately prior to the job. The operation shall also be reviewed by

Hazards Control and specific safety controls for the operation will be stated in a safety procedure.

5. Motor vehicles equipped with boom-type cranes shall be equipped with a spark arrester for the exhaust pipe and a fire extinguisher with a minimum rating of 10 B:C and shall be designed, tested and inspected as previously described.
6. All slings and handling fixtures shall be of approved design and construction for the weight to be handled. Special slings with lifting eyes and hooks will have those parts magnafluxed annually.

Vehicles, forklift trucks, cranes and mobile cranes are listed in Table V-1 along with the responsible person and primary area that they are in.

Other Hazardous Waste Equipment

The Shipping and Receiving Department maintains a number of vehicles and forklifts to move equipment routinely. All of this equipment is maintained by the Motor Pool and is routinely serviced every six months or as needed. The vehicles and forklifts are used to move the hazardous waste to staging areas as needed. In addition, the Plant Engineering Department has heavy equipment such as front-end loaders, backhoes, dump trucks, etc. that are used for gravel changes at the firing tables. This equipment is also serviced at six month intervals. When any of these vehicles or equipment are used on a hazardous waste operation, Hazards Control thoroughly surveys the vehicle before releasing it outside the area.

In addition, the Toxic Waste Control Group operates the following equipment which can be used at Site 300:

- a One-ton pickup truck modified to respond to hazardous waste calls and emergencies. It is equipped with a 4-way flashing amber light and signs mounted stating "Dangerous Cargo." Equipment such as portable pumps, hoses, absorbent, etc. can be quickly loaded onto it. This vehicle is also equipped with a first aid kit and fire extinguisher.

- o A 1/2 ton pickup truck with a lift gate is available to make relatively small (less than 200 gallons) nonexplosive waste pumpouts.
- o There are three 5,000 gallon tankers that can respond to large pumpouts of hazardous waste. One tanker is available for emergency responses, while two are used in operations.
- o A hazardous waste spill kit is available to Site 300. This kit is portable and is equipped with 100 pounds of absorbent, five gallons of contamifix (used to prevent airborne contamination), disposable coveralls, bag , respirators, surgical gloves, etc.
- o An assortment of electrical and gasoline driven pumps are available. These pumps have capacities up to 120 gpm and can pump corrosive liquids and sludges.
- o Two complete sets of chrome leather suits are maintained for responding to reactive or shock sensitive wastes such as old ethers, peroxide or super oxide formers. In addition, two blast shields constructed out of 1/4 inch steel are maintained at LLNL and can be mounted on a flatbed truck for safety during transportation.
- o Two complete sets of alkali metal resistant suits are maintained at LLNL for response to reactive waste of this type.

B. Safety Equipment

A wide variety of safety equipment is available to employees through LLNL's Central Supply (Stores). The equipment available through this source range from fire extinguishers, ear plugs, face shields, chemical resistant gloves, chemical safety cans, etc. In addition, the Hazards Control Department maintains a Respirator Section which fits and supplies workers with proper respiratory protection for the job being done. This protection ranges from dust masks up to Self Contained Breathing Apparatus (SCBA). The assigned Safety Team in the area evaluates the job being done and then calls upon the Respirator Section to provide the proper protection.

Areas at Site 300 where radioactive and/or toxic chemicals are routinely used have a respirator cabinet equipped with half-mask respirators. Workers in these areas are indoctrinated on the proper selection and use of respirators and are fitted for specific respirators annually. The Hazards Control Safety Team at Site 300 evaluates each job dealing with toxic materials and implements the proper controls before the job is performed.

Any facility which has a work station set up for using corrosive chemicals, such as acid dip tanks, also has an eye wash station located close by. These stations are checked routinely by Hazards Control to ensure proper operation. When handling toxic and corrosive chemicals, local ventilation such as fume hoods or close-capture systems are used if significant quantities of gas, vapor or airborne particulates are generated. This ventilation is a "once-through" type where no recirculating of exhaust air is permitted. The use of face shields, safety goggles, liquid-proof aprons and gloves when handling corrosive chemicals is required and the program is periodically audited by the Hazards Control Department.

C. Security

The security at Site 300 is governed by their charter to protect classified information. The entire perimeter of the Site is defined by a four foot high barbed wire fence and is posted with a sign saying "Keepout, Trespassing and Loitering Forbidden by Law, Explosive Test Area" and is patrolled by the Protective Security Officers (PSO). The areas at Site 300 are not open to the general public and access is controlled by the use of badges. The badge must be presented for examination to the PSO on duty each time access into the area is granted.

Certain areas of the fence's perimeter and other strategic points are monitored through television cameras to the central security building (Building 870). Throughout the Site are Police Posts which control access to the various facilities and areas.

The two active landfills are within the areas controlled by LLNL Security Department. In addition both the east and west landfills are

demarked by posts which delineate their boundaries and also by signs which notify employees that the landfills are there.

D. Lighting

No hazardous waste disposal operations occur at night. Therefore, no outside lighting is present at the two landfills. Limited outside lighting is present at the Explosive Burn Area (Building 829).

E. On-Site Water Supply

There are six wells at Site 300 from which water can be obtained (their locations are shown in Figure 3). Their capacities range from 11 gpm to 100 gpm. Only two wells (Wells #7 and #8) are used for potable water. Well #7 has a capacity of 80 gpm and is at a depth of 180 feet and Well #8 has a capacity of 11 gpm and is 150 feet deep.

The water from these two wells is pumped into eight storage tanks which have capacities ranging from 63,000 to 126,000 gallons. Between the eight tanks a total capacity of 617,000 gallons is present. The water is gravity fed to distribution mains and then to buildings, fire protection systems, etc. Backflow from the tanks into the wells is prevented by backflow check valves.

TABLE V-1

APPROVED VEHICLES FOR EXPLOSIVES HANDLINGH.E. TRUCKS

<u>Vehicles No.</u>	<u>Building</u>	<u>Supervisor</u>
E-90341	875	H. Bonde
E-90653 (1)	879	R. Silva
E-90707	810	B. Cummins
E-90270	875	H. Bonde
E-90774	827	L. Frahm
E-90775	854	W. Ford
E-90709	817	B. Cummins
E-90611	827	L. Frahm
E-90785	850/851	L. Simmons/E. Nidick
E-90786	802	R. Kaster
E-90787	833	R. Hurst
E-90788	851	W. Halladay
E-90792	818	M. Tandy
E-90864	850	L. Simmons
E-90868	805	B. Cummins
E-90870	810	B. Cummins
E-90872	834	D. Stupfel
E-90881	813	N. Halbert
E-90311	875	H. Bonde
E-90804	875	H. Bonde
E-90136 (2)	875	H. Bonde
E-90065 (")	875	H. Bonde
E-90340 (")	875	H. Bonde
E-90363 (")	875	H. Bonde
E-36491	810	B. Cummins

- (1) Loaner to be used to replace a vehicle being repaired or inspected.
- (2) These vehicles are tractors and trailers. They are used so infrequently that a routine inspection is not required. However, they shall be inspected by the Motor Pool just prior to each use in explosives service.

APPROVED VEHICLES FOR EXPLOSIVES HANDLING (Con't)

FORKLIFT TRUCKS

<u>Identifier</u>	<u>Responsible Person</u>	<u>Primary Area</u>
FL-101	H. Bonde	East Firing Area
FL-102	H. Bonde	854, 855, 858
FL-104	H. Bonde	854, 855, 858
FL-105	H. Bonde	836
FL-107	H. Bonde	810/Process Area
FL-109	H. Bonde	All Areas
FL-113	H. Bonde	All Areas

Liftall No. 1 (AEC 143130)	L. Simmons	850
Liftall No. 2 (AEC 143715)	W. Halladay	851
Liftall No. 3 (AEC 143527)	H. Smith	873

CRANE TRUCKS

Drott 85 (AEC 142791)	W. Halladay	West Firing Area
E-90377	L. Simmons	850
E-90378	R. Kaster	East Firing Area

MOBILE CRANES

Austin Western (5 ton) (AEC 81062)	H. Smith	Building 873
Pettibone (40 ton) (aec 263328)	H. Smith	Building 873

VI. GENERAL OPERATING PROCEDURES

The following are a set of operational procedures established for the control and safe handling of material and hazardous waste disposal operations. A key to these operational procedures involves transportation of the waste to and from buildings and LLNL. All movement of radioactive, reactive, toxic and explosive materials must have a controlled material ID tag (Figures 26 and 27). This tag is used to identify, package, release and ship on-site hazardous material. The releasing signature from the Hazards Control Department, Materials Management Group or the Toxic Waste Control Group is needed before the movement of the material can occur. The signature signifies that attention has been given to packaging and monitoring, preparedness at the receiving area, and clearance on procedural aspects. The approval of an Authorized Explosive Handler is required before any movement of explosives occurs.

There are only two groups authorized to transport explosives: Materials Management Transportation Group and Site 300 Supply Transportation Group. Most movements of hazardous materials at Site 300 are performed by the Supply transportation drivers, who also handle most of the explosives going from Livermore to Site 300. Small quantities of explosives sent to Site 300 may also be carried by Materials Management drivers. The Toxic Waste Control Group is not authorized to transport explosives.

