DOE/RL/12074--10 Rev. 0

ENGINEERING STUDY FOR THE DECONTAMINATION AND WASTEWATER TREATMENT FACILITY FOR THE ENVIRONMENTAL RESTORATION STORAGE AND DISPOSAL FACILITY

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5. CENPW Document Clearance Approval

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CONTENTS

CONTENTS (cont)

APPENDIXES:

A - Summary of Regulations and Research
B - Decontamination Facilities at Operating Sites
C - Discussions with Personnel Experiences With Decontamination Procedures
D - Research Into Automatic Wash Units and Frozen Carbon Dioxide Pellet/Water Blasting

FIGURES:

TABLES:

1.0 INTRODUCTION

1.1 STUDY SUBJECT

This study is one of a number of engineering studies being conducted to develop the design concept for the Environmental Restoration Storage and Disposal Facility (ERSDF) at Hanford. This study evaluates alternatives for decontamination of equipment used to transport Low-Level Radioactive Waste (LLRW) and other wastes to the ERSDF, as well as treatment and disposal options for any wastewater generated in the decontamination process.

1.2 ERSDF DESCRIPTION

The U.S. Department of Energy (DOE) has tasked the U.S. Army Corps of Engineers (USACE), Walla Walla District for the development of the conceptual design for the ERSDF at the Hanford site near Richland, Washington. The production of plutonium and related activities since 1943 have resulted in significant environmental (primarily soil) contamination on the Hanford site. The ERSDF will serve as the disposal facility for the majority of wastes excavated during remediation of waste management sites in the 100, 200, and 300 areas of the Hanford facility. The initial phase of the overall project has been designated by Westinghouse Hanford Company (WHC) as Project W-296, and is defined as the design and construction of facilities for the disposal of waste generated through the year 2001. The operation of the facility will be performed under another project. Only waste from the 100 and 300 areas will be disposed at the ERSDF during Project W-296. The USACE has tasked Montgomery Watson to conduct the engineering study under Delivery Order No. 0017, under the indefinite delivery order (IDO) contract number DACW68-92-D-0001, with the Walla Walla District.

The current concept for the ERSDF calls for burial of remediation derived waste in trenches up to 33 feet deep, covered with a 15-foot-thick cap. This cap, referred to as the Hanford Barrier, is specifically designed for this site to prevent infiltration and limit access to the waste for as long as reasonably possible. Some or all of the waste disposal units may be lined, and some or all of the waste may be buried in containers, depending on the nature of the waste and the outcome of future regulatory determinations. Along with the disposal units, the ERSDF will include waste handling and transportation faculties such as an administration building.

It is anticipated that the ERSDF will be located near the 200 areas, in the center of the Hanford site. This location was selected due to the central location and the favorable geologic conditions associated with this portion of the Hanford site. The site location is currently being evaluated by DOE.

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2.0 REGULATORY REQUIREMENTS AND COMMONLY USED OPERATING PROCEDURES

This section evaluates pertinent regulatory and nonregulatory guidelines to determine levels of compliance and cost-effective alternatives for the decontamination of reusable containers to be utilized at the ERSDF. The following tasks were completed:

- Review of regulatory guidelines to determine minimum levels of compliance.
- Determination of commonly-used decontamination procedures at similar facilities.

2.1 REGULATORY CRITERIA

There are a number of regulations that define the objectives of the decontamination facility. Some of these are included in the U.S. Code of Federal Regulations (CFR), while others are either Washington State Administrative Code (WAC) or DOE requirements in the form of DOE Orders. The requirements pertinent to the decontamination facility are summarized below.

2.1.1 40CFR 261 "Identification and Listing of Hazardous Waste" (July 1, 1992)

Section 261.7 "Residues and Hazardous Waste in Empty Containers" provides the definition of an empty container: (1) all is removed that can be removed by practices commonly employed; and (2) no more than 2.5 centimeters (cm) of residue on the bottom; or (3) no more than 0.3 percent of weight of total capacity remains for containers over 100 gallons. If any of the constituents of the soil are listed under the Resource Conservation and Recovery Act (RCRA) as acute hazardous waste in 40CFR 261.31, 261.32, or 261.33 (e), the container is considered empty if the container has been triple rinsed; has been cleaned by another method that has been shown to be effective in scientific literature, or by tests conducted by the generator, which demonstrate equivalent removal. Empty containers are also addressed similarly in WAC 173-303 Section 160.