WASTE TRANSPORTATION PROCEDURE

The requester or sender:

1. Completes the Controlled Material ID (CMID) tag before moving the material, including:
 - a. Complete address of sender(s) and receiver(s)
 - b. Classification of item if applicable
 - c. Number of packages and description
2. Contacts the authorized individual (Health and Safety Technician, Explosive Handler, etc.).
3. Packages the material in an approved DOT container secured by bolts, locking rings, etc.

4. Contacts the appropriate dispatcher to arrange for the transfer of the material and furnish the dispatcher with the following information:
 - o Name of sender
 - o Material to be transferred
 - o Building and room number (or area) where the material may be picked up
5. Explosives may only be delivered to the named individual or to another authorized explosives handler.

In addition to the controls stated above for on-site shipments, hazardous waste shipped off-site must comply with State and Federal regulations. Hazardous waste shipped off-site is done in accordance with LLNL/DOE/DOT safety standards and regulations. Off-site is defined here as the transport of hazardous wastes outside the boundary of Site 300 (see Figure 3) and includes the transfers between Site 300 and Livermore. These shipments are coordinated by the Toxic Waste Control Group.

The nature of the hazardous waste at Site 300 is relatively well defined. The following classes are used to describe the hazardous waste transportation off-site (both from Site 300 to Livermore and from Livermore to Site 300):

<u>Hazardous Waste</u>	<u>Abbreviation</u>	<u>Label(s)</u>	<u>United Nation Class</u>
Explosives, DOT			
Class A	Expl. A	Orange A	1
B	B	B	1
C	C	C	1
Flammable Liquid	F.L.	Red	3
Flammable Solid	F.S.	Red Striped	4
Water-Reactive Material	WRM	Blue	4
Oxidizing Material	Oxy. M	Yellow or Peroxide	5
Radioactive Material	RAM	Radioactive	7
Corrosive Liquid	Cor. L	Corrosive Liquid	8

All off-site shipments comply with the Department of Transportation regulations (Title 49) and are shipped with proper shipping papers, packaging and placards.

Hazardous Waste Control

The following individuals and groups have responsibilities concerning hazardous waste:

- o Each supervisor whose work generates hazardous waste must take the necessary steps to ensure that his operations are conducted in such a manner that the hazardous waste generated is properly packaged to prevent exposure to individuals. It is also the supervisor's responsibility to ensure that his operations generate the smallest volume of hazardous waste possible. His responsibilities include: (1) Instructing employees under his direction concerning the responsibilities stated above; (2) Determine that adequate controls have been established and that handling procedures are followed; (3) Ensuring that the procedural review and control extends to his transportation and handling activities within his control.
- o Each employee at the Laboratory who desires to ship hazardous waste is responsible for ensuring that the waste transported is addressed to someone qualified to handle it. It is also his responsibility to completely identify and describe the contents of each package being moved and to notify the Toxic Waste Control Group concerning any unusual problems or safety requirements associated with the shipment of this waste.
- o Personnel who perform final packaging of hazardous waste are responsible for following all LLNL, State and Federal codes, standards and regulations. They must contact the individual requesting the shipment in the case of problems or any uncertainty associated with the material.

- o The Toxic Waste Control Group has a responsibility for exercising an overall coordinating function for all hazardous waste shipped on and off site. The services provided by this group include verification of what types of hazardous waste are compatible and that applicable regulations are satisfied; that a proper evaluation (waste characterization) of the hazardous waste has been made; and that the packaging, labeling, marking, placarding and paperwork have been performed to ensure compliance with State and Federal laws.
- o The Hazards Control Department advises all responsible individuals and groups concerning the handling of all hazardous materials, including waste. They are responsible for providing technical evaluations, safety analyses, and procedural reviews of unusual hazardous shipments. They will provide and coordinate training of technicians in the handling and monitoring of hazardous materials and wastes.

A. EXPLOSIVE HANDLING AND DISPOSAL METHODS

The following procedures involve the handling and disposal methods of waste explosives at Site 300 and applies directly to building 829. As stated in Section IV-A, this area is used for the disposal of explosives contaminated combustible waste and the disposal of explosive materials and parts by burning. Destruction by intentional detonation is not permitted in this area.

Disposal of small amounts of secondary explosives and contaminated waste from the Livermore operations is permitted provided the following procedures are followed:

1. Items that are to be destroyed by burning must be packaged separately from those intended for detonation. If questions arise, the Building 810 supervisor must be contacted.
2. Each package must be labeled as containing explosives with an estimate of the quantity and type of explosive present.

3. Classified parts must have both the Controlled Material ID (CMID) Tag and the classified parts documentation.
4. Only machine turnings, contaminated solvents and combustible explosives are permitted in the Building 829 area.
5. Items must be identified and packaged in such a manner as to require minimal handling or inspection upon the arrival at Site 300.
6. Shipments are to be addressed to the Explosives Process Area Coordinator, T-44, Site 300.
7. Before the shipment occurs, the T-44 Area Coordinator must be notified and allowed adequate time to prepare for the receipt of the waste.

The responsibilities for the disposal operations in the Building 829 area are as follows:

- o Facility Supervisor is responsible for assuring that all operations are performed safely and that the procedures outlined in Reference 3 are followed.
- o The explosive technicians are expected to take all reasonable precautions to protect themselves and their fellow workers and to perform only those tasks that they believe can be accomplished safely. When they have any doubt regarding the safety of their work, they are expected to check with their supervisor before proceeding.
- o The Hazards Control Safety Team is available to (1) Assist individuals in evaluating safety problems; (2) provide surveillance of the work environment; (3) to stop an operation which appears imminently dangerous to personnel, equipment or the environment.

All visitors to this area are required to report to the office in Building 813 for clearance to enter the Building 829 area. They will be advised there by the Supervisor or his alternate of the necessary Health and Safety Procedures relevant to the visitors work or purpose.

1. Allowable Explosives for Disposal in Burn Pits

- a. LLNL Type A explosives single piece under 1.5 Kg weight, noncased.
- b. Machine cuttings from LLNL Type A, B or X explosives. A maximum of 90 Kg of explosives may be burned in Pit #3 at one time. Pits #1 and #2 are used for burning contaminated waste and small quantities of experimental explosives.
- c. An Operational Safety Procedure shall be written before burning Type B explosives in quantities greater than 2 Kg.
- d. Wet explosives chemistry waste which will burn without detonation in small quantities in the dried form are permitted.
- e. Chemical lens with XTX, LX-13, PBX-9007 or 9407 only (see Section III for composition). Fifteen lens or less may be destroyed by burning in the furnace.

2. Explosive Identification

All explosives received for disposal must be properly identified and include the following minimum information:

- a. Description of the material, LLNL explosive type and storage classification.

- b. The quantity of the explosive.
- c. Any special degree of sensitivity or other pertinent information concerning its hazard.
- d. Package which contains the waste must be marked for destruction.
- e. The name, telephone number of the generator and a chargeable account.
- f. Any disposal of waste materials which is not covered in this procedure because of reactivity or sensitivity must be covered by a Chemistry Job Summary or an Operational Safety Procedure (OSP) which must have Hazards Control approval.

3. Methods of Disposal

Explosives that burn without detonation are burned unless cased or in very large pieces. The general burn operations in the Building 829 area are covered in Section IV-A of this report. Specific operations of each of the Pit areas and furnace at Building 829 will be covered.

Burn Pit #1

1. Burn Pit #1 (See Figure 9) is to be used for the burning of explosives contaminated combustible waste.
2. Obtain five gallon can of fuel oil and small amount of excelsior from storage. Saturate excelsior and waste with fuel oil.
3. The Explosive Technician-in-Charge will confirm the integrity of the squib firing system.
4. Obtain two squibs from the magazine.

5. Connect squibs to firing leads.
 6. Place squibs in the excelsior blanket.
 7. Proceed as outlined in General Operations (Section III-A) and fire squibs.
- b. Burn Pit #2
1. Allowable explosives for Burn Pit #2 (Figure 9) are H.E. Chemistry explosive wastes that are expected to burn unconfined without detonating. The total quantity of explosives in the pit is usually less than 0.1 Kg.
 2. Explosive waste in containers generated from the Livermore Explosive Chemistry (explosives in water) will be transported immediately to the explosives burn area or to Building 818 if the burn area is closed.
 3. Explosive waste cans will be emptied as soon as possible into Pit #2.
 4. Burn Pit #2 has two separate areas that are defined by four-inch high metal frames. These burn pits will be used alternately. Stepping inside the burn areas is not permitted.
 5. Place a 150mm thick blanket of excelsior or other approved igniter material in burn area.
 6. Pour wet explosive mixture and contaminated waste onto excelsior in the burn area.
 7. The pit will be checked daily to determine the condition of the waste material.
 8. When the waste is dry, perform the burning operations according to paragraphs 3 through 7 in the Burn Pit #1 instructions (Section VI.3a).

d. High Explosive Furnace

1. This furnace is capable of burning wet machine cuttings of explosives and classified parts containing small amounts of explosives. Complete combustion can be accomplished in about two hours.
2. The Explosive Technician-in-Charge will lock out the power supply to the burner at the control shelter and retain the key.
3. The furnace fuel supply should be checked and have a minimum 1/4 tank before a burn begins.
4. Explosives will be unloaded and placed on the grate of the furnace. Care must be taken to leave some air space between bags of the machine cuttings. Not over 11 Kg of explosives will be burned at one time.
5. Follow the procedures covered in the General Operations (Section III-A). Adjust timer to allow a two hour burn.

e. Detonation

Explosives that may detonate during burning and cased explosives of any type including detonators and large pieces of explosives are detonated at a firing bunker (usually Building 851). Classified parts, inert or otherwise, may be officially destroyed when contained in a shot of this type. Disposal shots of cased explosives, primary explosives, detonators, LLNL Type X and individual pieces over 1 Kg are assembled by Explosive Technicians and then detonated. The details of firing shot procedures are available in Reference 3.

f. Solvent Immersion

Explosive components of LLNL Type C detonator switch with exposed explosive and other allowable explosives in small quantities can be dissolved in a suitable solvent. This work may be done at any Process Area Explosive Facility. The following procedures are to be followed:

1. No more than five detonators will be placed in a stainless steel container and covered with about 5 cm of acetone.
2. Detonators will be soaked until all explosives have been dissolved. A brush can be used to wipe explosives to accelerate the dissolving.
3. When the explosive is completely dissolved, the metal parts will be removed and rinsed with a small portion of acetone.
4. It is sometimes necessary to dissolve explosive components of various assemblies. These may be immersed, dipped or brushed with acetone as necessary. Any operation involving more than 0.01 Kg of explosives shall require a Special Operational Safety Procedure approved by Hazards Control.
5. The acetone/explosive mix will be transported to the disposal area in polyethylene bottles and poured onto excelsior in the Burn Pit #2 for scheduled burning.

g. General Packaging Requirements

1. Explosives are collected in special waste containers. These covered containers (rubber covers for machining wastes) are painted orange with the label "EXPLOSIVES" in red letters on a white band.
2. Larger pieces of scrap explosives (0.9 Kg) are wrapped and placed in explosives transportation containers.

3. The Supervisor of Building 810 should be contacted for instructions on disposal of cased explosives. Cased explosives are not to be placed in Explosive Scrap cans. Detonators are packaged separately.
4. All containers must be labeled as to its contents. Explosives should be identified as to LLNL type and compatibility group, weight and any special instructions about material sensitivity or toxicity.
5. Pickup or delivery of this waste will only be done by an Explosive Technician.
6. Combustible waste material such as wrapping paper, paper bags, cartons, etc., which are visibly contaminated with explosives may be deposited only in approved waste cans (30 gallon steel can and lid painted orange with red letters on white band stenciled "Combustible Waste Explosives Contaminated").
7. Noncombustible waste contaminated with explosives such as tool bits, metal parts, etc. shall be placed in approved waste containers. (Standard 30 gallon steel cans and lid painted orange with white letters on black band stenciled "Explosives Contaminated Noncombustible."
8. Such waste material must be decontaminated as much as possible before disposing in the East or West landfills.

B. URANIUM AND BERYLLIUM DISPOSAL METHODS

The largest volume of hazardous waste generated at Site 300 falls into this category primarily from the firing table debris. As mentioned in Section III-B, this waste amounts to about 850 Kg of Uranium-238 (depleted : D-38) and 125 Kg of beryllium in debris that occupies approximately 1600 m³ and weighs 7.1×10^7 Kg. Other items contaminated with D-38 and beryllium such as shoe covers, paper wipes, etc. are also disposed of on-site, but their volume is negligible compared to the firing table debris.

The following procedures are to be followed when working on the firing table:

1. All firing tables are considered contaminated areas except during the time between gravel change and the first detonation containing radioactive materials or beryllium. Since only parts of the table may be changed each time, there may be contaminated sections of the table remaining. Facility Supervisors should, therefore, be aware where people will be on the table so that appropriate protective action can be taken.
2. All equipment which has become contaminated with firing table material shall be washed down before leaving the firing areas. Earth moving equipment which will not be removed from Site 300 need not be tagged or checked by Hazards Control after it is washed down or until it is shipped off-site.
3. Protective clothing, coveralls or coats that generate static electricity shall not be worn by personnel handling any electrical sensitive explosives or components.
4. All personnel working on a contaminated firing table must wear contamination control protective footwear. A supply of plastic shoe covers shall be maintained at all firing facilities for those who are not wearing the LLNL issued protective footwear.
5. All personnel working on a contaminated firing table where significant amounts of gravel are moved or distributed must wear protective clothing which includes underwear, socks and coveralls. The principal hazard on the firing tables is from radioactive or beryllium dusts left from a shot. Whenever a person must contact the table soil with his clothing or performs an operation which suspends visible dust, protective clothing and respirators are required.

6. The criteria used for firing table gravel changes and disposal is covered in Section III-B of this report.
7. Before firing table gravel is to be moved and disposed of, personnel on the table must wear protective clothing. Visitors and unnecessary persons are not allowed on the table during gravel moving. Firing tables must be thoroughly watered down prior to work involving the gravel movement. If the operation results in dust suspension, respiratory protection is required.
8. Only depleted uranium, beryllium and thorium are permitted in the landfills at Site 300.

The operational controls used at the landfills to limit the quantity of hazardous waste present at any given time were derived using guidelines established by the NRC (Title 10, Part 20.304). The restrictions are that: (1) The total quantity of radioactive materials buried at any one location and time not exceed 1,000 times the amount specified in Appendix C; (2) Burial is at a minimum depth of four feet and (3) Successive burials are separated by distances of at least six feet and not more than 12 burials are made in any year.

Appendix C of this regulation does not specify depleted uranium but does list natural uranium at 100 microcuries. This would allow the disposal of 0.1 curie of natural uranium in any given location. Since depleted uranium is less radioactive than natural uranium, it would be a good conservative index to use this guideline for determining the quantity of depleted uranium that should be disposed of in a given location. One tenth of a curie of U-238 approximately 300 Kg. Therefore, only 300 Kg of D-38 is to be disposed of in any given location at the landfills.

C. ANALYTICAL CHEMICAL DISPOSAL METHODS

The chemistry areas at Site 300 generate a small volume of chemical waste which is produced either as an intentional or unintentional product or by-product of the research process. A waste disposal program is to recognize all potential waste sources, designate specific handling and disposal procedures and identify waste control measures. This section of the report addresses waste handling and disposal procedures to be followed for analytical chemical waste. All chemical waste types, once they have been properly characterized and packaged, is shipped to LLNL for processing.

Small Volume Chemical Waste

- o The generator of the chemical waste is responsible for the proper characterization, handling and packaging of chemical waste. The Hazards Control Department or the Toxic Waste Control Group will provide the necessary assistance to the generator in order to accomplish this task.
- o The waste generator shall first determine the nature of the chemical waste which is easily accomplished if the compound is known. For waste compatibility reasons the waste must be classified into one of the following five categories:
 - Oxidizers
 - ~~Water Reactive~~
 - Corrosive
 - Flammability
 - Explosive

Questions concerning these categories can be clarified by the TWC Group.

- o Compatible chemicals in small containers (less than 4 liters) are to be packaged in lard cans surrounded by an inert, moisture absorbing material such as dry-sorb, vermiculite, etc.
- o The chemicals contained within the lard can should be identified individually on the Hazardous Waste Identification Sheet shown in Figure 28. After the lard can has been closed, it should be taped with

the identification sheet placed in a plastic envelope and taped to the outside of the container.

- o Lard cans containing compatible waste chemicals should be placed in a 55-gallon DOT 17H drum supplied by the Toxic Waste Control Group with the void spaces filled with cushioning material to prevent movement. Chemicals that are in one lard can must be compatible with the other lard cans within the same 55-gallon drum.
- o A summary of the drum's contents shall be attached to the outside of the 55-gallon drum using both the CMID Tag (Figures 26 and 27) and the Waste Identification Sheet (Figure 28).
- o Coordination of pickup of the waste will be done through the Hazards Control Department or the Toxic Waste Control Group.
- o The movement/tracking of this waste will be entered on the Toxic Waste Control's computer system.

Larger Volume of Chemical Waste

Larger volumes of chemical wastes are typically generated from industrial type systems such as acid dip tanks. However, there are situations which will require larger volumes (greater than 4 liters) of waste to be disposed of. The procedures to be followed in these cases are:

- o The generator is to obtain a Bung-hole 55-gallon drum from the Toxic Waste Control Group after describing the type of waste that will be placed inside it. The steel 55-gallon drum that have bungs are DOT17E with a 4 mil. epoxy coating on the inside. Corrosive materials such as acids and caustics should not be placed in these drums. Permissible compounds are solvents, fuels, oils, etc. Corrosive material should be placed in DOT 6D/2S bung hole drum that has the plastic liner and plastic bungs. Advice and selection of container can be obtained from the Toxic Waste Control Group.
- o Once the generator determines that a 55-gallon drum is to be used for a certain classification of waste, the Waste Identification Sheet (Figure 28) should explicitly state so. The following classifications should be established for each 55-gallon drum:

- Oils (DOT 17E Drum)
- Halogenated Solvents (DOT 17E Drum)
- Nonhalogenated Solvents (DOT 17E Drum)
- Acids (DOT 6D/2S Drum)
- Caustics (DOT 6D/2S Drum)
- Aqueous Based, Noncorrosive Waste (DOT 17E Drum)

Only compatible chemicals falling into one of these classifications are allowed in any drum.