2.1.2 49CFR 173 "Research and Special Programs, Department of Transportation (DOT)" (December 31, 1991)

Subpart I covers radioactive materials. Subpart 173.411 (e) and (f) states that the external surface of containers, as far as practical, should be easily decontaminated and will avoid, as far as practical, pockets or crevices where water might collect. Subpart 173.421 requires the radiation level on the external surface not exceed 0.5 mrem per hour; the non fixed contamination on the external surface shall not exceed the limits given in Subpart 173.443, and the outside of the package is to be marked "Radioactive."

Subpart 173.427 defines empty containers as having an internal contamination of less than 100 times the limits given in Subpart 173.443. Subpart 173.443 defines exterior contamination as beta-gamma radiation of 10^{-5} micro curies per square centimeter (Ci/sq cm) and 22 disintegrations per minute per square centimeter (dpm/sq cm) and alpha radiation of 10^{-6} micro Ci/sq cm and 2.2 dpm/sq cm.

Also, vehicle use and radiation is limited to 0.5 mrem per hour on accessible surfaces with no significant removable surface contamination. Interior surfaces of the empty vehicle should be less than 10 mrems. The FDC states on pages 8 and 12 that vehicles that leave the site must be released for "unrestricted use" within the Hanford site, and on-site equipment must be "regulated equipment", (i.e., equipment used within the radiation controlled area). A WHC document "Hazardous Material Packaging and Shipping" (WHC-CM-2-14) states that hazardous waste and hazardous materials transport, radiological waste transport, and radiological mixed waste transport must meet DOT requirements.

2.1.3 Hanford Site Radiological Control Manual (HSRCM-1)

Specifies that for removable contamination, alpha must be less than 20 dpm/100 sq cm and beta-gamma must be less than 1,000 dpm/100 sq cm. For total (fixed plus removable) contamination, alpha must be less than 500 dpm/100 sq cm and beta-gamma must be less than 5,000 dpm/100 sq cm.

2.1.4 WHC-CM-4-10 "Radiological Protection" Section 11

Paragraph 4.4.4 covers regulated vehicles and equipment as follows: Loose surface contamination shall be maintained less than the minimum detectable activity of beta-gamma at 100 counts per minute (cpm) above background activity, where background activity is less than 160 cpm. Minimum detectable alpha activity is 20 cpm gross.

2.1.5 Summary of Criteria

The most restrictive requirements are summarized below:

- Containers will be considered empty by visual inspection to determine that any residual material does not exceed 2.5 cm in thickness or 0.3 percent of the capacity of the container (40CFR 261).
- Radiation levels on exterior surfaces shall not exceed 0.5 mrem/hr and shall meet the criteria below:

	Removable (dpm/100 square cm)	Total (dpm/100 square cm)
Alpha Radiation	≤ 20	≤ 300[a]
Beta-gamma Radiation	≤ 1,000	≤ 5,000[b]

[a]From DOE Order 5480.11

[b]Proposed increase to 15,000 dpm/100 square cm in 10CFR 834

2.2 DECONTAMINATION PROCEDURES AT OTHER DISPOSAL FACILITIES

The following seven hazardous waste or radioactive materials disposal facilities were contacted to collect information on their decontamination and wastewater treatment experience: UMTRA (Grand Junction, CO); EnviroCare of Utah (Clive, UT); Envirosafe of Idaho (Bruneau, ID); Chemwaste (Arlington, OR); Idaho National Engineering Laboratory (Idaho Falls, ID); US Ecology (Hanford, WA); and Hanford 2706-T Plant (Hanford, WA).

Details of these contacts are included in Appendix B. Two of the facilities do not accept bulk waste and, therefore, do not need to decontaminate transport vehicles. All five of the facilities that perform routine decontamination use water for the decontamination process, although the 2706-T Plant will be converting to a blasting process that uses ice pellets. At two of the facilities that use water in the decontamination process, the water is recycled using techniques that range from simple settling to filtration with carbon filters. Excess water is evaporated, used for dust control, added to incoming material to optimize compaction, or treated and disposed.

A record of contacts with individuals experienced in decontamination is included in Appendix C. As a result of these contacts, the following methods of decontamination were considered: hand wiping, cleaning with solvents, strippable coatings, high pressure air blasting, surface vacuuming, water washing (usually under high pressure), and abrasive blasting (with sand, frozen carbon dioxide pellets, or ice). These methods are discussed again in Section 3.2.

3.0 DECONTAMINATION ALTERNATIVES

The actual operating scheme of the ERSDF has not been finalized, but it is likely that trucks and/or rail cars, maintained in accordance with the FDC, will be used to transport contaminated material in containers from the remediation site(s) to the disposal cells where the material will be buried and capped (Figure 1). The trucks will then transport the empty containers to the decontamination facility where the containers will be decontaminated and reloaded onto rail cars or flat bed trucks for return to remediation site(s) and reuse.