- o Every addition of a waste to a drum should be logged in on the Waste Identification Sheet. DO NOT FILL THE DRUM FULL - ALLOW AN ULLAGE OF 6 INCHES FROM THE TOP OF THE BUNGS.
- o After the drum is full, the generator is to pull a sample according to the Site 300 Waste Analysis Plan (detailed information can be obtained from the Toxic Waste Control Group). The following analysis is required for the drum in addition to the information contained on the Waste Identification Sheet:

- Oils: Flash Point
- Halogenated Solvents: Information on ID Sheet Only
- Nonhalogenated Solvents: Information on ID Sheet Only
- Acids: pH Determination
- Caustics: pH Determination

The flashpoint is needed only to determine the waste's characterization in three categories: below 100°F - flammable; above 100°F but below 140°F - ignitable; above 140°F but below 200°F - combustible.

- o RADIOACTIVE LIQUID WASTE IS NOT TO BE PLACED IN ANY OF THE DRUMS. Special cases where radioactive liquid wastes are generated shall be managed - according to a case-by-case basis after consultation with the Hazards Control Department and the Toxic Waste Control Group.

D. INDUSTRIAL WASTE DISPOSAL METHODS

All industrial-type hazardous waste disposal requirements shall be managed by the Toxic Waste Control Group at LLNL. A representative from this group is permanently assigned to Site 300. Industrial hazardous waste and waste contaminated with explosives, radioactive materials and beryllium should be kept separate. If this is not possible the waste generating operation must be reviewed by Hazards Control and the Toxic Waste Control Group.

The primary industrial waste streams are spent acid dip tank solutions (nitric, phosphoric and chromic acids), caustic dip tanks (sodium hydroxide solutions) and solvent waste streams (trichloroethylene, trichloroethane, freons, etc.).

The following procedures are to be followed when hazardous waste of this type is generated:

- o The generator is to characterize the waste as outlined in Section III of this plan. The Toxic Waste Control Group will pump out or remove the hazardous waste directly from the point of generation if the following two conditions are met:
 - 1. Waste is contained in a system or tank that is not mobile (examples, nonmovable retention tanks, tied down dip tanks, etc.).
 - 2. Waste is contained in a system that is not a piece of equipment such as electrical transformers, milling machines and other machinery.
- o After the generator of the waste has characterized the waste, the LLNL Liquid Waste Treatment Facility should be notified (Ext. 2-9766) and a removal time scheduled.
- o The TWC Group will respond with the necessary pumps, specification containers, etc. according to the needs of the hazardous waste to be removed.

- o The TWC Group and anyone assisting the operation will wear protective clothing, respirators, gloves, face shields, etc. as required by the Hazards Control Department.
- o After the waste removal operation is complete, the TWC Group will fill out all necessary paperwork (such as the DOT shipping papers) to transport this waste to LLNL for processing.
- o The TWC Group shall be responsible for placing all proper DOT labels, markings, placarding, etc. on the containers and vehicle for proper transport. The containers holding this waste shall be DOT approved and secured in such a manner to prevent shifting of contents during transport.
- o Containers already filled by individuals other than the TWC personnel shall be transported to LLNL via the Transportation Department or the Materials Management Group. All DOT regulations (Title 49 Code of Federal Register) shall be followed. The waste shall be entered on the TWC's computer system for tracking.

E. DISPOSAL OF LLNL WASTES AT SITE 300

It is sometimes necessary to ship waste from LLNL to Site 300 for the treatment and/or disposal of the material. The only waste types that are authorized to be shipped are certain explosives, classified items containing explosive material, firing shot debris similar to the firing table debris generated at Site 300 and a limited amount of friction sensitive, shock sensitive or highly reactive chemicals. This latter category of waste requires a Special Operational Procedure which is approved by the Toxic Waste Control Group Leader, the Hazards Control Department Field Team Leader, the professional safety team members (Industrial Hygiene, Fire Safety, Explosive Safety, Environmental Analyst and the Industrial Safety members) and the Manager at Site 300.

The following procedures are to be followed for the disposal of LLNL waste at Site 300:

- o Waste that is to be destroyed by burning must be packaged separately from that intended for detonation. If a question arises as to how this determination is to be made refer to Sections III and IV or contact the Building 810 supervisor (Ext. 112-270 or 112-368).
- o Each package must be labeled as containing explosives and the classification.
- o Classified parts must have both the Controlled Material ID Tag and the classified parts documentation.
- o Items must be identified and packaged in such a way as to require minimal handling or inspection upon arrival.
- o The Toxic Waste Control Group should be notified before the shipment occurs to verify that the waste is properly identified and recorded on their records (Ext. 2-1925).
- o Shipments are to be addressed to the Explosives Process Area Coordinator, T-44, Site 300 (Ext. 112-255). The coordinator is to be notified before the waste is shipped.
- o The transportation of this material shall be in compliance with all applicable DOE and DOT regulations.

F. ENVIRONMENTAL MONITORING PROGRAM

The environmental monitoring program at Site 300 is a continuing LLNL surveillance program run by the Environmental Evaluations Group in the Hazards Control Department. The sampling program consists of the routine collection of air, water, vegetation and soil samples. The samples are analyzed for radioactivity and beryllium and their locations are shown on the topographical map attached to this report. The complete monitoring program is described in detail in Reference 13.

The air filters are collected and analyzed on a monthly basis whereas the water and soil samples are collected and analyzed annually. The 10 air

samplers at Site 300 use Whatman-41 cellulose filters ($5.2 \times 10^{-2} \text{m}^2$). The filters are cut in half, and half of each filter is retained for beryllium analysis. The other half is used for radioactive analysis.

Soil samples are collected to a depth of 5 cm and are dried, ground, blended, and analyzed for radioactivity. Since the work at Site 300 involves the use of depleted uranium, analysis is made to determine how the Site's test work perturbs the $^{235}\text{U}/^{238}\text{U}$ ratio of the soil. Isotopic uranium measurements are made with isotopic-dilution mass spectrometry. The isotopic uranium data is covered in Reference 13.

Site 300 water samples are collected from on-site wells (Locations 1-6), an off-site creek and two off-site wells. Location 20 is Site 300 rainwater and Location 21 is a spring fed pond near Bunker 812. The samples are analyzed for gross alpha, beta radioactivity and tritium. Because of the low tritium activities, it is necessary to distill and electrolytically enrich the samples before liquid-scintillation counting.

Each month, vegetation samples (usually native grasses) are collected at site 300 as shown in the attached map. These samples are freeze-dried, and the tritium radioactivity in the recovered water is determined by liquid scintillation counting.

Beginning in 1977, as a means of evaluating the possible impact of the Laboratory on locally grown foodstuff, the tritium content of Livermore Valley wines was measured and compared with that found in other California wines and European wines. Samples of honey and goat milk are also collected from various areas in the valley and analyzed for tritium.

G. DECONTAMINATION PROCEDURES

Figure 29 shows the layout for Building 819 which is utilized for pesticide mixing and the final decontamination of parts, machinery and equipment that has been in contact with explosives.

The following procedures and controls shall be followed when this facility is in operation:

1. All contaminated parts, equipment, machinery or vehicles must enter from the north side of the building.
2. Other than explosives contaminated material, no explosives are allowed in the building.
3. All decontaminated equipment must be inspected by Hazards Control and be properly tagged before leaving Building 819 unless it is going directly to an explosives area at Site 300.
4. No contaminated parts are permitted in Rooms 101 and 102.
5. Explosives contaminated parts are permitted only in approved and posted areas of the building.
6. Radioactive materials are either restricted or prohibited (See Reference 3) and requires a Special Operational Safety Procedure for their presence within the facility.
7. No pesticides will be stored in Building 819. Only the amount to be mixed in the closed system is permitted in the building.
8. All visible pieces of explosives must be removed before the part is brought to Building 819.
9. The building's supervisor or his designated alternate must be notified prior to the delivery of the contaminated material.
10. Items are decontaminated by washing with hot soapy water which is not recirculated. Nonmetallic brushes and cloth rags may be used to aid in cleaning. Acetone may be used in the breezeway if a solvent is required. Steam cleaning is permissible provided the steam pressure does not exceed 15 psi.

11. Qualified Maintenance Machinists may disassemble and decontaminate vacuum pumps, Stokes gages and vacuum traps. All other decontamination must be done by or in the presence of a qualified Explosives Technician.
12. Oil removed from pumps must not be disposed of in the building drains. Procedures outlined in Section VI.A of this report must be followed.
13. Vehicles are not to be parked on the concrete ramp except for decontamination wash down.
14. After the job is completed, the entire work area must be cleaned before leaving the building.

Pesticide Handling

1. All the mixed pesticides and rinse water shall be used in the field. Rinse water and waste pesticide cannot be drained into the pond without a permit from the State Water Quality Control Board.
2. Empty pesticide containers shall be disposed of at the Corral Hollow landfill after inspection by the County Agricultural Inspector who will inspect the containers at Site 300.
3. All employees handling pesticides shall be trained in their safe handling.

Personnel Controls

1. LLNL issued safety shoes or shoe covers shall be worn when explosives contamination is present.
2. Smoking and the consumption of beverages and food will not be permitted in the building.
3. All matches and spark producing instruments shall be deposited in the box at the entrance gate prior to entering the area.