3.1 METHODOLOGY

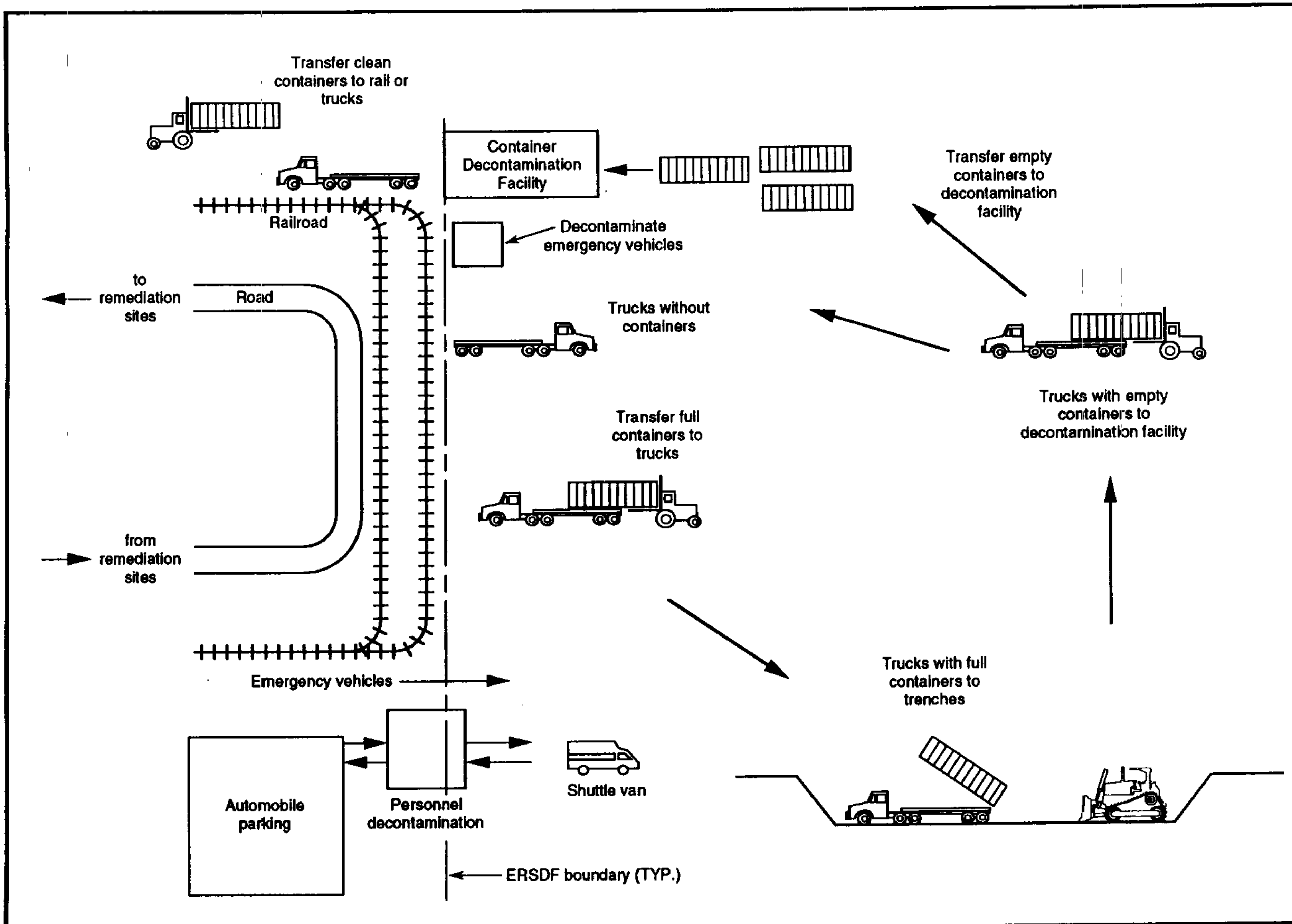
The volume of wastewater generated and the method selected for treatment will depend on the materials removed from containers which come from the remediation site(s). During the 22 years of operation, it is estimated that the waste material to be disposed at the ERSDF will have the following composition:

	Percent of Total	Cubic Yards
Low-Level, Low-Activity Radioactive Waste (LLRW)	95.2%	27,161,100
Low-Level, High-Activity Radioactive Waste (HLRW)	0.6%	170,300
Dangerous LLRW	1.5%	428,000
Dangerous HLRW	0.6%	169,700
TRU Waste	0.5%	142,600
Dangerous, Nonradioactive Waste	0.8%	228,200
Nondangerous, Nonradioactive Waste	0.8%	228,200
TOTAL	100.0%	28,528,100

Based on the current estimates of the annual remediation waste production, there will be a maximum of 65,344 containers per year (based on 32 cubic yards per container). Assuming 380 shifts per year, an average of 172 containers per shift will be handled. For conservative purposes, this report is based on 175 containers per shift.