4. All employees must wear eye protection while working in the area.
5. Organic vapor respirators and rubber gloves shall be worn if solvents are used in the breezeway.
6. Pesticide cartridge handling respirators and natural rubber gloves shall be worn when working with pesticides.
7. At least one person responsible to the pesticide operations shall hold a valid state agricultural pest control advisor license.

Cleaning Operation for Explosive Waste Clarifiers

The following procedures are to be followed when the explosive waste clarifiers are cleaned:

1. Explosive sediment shall be drawn off a minimum of once weekly.
2. The clarifiers shall be drained and cleaned at least once a year.
3. The maximum number of personnel shall be two, one of whom shall be a qualified Explosives Technician.
4. The minimum number of personnel shall be two, one of whom shall be a qualified Explosives Technician.
5. Remove trash basket at the top of the clarifier and dump contents into the specially issued container.
6. Remove solids in the bottom of the cone by manipulating the shut off valve and using a pincer clamp. A wooden or aluminum rod may be used to loosen the cake. Do not bang rod against sidewalls of the clarifier. The solids are to be collected in the special containers fitted with filter bags sitting in the drip can. No more than approximately 25 pounds of explosives are to be placed in individual filter bags.

7. The residue in the filter bag is drained into the special container until excess water is removed (approximately 6 hours) and no later than the end of the working day. Clean any spilled explosives from the concrete pad.
8. The filter bag containing the residue is then removed from the container, and the filter bag contents placed in a drip proof container for transporting to the explosives disposal area (Building 829).
9. The clarifier area is to be cleaned of explosives prior to securing operations.
10. At the explosives disposal area (Building 829), the filter bag and contents are to be placed on the explosive furnace and burned the same day.
11. The drip proof containers shall be cleaned of explosives at Building 819.

H. FACILITY CLOSURE

There are no plans or anticipation of closing this facility within the next five years.

I. PERSONNEL

All Site 300 explosives facilities are under the supervision of a responsible Site 300 person who must assure LLNL Management that any operation done at that facility follows proper procedures and that all work is done by qualified personnel.

Because of the diversity of the research work being done at Site 300, it is not realistic to have every individual thoroughly familiar with the changes in operating and safety procedures, or have an in-depth knowledge of all the characteristics of explosives. The experimenter should primarily be concerned with the technical aspects and identify potential problem areas of the test or experiment and not participate in the actual work on the explosives. Therefore, no H.E. qualification or training is explicitly required. However, any experimenter's parent department may have additional requirements for their personnel.

It is Site 300's policy that "hands-on" explosive work is done only by qualified Site 300 personnel. The only exceptions to this are in Radiography and Chemistry. The Radiography Group personnel are trained and qualified in the same manner as Site 300 personnel. The Chemistry Department operates the H.E. facilities and considering that the H.E. chemists are the most knowledgeable, qualified personnel, they are permitted to do hands-on work with explosives. A list of qualified Chemistry personnel for Site 300 is maintained by the Chemistry Department, and documentation and qualification records are kept in Livermore.

Qualifications for explosives work in one building or area of the Site does not necessarily extend to other buildings or areas.

There are occasions when unqualified personnel are allowed to assist in work on explosives. However, a qualified technician must be present and is considered to be in charge of the operation. Training is primarily "on-the-job" training under the guidance of a qualified employee.

The training record shown in Figure 30 is completed for each employee who will be using explosives by their Supervisor. The Supervisor reviews the training plan with Hazards Control Explosives Safety before training begins to assure agreement on what constitutes adequate training for qualification. The Supervisor uses the form to summarize the on-the-job training, appropriate training courses and other training experience which serve to qualify the employee. Training courses are available through the Hazards Control Department to assist the Supervisor in providing some of this training.

Before an employee is evaluated as a qualified H.E. handler, their Department Representative must countersign and forward the form to Hazards Control Explosives Safety for their approval. A member of the Explosive Safety Group will then meet with the employee to discuss hazards and safety requirements associated with the job and sign the form in concurrence if no problem areas are noted. This completes the requirements for designating the employee as an explosives user. Hazards Control distributes copies of the completed qualification record and keeps the original on file.

An annual review of each person's qualifications and work assignment shall be made by the Supervisor to ensure that the person is still capable of performing the operations indicated on the Training Qualification Record. In addition, recent changes in pertinent procedures and other safety matters of concern to the supervisor or the employee are to be discussed. This review is recorded on the Explosives Users' Qualification Review (Figure 31).

The Supervisor is not to permit any employee to continue working with explosives if he is unable to perform his job safely.

Functional Job Titles for Explosive Users

1. Explosive Vehicle Operator
2. Explosives Shipping and Receiving Specialist
3. Explosives Technician
4. Explosives Environmental Test Technicians
5. Explosives Process Area Coordinator
6. Explosives Radiography Technician
7. Explosives Machinist
8. Explosives Machinist Helper
9. Explosives Chemistry Technician
10. Firing Facility Operator
11. Firing Facility Laborer

Toxic Waste Control Group Training

Waste explosives or waste contaminated with explosives are handled and destroyed by Site 300 personnel. Nonexplosive hazardous waste is processed by the Toxic Waste Control Group personnel. These waste types are the chemical and industrial wastes which have been described earlier in this report. The training records of the individuals in this group are summarized in Appendix A.

The bulk of these courses are offered by the Hazards Control Department at the request of the TWC Group Leader. However, a structured hazardous waste training program is being put together covering the following areas:

- Chemical Waste Compatibilities
- Reactivities of Chemical Wastes
- Regulations Concerning Hazardous Wastes (DOE/DOT/EPA/
California Department of Health Services)
- Handling Radioactive Wastes
- Hazardous Waste Sampling Procedures and Analysis

These areas will specifically address the problems encountered with hazardous waste with special interest on chemical reactions and consolidation of chemicals.

VII. CONTINGENCY PLAN

A Contingency Plan for the Hazardous Waste Operations at LLNL has been written and is listed in Reference 14.

VIII. ENVIRONMENTAL CONTROL PERMITS

The environmental control permits that Site 300 currently is operating under are:

A. San Joaquin County Air Pollution Control District.

1. AP75-105 and AP80-102 gasoline storage and vapor recovery.
2. AP80-103 Spray Paint Booths.
3. AP80-104 to -113 Boilers.

B. California Regional Water Quality Control Board, Central Valley Region.

1. 80-183 Liquid Industrial Waste Discharges.
2. 80-184 Solid Waste Landfills.

IX. RECORDS AND REPORTS

The volumes and weights of hazardous waste sent to the landfills from the firing tables are recorded monthly by the Hazards Control Department and compiled by the Toxic Waste Control Group quarterly. These quarterly compilations are sent to the DOE as part of their Solid Waste Information Management System (SWIMS) for recording the quantity of radioactive material disposed of. The quantity of beryllium disposed of in the landfills is recorded but not compiled.

The quantity of high explosives and explosives contaminated waste disposed of in the Building 829 area is recorded in a log book and maintained by building personnel. The type of information recorded is covered in Section VI.A of this report.

Hazardous waste which is shipped from Site 300 to LLNL for processing must have a Controlled Material ID (CMID) Tag attached to it which provides details of the quantity and nature of waste transported. Both an internal document number and the CMID Tag number along with a description of the waste, quantity, date of generation and receipt, generators name, location and any other pertinent information is entered on the Toxic Waste Control Computer tracking system. (The computer is a PDP-10). Shipments of this sort are entirely coordinated through this group and any discrepancies between the quantity generated and the quantity received at LLNL can be quickly tracked down. Hazardous waste shipments from Site 300 to any place other than the Livermore Site (Toxic Waste Control Group) are prohibited.

REFERENCES

1. LLNL Health and Safety Manual.
2. Johnson, J. S. "Lawrence Livermore Laboratory's Beryllium Control Program for High-Explosive Test Firing Bunkers and Tables," UCID 18006, Rev. 1, November, 1980.
3. Site 300 Safety and Operational Manual.
4. Dobratz, B. M., "LLNL Explosives Handbook. Properties of Chemical Explosives and Explosive Simulants."
5. U. S. Department of Health, Education and Welfare, "Radiological Health Handbook," January, 1970.
6. Los Alamos Handbook of Radiation Monitoring, Los Alamos Scientific Laboratory, 1970, LA-4400.
7. Verbal Communication, August, 1980, Arthur Toy.
8. Verbal Communication, August, 1981, Tore Straume.
9. Eastman Kodak Company, "Chemical Composition of Photographic Processing Solutions," Publication No. J-47, 1975.
10. LLNL Health and Safety Manual, "Safe Handling, Storage and Disposal of Polychlorinated Biphenyl Oils (PCB's), Supplement 21.17, Rev. December 1, 1980.
11. Verbal Communication, August, 1981, H. J. Mise.
12. Extracted from M. Desouky's work on Chemical Compatibilities, Unpublished List, August, 1981.

13. Toy, A. J., et al., "Environmental Monitoring at the Lawrence Livermore National Laboratory: 1980 Annual Report," UCRL-50027-80, April 15, 1981.
14. Auyong, M., "Contingency Plan for the Lawrence Livermore National Laboratory Site 300 Hazardous Waste Operations," September, 1981.

FRANKS, GUYLE K

APPENDIX A

OFFSITE TRAINING:

12/07/79 HAZARDOUS/TOXIC WASTE DISPOSAL 16 HRS LION TECHNOLOGY
March, 1980 DOT Hazardous Material Shipping - Sponsored by DOE/DOT

LEWIS, JAMES S

EDUCATIONAL AIDS PROGRAM:

1979 SU COL OF NOTRE DAME UG

PEPKINS, CAROL L

EDUCATIONAL AIDS PROGRAM:

1980 SP CHABOT UG MATH X
1980 W CHABOT UG MATH X

OFFSITE TRAINING:

10/26/79 FUNDAMENTALS OF OCCUPATIONAL SAFETY 40 HRS NATIONAL SAFETY COUNCIL

ROBERTS, RUSSELL S

EDUCATIONAL AIDS PROGRAM:

1980 W USF G ECOSCIENCE 250
CONVERSION TECHNOLOGIES 251
GROUP RESEARCH 252A

OFFSITE TRAINING:

03/07/80 MGT & DISPOSAL OF HAZARDOUS & CHEM WASTES 16 HRS J T BAKER CHEMICAL
March, 1980 DOT Hazardous Material Shipping - Sponsored by DOE/DOT
November, 1979 Handling Hazardous Materials and Wastes - Sponsored by the Operations
Council of American Training Association, Inc.

HAYES, MICHAEL N

OFFSITE TRAINING:

9/8-11/81 Hazardous Material Transportation - Sponsored by DOE/LLNL

SEDILLO, EDWIN M.

OFFSITE TRAINING:

9/8-11/81 Hazardous Material Transportation - Sponsored by DOE/LLNL

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
CARLSON, CHRIS L	HS8003	HAZARDS CONTROL ORIENTATION	04/23/80
	HS8005TT	SAFETY & RISK MANAGEMENT	02/29/80
	HS8164	CARDIOPULMONARY RESUSCITATION	05/09/80
	HS8165	CPR RETRAINING	05/29/81
	HS8168	FIRE EXTINGUISHERS	03/18/80
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8410TT	ADV. H&S INDUST VENTILATION	07/08/80
	HS8415TT	CONFINED SPACE HAZARDS	08/12/80
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	08/26/80
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8438TT	ADV H&S PREC LABELING	08/12/80
	HS8442TT	ADV H&S RESP PROTEC	05/27/80
	HS8463	SCOTT AIR PAK	03/13/80
	HS8520	LASER SAFETY	03/13/80
	HS8550	SEISMIC SAFETY TRAINING	04/28/80
	HS8563	INCIDENTAL CRANE OPERATOR	02/28/80
	HS8563	INCIDENTAL CRANE OPERATOR	11/03/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8601	RADIATION SAFETY ORIENT. TION	04/03/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	02/24/81
	HS8605TT	ADV H&S HJ ACT ALPHA FISS PROD	06/19/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/10/81
	HS8614TT	ADV H&S RAD SOURCE/ISOTOPIC	04/23/81
	HS8616TT	ADV H&S RAD SOURCE/X-RAY	04/28/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/12/81
	HS8626TT	ADV H&S SHIELDING	05/12/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/10/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8660	RADIATION DET'N INSTRUMENTS	03/20/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81
	PS9000	START ORIENTATION	02/11/80
	SC9500	PRINCIPAL SECURITY LECTURE	07/10/80

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
ELLIOTT, VICTOR L	ED7908A	CAREER PLANNING-ORIENTATION	11/03/80
	ED7908A	CAREER PLANNING-ORIENTATION	02/02/81
	ED7908G	CAREER/LIFE PLANNING WORKSHOP	03/06/81
	HS8003	HAZARDS CONTROL ORIENTATION	04/23/80
	HS8030TT	SAFETY OVERVIEW	05/13/80
	HS8168	FIRE EXTINGUISHERS	06/26/80
	HS8201TTA	ADV H&S EXP SAFE ORIENT	01/27/81
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8415TT	CONFINED SPACE HAZARDS	08/12/80
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	08/26/80
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8438TT	ADV H&S PREC LABELING	08/12/80
	HS8442TT	ADV H&S RESP PROTEC	05/27/80
	HS8463	SCOTT AIR PAK	03/13/80
	HS8590TT	INDUSTRIAL SAFETY OVERVIEW	09/09/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8596TT	WORKING AT HEIGHTS & OVERAA	12/ 9/80
	HS8601	RADIATION SAFETY ORIENTATION	06/18/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	03/06/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACTOR	03/10/81
	HS8614TT	ADV H&S RAD SOURCE/ISOTOPIC	05/08/81
	HS8616TT	ADV H&S RAD SOURCE/X-RAY	05/08/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/10/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8660	RADIATION DET'N INSTRUMENTS	07/29/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81
	PS9000	START ORIENTATION	02/04/80
	SC9500	PRINCIPAL SECURITY LECTURE	01/31/80
	SC9500	PRINCIPAL SECURITY LECTURE	02/07/80

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
HAYES, MICHAEL N	HS8003	HAZARDS CONTROL ORIENTATION	12/03/79
	HS8030TT	SAFETY OVERVIEW	05/13/80
	HS8050TT	OFF-SHIFT OPERATIONS OVERVIEW	10/09/79
	HS8110TT	SELF INSPECTION PROGRAM	01/08/80
	HS8112TTA	ADV H&S FIRE PROT/SPRINKLERS	11/13/79
	HS8112TTA	ADV H&S FIRE PROT/SPRINKLERS	11/27/79
	HS8114TT	ADV H&S EMERGENCY PLANNING	12/11/79
	HS8116TT	ADV H&S EVACUATION	12/11/79
	HS8118TT	ADV H&S EXITS	01/08/80
	HS8120TT	ADV H&S FIRE HAZARDS	01/08/80
	HS8201TTA	ADV H&S EXP SAFE ORIENT	01/27/81
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8420TT	HANDLING CHEM CARCINOGENS	11/07/79
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	08/26/80
	HS8426	ALKALI METALS	04/29/81
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8442TT	ADV H&S RESP PROTEC	12/06/79
	HS8442TT	ADV H&S RESP PROTEC	05/27/80
	HS8463	SCOTT AIR PAK	10/25/79
	HS8463	SCOTT AIR PAK	03/26/80
	HS8463	SCOTT AIR PAK	10/10/80
	HS8561	FORK TRUCK OPERATOR	10/28/80
	HS8563	INCIDENTAL CRANE OPERATOR	02/28/80
	HS8590TT	INDUSTRIAL SAFETY OVERVIEW	09/09/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8601	RADIATION SAFETY ORIENTATION	06/18/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	03/06/81
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	09/25/79
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	06/19/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/20/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/22/81
	HS8626TT	ADV H&S SHIELDING	05/22/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/20/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8650TT	ADV H&S DECONTAMINATION TECH	09/25/79
	HS8660	RADIATION DETCT'N INSTRUMENTS	07/29/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	03/06/81
	PS9000	START ORIENTATION	09/06/79
	SC9500	PRINCIPAL SECURITY LECTURE	04/03/80
	SC9510	ADMIN. ESCORT BRIEFING	05/12/80

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
HENRY, RICHARD K	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	02/24/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/10/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/12/81
	HS8626TT	ADV H&S SHIELDING	05/12/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/10/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	03/24/81
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	03/24/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81
	PS9000	START ORIENTATION	01/05/81

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
JESSIE, BILLY R	ED7908A	CP-ORIENTATION	11/03/80
	HS8005TT	SAFETY & RISK MANAGEMENT	02/29/80
	HS8110TT	SELF INSPECTION PROGRAM	01/08/80
	HS8112TTA	ADV H&S FIRE PROT/SPRINKLERS	11/13/79
	HS8112TTA	ADV H&S FIRE PROT/SPRINKLERS	11/27/79
	HS8114TT	ADV H&S EMERG PLANNING	12/11/79
	HS8116TT	ADV H&S EVACUATION	12/11/79
	HS8118TT	ADV H&S EXITS	01/08/80
	HS8120TT	ADV H&S FIRE HAZARDS	01/08/80
	HS8162	FIRST AID(MULTIMEDIA)	11/16/78
	HS8164	CARDIOPULMONARY RESUSCITATION	02/16/79
	HS8168	FIRE EXTINGUISHERS	10/11/78
	HS8201	EXPLOSIVE SAFETY ORIENTATION	02/15/79
	HS8201TTB	ADV H&S EXP SAFE PRACT	04/10/79
	HS8260	ELECTROEXPLOSIVE DEV SAFETY	02/22/79
	HS8261	ELECTROEXPLOSIVE DEV SFTY LAB	02/22/79
	HS8400TT	ADV H&S AIR FILTER CHNG PROCED	10/27/78
	HS8410TT	ADV. H&S INDUST VENTILATION	10/24/78
	HS8420TT	HANDLING CHEM CARCINOGENS	11/28/78
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	09/26/78
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	11/07/78
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	10/10/78
	HS8436TT	ADV H&S INDUST NOISE	10/10/78
	HS8438TT	ADV H&S PREC LABELING	11/07/78
	HS8442TT	ADV H&S RESP PROTEC	09/12/78
	HS8463	SCOTT AIR PAK	10/10/78
	HS8463	SCOTT AIR PAK	07/15/80
	HS8503TT	ADV H&S COMPRESSED GASES	01/09/79
	HS8520	LASER SAFETY	09/28/78
	HS8520TT	ADV H&S LASER SAFETY	01/30/79
	HS8521	CAPACITOR SAFETY	11/14/78
	HS8550TT	ADV H&S MATERIALS HANDLING	02/27/79
	HS8561	FORK TRUCK OPERATOR	10/26/79
	HS8564TT	ADV H&S MACHINE TOOL OPER	02/13/79
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	05/22/79
	HS8602TT	ADV H&S CRITICALITY SAFETY	07/31/79
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	09/25/79
	HS8607	X-RAY SAFETY	10/27/78
	HS8610	RADIATION SAFETY	04/24/79
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	05/08/79
	HS8621	MT. CERT. PROGRAM	09/05/79
	HS8626TT	ADV H&S SHIELDING	07/17/79
	HS8628TT	STREAMING&SCATTERING RADIATION	07/17/79
	HS8630TT	ADV H&S CONTAIN POL/PROC	08/28/79
	HS8650TT	ADV H&S DECONTAMINATION TECH	09/25/79
	HS8660	RADIATION DETECT'N INSTRUMENTS	01/16/79
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	05/08/79
	HS8665TT	ADV H&S RADIATION INST USE	05/22/79
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	04/24/79
	SC9510	ADMIN. ESCORT BRIEFING	07/08/80
KERNS JR, LYLE K	HS8463	SCOTT AIR PAK	02/12/80