Most of the containers will be used to transport LLRW. These containers will be decontaminated in the ERSDF. Some of the waste materials (e.g., HLRW, Dangerous HLRW, and TRU) may be transported in single-use containers that will be either temporarily stored at the ERSDF or buried with the waste. All reusable containers transporting Dangerous LLRW and Dangerous, Nonradioactive wastes will be decontaminated using portable decontamination equipment on a pad adjacent to the main decontamination building at the ERSDF. Due to the type of waste, it is not desirable to decontaminate these containers in the main decontamination facility since this waste could possibly contaminate the other containers. Portable decontamination equipment is being provided to decontaminate the on-site equipment for maintenance. Since it is already needed, it can also be used to decontaminate the exterior of these containers. Since these containers transport only 2.3% of the waste, there will be an average of four containers per shift to decontaminate by the portable decontamination equipment (based on 175 containers per shift).

If containers are used for backhaul, additional regulatory requirements which have not been considered as part of this study will be applicable.



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3.1.1 Decontamination of Interior Surfaces

Since most of the material being transported to the ERSDF is expected to be of a free-flowing, granular nature, retention of materials inside the container is not expected; therefore, visual inspection will be sufficient. The interior of the containers are considered to be empty if no more than 2.5 centimeters or 0.3 percent of the capacity of the container remains after being emptied (40CFR 261). If the containers appear to contain excess material, the container will be either re-emptied or washed.

The interior of the containers will be washed on a pad adjacent to, but isolated from, the main decontamination facility/exterior cleaning equipment to prevent contamination by material from the container as well as contaminated cleaning agents. Since this pad will be needed only occasionally, a simple system, such as the one utilized at the UMTRA decontamination facility in Grand Junction, Colorado, will suffice. In this system, a mechanical hoe scrapes the interior of the container. If this is unacceptable, the truck will drive into an asphalt-lined bed (with secondary containment and leachate collection system) to allow capture of material. The truck will raise the container and operators will manually wash the interior with high-volume water hoses. After washing, the truck will deliver the container to the decontamination facility for decontamination of exterior surfaces.

If waste material adheres to the interior of a container, use of anti-bonding agents should be considered. These anti-bonding agents will allow a more thorough release of the material when it is emptied, which will minimize the need for the separate facility for the decontamination of the interior of the containers. Anti-bonding agents, such as polished interior surfaces, oil, straw, and various chemical compounds, facilitate release of materials during dumping. Unless very wet, organic, or silty materials are encountered, anti-bonding agents or the separate decontamination facility will seldom be needed. At the UMTRA facility in Grand Junction, anti-bonding agents were used with wet soil and, depending on the soil types, were sometimes ineffective. The best solution, at that facility, was to use an excavation type hoe with a toothless bucket to scrape the inside of containers to remove material.

3.1.2 Exterior Surfaces

The exteriors of the containers will be decontaminated at the remediation site(s) in accordance with 49CFR 173 "Research and Special Programs Administration, DOT" prior to transport to the ERSDF. If standard precautions are exercised during on-site transportation and emptying of containers, little or no dust or spilled material should adhere to the containers. Spilled materials that may accumulate around the discharge gate of the container could be easily removed using a long-handled shovel or similar tool. A properly-designed discharge gate should minimize any spills. Decontamination of the exterior of the containers after emptying will be performed at the main ERSDF decontamination facility.

3.1.3 Other Decontamination Activities

The transport trucks, rail cars, and other dedicated pieces of equipment will need to be decontaminated only periodically, whereas containers will need to be decontaminated on a regular basis. A portable decontamination unit (high-pressure washer) should be maintained for the periodic washing of transport vehicles, support vehicles, and equipment.

Support vehicles, emergency vehicles, operations personnel, and visitors will need to be decontaminated each time they leave the site. Emergency vehicles (e.g., fire and medical) are the only vehicles that will be allowed to enter the site. They will be decontaminated by use of a low-volume, high-pressure washer unit. All other support vehicles, such as vehicles used to transport visitors and personnel, will be dedicated to on-site use only.