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
LANNUM, JAMES D	ED7301	USING EDD RESOURCE CENTER	10/30/80
	HS8C03	HAZARDS CONTROL ORIENT	07/30/80
	HS8168	FIRE EXTINGUISHERS	07/18/80
	HS8201TTA	ADV H&S EXP SAFE ORIENT	01/27/81
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	08/26/80
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8463	SCOTT AIR PAK	06/12/80
	HS8561	FORK TRUCK OPERATOR	11/11/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8601	RADIATION SAFETY ORIENTATION	06/18/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	03/06/81
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	06/09/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/20/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/22/81
	HS8626TT	ADV H&S SHIELDING	05/22/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/20/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8660	RADIATION DETC'N INSTRUMENTS	07/29/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81
	PS9000	START ORIENTATION	04/14/80
	SC9500	PRINCIPAL SECURITY LECTURE	12/08/80
LEWIS, JAMES S	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8550	SEISMIC SAFETY TRAINING	04/16/80
	HS8561	FORK TRUCK OPERATOR	05/19/81
	HS8562	FORK TRUCK SAFETY TALK	05/12/81
	HS8569	INCIDENTAL CRANE OPERATOR SAFE	06/03/81
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	02/24/81
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	06/09/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/10/81
	HS8614TT	ADV H&S RAD SOURCE/ISOTOPIC	05/08/81
	HS8616TT	ADV H&S RAD SOURCE/X-RAY	05/08/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/22/81
	HS8626TT	ADV H&S SHIELDING	05/22/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/10/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	03/24/81
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	03/24/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81
	PS9000	START ORIENTATION	04/23/79
PERKINS, CAROL L	SC9500	PRINCIPAL SECURITY LECTURE	09/20/79
	HS8660	RADIATION DETC'N INSTRUMENTS	01/16/79

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
ROBERTS, RUSSELL S	ED7024	INTERVIEW. & SELECT. EMPL.	01/24/80
	ED7041	WORKING TOGETHER (L/R WKSHP)	04/14/80
	HS8003	HAZARDS CONTROL ORIENT	08/06/79
	PS9000	START ORIENTATION	07/02/79
	SC9500	PRINCIPAL SECURITY LECTURE	07/05/79
SEDILLO, EDWIN M	SC9510	ADMIN. ESCORT BRIEFING	10/09/79
	HS8003	HAZARDS CONTROL ORIENT	04/23/80
	HS8030TT	SAFETY OVERVIEW	05/13/80
	HS8168	FIRE EXTINGUISHERS	06/26/80
	HS8201TTA	ADV H&S EXP SAFE ORIENT	01/27/81
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8415TT	CONFINED SPACE HAZARDS	08/12/80
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8438TT	ADV H&S PREC LABELING	08/12/80
	HS8442TT	ADV H&S RESP PROTEC	05/27/80
	HS8463	SCOTT AIR PAK	05/01/80
	HS8463	SCOTT AIR PAK	05/26/81
	HS8563	INCIDENTAL CRANE OPERATOR	02/28/80
	HS8590TT	INDUSTRIAL SAFETY OVERVIEW	09/09/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8601	RADIATION SAFETY ORIENTATION	06/18/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	02/24/81
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	06/19/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/20/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/22/81
	HS8626TT	ADV H&S SHIELDING	05/22/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/20/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8660	RADIATION DET'N INSTRUMENTS	07/29/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	02/24/81

CLASSES TAKEN FROM 9/30/78 TO 7/31/81

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
STONE, MARTIN A	HS8003	HAZARDS CONTROL ORIENT	01/17/80
	HS8030TT	SAFETY OVERVIEW	05/13/80
	HS8168	FIRE EXTINGUISHERS	06/26/80
	HS8201TTA	ADV H&S EXP SAFE ORIENT	01/27/81
	HS8202TT	H&S TECH TRAINING SECT 2	02/10/81
	HS8415TT	CONFINED SPACE HAZARDS	08/12/80
	HS8422TT	ADV. H&S INDUST TOXICOLOGY	08/26/80
	HS8426	ALKALI METALS	04/29/81
	HS8430TT	ADV H&S AIR SAMPLING	07/22/80
	HS8432TT	ADV H&S AIR SAMP & ANAL LAB	07/22/80
	HS8434TT	ADV H&S POTABLE WATER SYSTEMS	07/22/80
	HS8436TT	ADV H&S INDUST NOISE	05/13/80
	HS8438TT	ADV H&S PREC LABELING	08/12/80
	HS8442TT	ADV H&S RESP PROTEC	05/27/80
	HS8463	SCOTT AIR PAK	02/12/80
	HS8463	SCOTT AIR PAK	04/15/81
	HS8561	FORK TRUCK OPERATOR	10/28/80
	HS8563	INCIDENTAL CRANE OPERATOR	02/28/80
	HS8590TT	INDUSTRIAL SAFETY OVERVIEW	09/09/80
	HS8591TT	ELECTRICAL SAFETY-MISC TOPICS	09/23/80
	HS8593TT	MECHANICAL GUARDING	10/21/80
	HS8601	RADIATION SAFETY ORIENTATION	06/18/80
	HS8601TT	ADV H&S EFF RAD & BIO & PROTEC	03/06/81
	HS8605TT	ADV H&S HI ACT ALPHA FISS PROD	06/19/81
	HS8612TT	ADV H&S RAD DECAY & NUC REACT	03/20/81
	HS8614TT	ADV H&S RAD SOURCE/ISOTOPIC	05/08/81
	HS8616TT	ADV H&S RAD SOURCE/X-RAY	05/08/81
	HS8620TT	TRITIUM HAZARDS & CONTROL	05/22/81
	HS8626TT	ADV H&S SHIELDING	05/22/81
	HS8640TT	ADV H&S DOSIMETRY, INT & EXT	03/20/81
	HS8645TT	ADV H&S INTERNAL DOSE/RADIOACT	04/03/81
	HS8660	RADIATION DETCT'N INSTRUMENTS	07/29/80
	HS8660TT	ADV H&S DETEC & MEASURE OF RAD	04/03/81
	HS8662TT	INSTRUMENT CALIBRATION & MAINT	04/14/81
	HS8665TT	ADV H&S RADIATION INST USE	04/14/81
	HS8690TT	ADV H&S EFFLUENT MONITOR PROG	03/06/81
	PS9000	START ORIENTATION	01/07/80
	SC9500	PRINCIPAL SECURITY LECTURE	05/15/80

EMPLOYEE NAME	COURSE NUMBER	NAME	COURSE DATE
MALONE, CHRISTINE X.	UC-Ext.	COMMUNICATION ON THE JOB:	
		A SEMINAR FOR SECRETARIES	06/15/76
	LLL-7374	TRAVEL & VOUCHER PROCEDURES	08/76
	ME & EE	SECRETARIAL PROFESSIONALISM	10/77
	ED7475	ADM. TRAINING FOR OFFICE PERS	12/78
	ED7500	BASIC CLERICAL WANG	01/30/79
	ED7501	BASIC WANG REVIEW	02/20/79
	SC9510	ADMIN ESCORT BRIEFING	03/21/79
	ED7045	MANAGING UNDER BERMAN BILL	04/26/79
	ED7005ST	EFFECTIVE ROLE OF SUPERVISOR	06/13/79
	ED7006ST	COMMUNICATIONS I	06/19/79
	ED7009ST	COMMUNICATIONS II	06/21/79
	ED7015ST	AFFIRM ACTION/FAIR EMP PRAC	06/23/79
	ED7016ST	SUPERV AS COUNSELOR/COACH	07/10/79
	ED7011ST	SAFETY	07/19/79
	ED7028ST	SYS FOR IDEN MOTIV BEHAVIOR	07/31/79
	ED7027ST	DEVELOPING SUBORDINATES	08/02/79
	ED7023ST	SUPERVISORY PERFORMANCE APPRAI	10/22/79
	HS8550	SEISMIC SAFETY TRAINING	02/21/80
	---	CLERICAL BRIEFING	10/15/80
	ED7476	PROFESSIONAL DEVELOPMENT	12/16-18/80

LOCATIONS OF LLNL AND SITE 300
Figure 1

SITE BOUNDARY

OPERATIONAL AREAS

Figure 2

BLDG 806, 807 COMPLE

1

SCALE 1" = 200'-0"

PROCESS AREA

Figure 4

BLD'G 817 COMPLEX
#2

PROCESS AREA
Figure 5

BLDG B27C, B27D COMPLEX
#3

BLDG 827E COMPLEX

4

BLD'G 528 COMPLEX

#5

PROCESS AREA

Figure 8

829 COMPLEX H.E.
BURN FACILITY

#6

PROCESS AREA
Figure 9

BUILDING 807 H.E. DRAIN TRENCH SYSTEM

Figure 10

NOTES

1. The above profile and plan are based on the ground as shown on the maps 1-1, 1-2, 1-3 and 1-4. The profile and plan are based on the ground as shown on the maps 1-1, 1-2, 1-3 and 1-4.
2. The proposed drain line is shown on the profile and plan. The profile and plan are based on the ground as shown on the maps 1-1, 1-2, 1-3 and 1-4.
3. The proposed drain line is shown on the profile and plan. The profile and plan are based on the ground as shown on the maps 1-1, 1-2, 1-3 and 1-4.
4. The proposed drain line is shown on the profile and plan. The profile and plan are based on the ground as shown on the maps 1-1, 1-2, 1-3 and 1-4.

ATOMIC ENERGY COMMISSION	
INDIAN INSTITUTE OF TECHNOLOGY	
BOMBAY	
PROJECT NO. 1000	
TITLE: N.E. DRAINAGE LINE	
SCALE: 1" = 100'	
DATE: 10/10/50	
BY: [Signature]	
CHECKED BY: [Signature]	
APPROVED BY: [Signature]	

BUILDING 807 H.E. DRAINAGE PROFILE

Figure 11

BUILDING 807 H.E. DRAINAGE PROFILE
Figure 12

BUILDING 827C H.E. TRENCH SYSTEM
Figure 14

<p>ALF. CHANCE AND PARTNER</p> <p>ARCHITECTS</p> <p>STANDARD DEVELOPMENT PLANTING</p> <p>PLANNING, CONSTRUCTION, SITE WORK</p> <p>STONIS, BUREAU, CARPENTRY, AND JOINERY, CALIFORNIA</p>		<p>DESIGNED BY</p> <p>DATE</p> <p>SCALE</p> <p>REVISIONS</p>	<p>DATE</p> <p>SCALE</p> <p>REVISIONS</p>	<p>RUTH and GOING</p> <p>CIVIL ENGINEERS</p> <p>28</p>
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BUILDING 827 H.E. FILTER BOX
Figure 15

PLAN OF CHINESE PALACE AND H.E. LAGOON
KIMBART DEVELOPMENT FACILITIES
BUILDING NO. 800 - SITE 800
ATOMIC ENERGY COMMISSION - SAN JOSE COUNTY, CALIFORNIA

REVISIONS	DATE	BY	CHKD
1	10/1/58	W. J. H. H.	W. J. H. H.
2	10/1/58	W. J. H. H.	W. J. H. H.
3	10/1/58	W. J. H. H.	W. J. H. H.
4	10/1/58	W. J. H. H.	W. J. H. H.
5	10/1/58	W. J. H. H.	W. J. H. H.
6	10/1/58	W. J. H. H.	W. J. H. H.
7	10/1/58	W. J. H. H.	W. J. H. H.
8	10/1/58	W. J. H. H.	W. J. H. H.
9	10/1/58	W. J. H. H.	W. J. H. H.
10	10/1/58	W. J. H. H.	W. J. H. H.

BY AUTH and GOING
CIVIL ENGINEERS
San Jose, California

30

BUILDING 827C H.E. TRENCH AND LAGOON
Figure 17

Figure 18

BLDG 873 COMPLEX

8

Figure 19

WATER AND SANITARY SEWER FOR CRAFT SUPPORT AREAS

Figure 20

PIT #7 - EAST AREA
Figure 22

PIT #7 - WEST AREA
Figure 23

BUILDING 850 SITE PLAN

Figure 24

DISTRIBUTE ONE COPY TO:
SHIPPER - DRIVER - AREA REP. - RECEIVER (CARD)

HAZARD/CONTROL MATERIAL ID TAG

TO: NAME _____ FROM: DATE _____

REC. SIG. _____ NAME _____

LIV ☐ OFF-SITE ☐

300 ☐ BLDG RM BERM ☐ BLDG RM

BERK ☐ BLDG RM

IDENTITY

OF ITEM: _____

SERIAL # _____

AUTH BY _____

OSP # _____

HAZARDOUS MATERIAL CONTAINED:

RADIOACTIVE MATERIAL

Solid ☐ Dispersible ☐ Liquid ☐

Radionuclide _____ Curie _____

Emission _____

Exempt Packaging (if any) _____

Date _____ H. C. Release by _____

NON-RADIOACTIVE MATERIAL

Solid ☐ Dispersible ☐ Liquid ☐

Material _____ Amt _____

Date _____ H. C. Release by _____

EXPLOSIVE MATERIAL

Material _____ LLL Type _____

Number of units in package _____ Total Net Weight _____

Date _____ Explosive Specialist Release _____

CONTROLLED MATERIAL CONTAINED:

YES ☐ NO ☐ SPECIALT. _____

☐ SEAMTIL _____

☐ CLASIFIED PART(S) _____

☐ SEALED SOURCE _____

☐ STABLE ISOTOPE (I) _____

Type _____ Amt _____ S. Value _____

☐ PRECIOUS METAL _____

Type _____ Wt gms _____

☐ MOCK _____

☐ OTHER (Specify) _____

CLASSIFICATION:

ICF ITEM: _____

BY SHAPE _____

BY MAT'L _____

REMARKS:

15 - No Reverse

or Card Copy

DELIVERED BY

NAME, DRIVER

LL 3076 (REV. 5/71)

113532

White

Yellow

Pink

Orange

HAZARD/CONTROL MATERIAL ID TAG

Figure 26

DECONTAMINATION INSTRUCTIONS

DISPOSITION: To Sender ☐ To Salvage ☐ To Disposal ☐

Date Needed _____

Est. Value _____

Account No. _____

REMARKS _____

DECONTAMINATION INSTRUCTIONS

AND/OR REMARKS

REMARKS: _____

BACK SIDE OF ID TAG

Figure 27

WASTE IDENTIFICATION SHEET

DO NOT ADD WASTE to this container without contacting your RCRA representative at extension _____ or the Toxic Waste Control Group at extension 2-1925. If incompatible wastes are added, a violent reaction, fire or explosion may occur.

STORAGE LOCATION: 9136.43

DRUM NUMBER: INTERNAL DOC NO _____

[illegible]

Figure 29
124

4/23/81

Name _____ Employee No. _____ Year _____

Department _____ Job Title _____

Qualification details: _____

(S) (A) (U) (P) (C) (D) (A) (S) (A) (U) (P) (C) (D) (A)

SUPERVISOR'S SUMMARY

[illegible]

The above named employee has received sufficient training and I consider him to be fully qualified.

SUPERVISOR _____ DATE _____

DEPARTMENT APPROVAL _____ DATE _____

HAZARDS CONTROL DATE

4/23/81

Figure 31
EXPLOSIVES USER'S QUALIFICATION REVIEW

Name: _____ Department: _____
Specialty: _____ Training Record Date: _____

A. I have discussed or reviewed the following subjects with this employee:

- ☐ His training qualification record with date as shown above (if your copy is not available contact Hazards Control for another).
- ☐ Any physical injury or other condition which would prevent this employee from performing his job safely.
- ☐ Latest revision to the building procedures which control his work with explosives.
- ☐ Latest revisions to both Section 1 and the Emergency Section of the Site 300 Safety and Operational Manual (Site 300 personnel).
- ☐ Latest revisions to sections of the Site 300 Safety and Operational Manual that pertain to his work (e.g. Firing Facility Operators - Section 3, Explosive Technicians - Section 2, etc.).
- ☐ Any supplementary Operational Safety Procedures that are in effect and that pertain to his work.

B. Other safety matters discussed or of concern to employee:

C. I consider this employee:

- ☐ Still Qualified (with changes as indicated) ☐ No longer qualified

Remarks: _____

Date of Review

Signature of Supervisor

I have had an opportunity to discuss with my Supervisor my job qualifications and other safety matters that are of concern to me.

Signature of Employee

LEGEND

- FLOW LINE OF SWALE
- EDGE OF PAVEMENT
- EDGE OF DIRT ROAD
- SPOT ELEVATION
- PHOTOGRAPH CENTER
- EXISTING POLE
- EXISTING TREE
- TRIANGULATION STATION
- EXISTING BUILDING

SITE 300

LAWRENCE LIVERMORE LABORATORY University of California
PLANT ENGINEERING

RELEASE FOR CONSTRUCTION

DATE	7-20-77
BY	R SMITH
FOR	J
PROJECT	CFB
SCALE	300'-C-94' 1" = 600'
REVISION	1/1
PROJECT NO.	PSC-77-300-015E4