Maintenance vehicles used to perform routine fueling and maintenance of support vehicles should also be dedicated to on-site use to eliminate the need for daily decontamination. Any equipment requiring off-site maintenance or repair will be decontaminated initially on site, then enclosed in sheeting and loaded onto a flat-bed truck for transport to the 2706-T Plant for complete decontamination prior to maintenance or repair.

3.2 ALTERNATIVE METHODS OF DECONTAMINATION

The following decontamination processes were considered as potential methods of cleaning containers used to transport hazardous waste from remediation site(s) to the ERSDF: hand wiping, cleaning with solvents, strippable coatings, high-pressure air blasting, surface vacuuming, steam cleaning, water washing (high volume or high-pressure, low-volume), and abrasive blasting (with sand, carbon dioxide pellets, or ice).

Wipes are currently used to decontaminate small objects and personnel suits. The use of wipes on the large number of large containers to be employed at the ERSDF would require large volumes of wipes and, unless automated, a significant number of employees. If automated, the wipes would need to be replaced regularly to minimize contamination of one container with the material from a previous container. The replacement of these wipes would also take considerable amounts of time. Therefore, this approach was eliminated from further evaluation.

The use of solvents would take large volumes of solvents to properly decontaminate the exterior surfaces. This process also has the potential for generating hazardous wastes which will need to be handled and disposed of at a RCRA facility. Also, this process is not currently used on a large scale facility, so it was eliminated from further evaluation.

The use of strippable coatings would require labor to both strip the coating and apply the replacement coating, and would generate significant amounts of waste coatings that would be disposed of at the ERSDF. Due to these considerations, this option was eliminated from further evaluation.

High pressure air blasting would work except when the containers were wet due to rain or mud. To decontaminate the containers when wet or muddy would require a different process such as water, steam, or blasting. Since the process could not be guaranteed to provide complete decontamination under all conditions, it was eliminated from further consideration.

The use of a vacuum to decontaminate the exterior of the containers would work except for containers that were wet or muddy. Once again, a different type of process such as water, steam, or blasting would be needed. Since the process could not be guaranteed to provide complete decontamination under all conditions, it was eliminated from further evaluation.

Steam is currently used to decontaminate vehicles, particularly drilling equipment, used at hazardous waste sites. It is an effective agent for cleaning, but it does require significant amounts of fuel to heat the steam. Currently, a source of fuel is not available so either a new fuel pipeline or trucking of propane to the site would be required. Also, there is a safety concern with steam piping and boilers. The dislodged material would be wet and therefore not amenable to vacuum removal. It is anticipated that a mechanical conveying device would be needed. Since no large scale operating facilities are available, the best approach to material handling can not be determined. Therefore, this alternative was eliminated from further evaluation.

Water washing and carbon dioxide pellet blasting are reviewed in depth in Section 4.0 and compared in Section 5.0.

4.0 WATER WASHING AND CARBON DIOXIDE PELLET BLASTING METHODS

The FDC, Section 3.4, lists two guidelines pertinent to the decontamination process: (1) that the design shall use materials for decontamination that are not considered dangerous, and (2) that consideration be given to recycling all decontamination materials. In consideration of these guidelines, two methods, water washing and carbon dioxide pellet blasting, were evaluated and compared.

4.1 WATER WASHING

Water washing is commonly utilized to decontaminate equipment. The following reports and regulations reference water decontamination methods (see Appendix A for details):

DOE Order 5820.2A
WAC 173-303 Section 395.4
HSRCM-1 Chapter 4
WHC-CM-4-3 Vol. 4
Bauer WHC-SD-EN-FDC-003
Westinghouse WHC-EP-0454
Westinghouse WHC-EP-0457
Kaiser-April 1991
Reick-WHC-SD-W026-CDR-004

Water washing is used at a number of hazardous waste facilities for decontamination of reusable, hazardous waste containers. At the UMTRA facility, large volumes of water are used in fire hoses to rinse the exteriors of the containers. The Hanford 2706-T Plant, EnviroCare of Utah, Envirosafe of Idaho, and Chemwaste of Oregon all use high-pressure water applied with hand-held wands. Based on discussions with these facilities and with other experienced personnel, water will adequately decontaminate equipment, although the water may need to have a detergent or chemical compound added to facilitate the cleaning action. Hot water should be provided for occasional use. If high-volume washing is used (i.e., fire hose systems), large volumes of water are needed. Conversely, use of low-volume, high-pressure systems reduces the volume of water required and recycling is economically achieved. Automated decontamination package systems are available to wash, rinse, and dry the containers, in addition to recycling the water. Such systems can reduce water consumption by 80 percent.

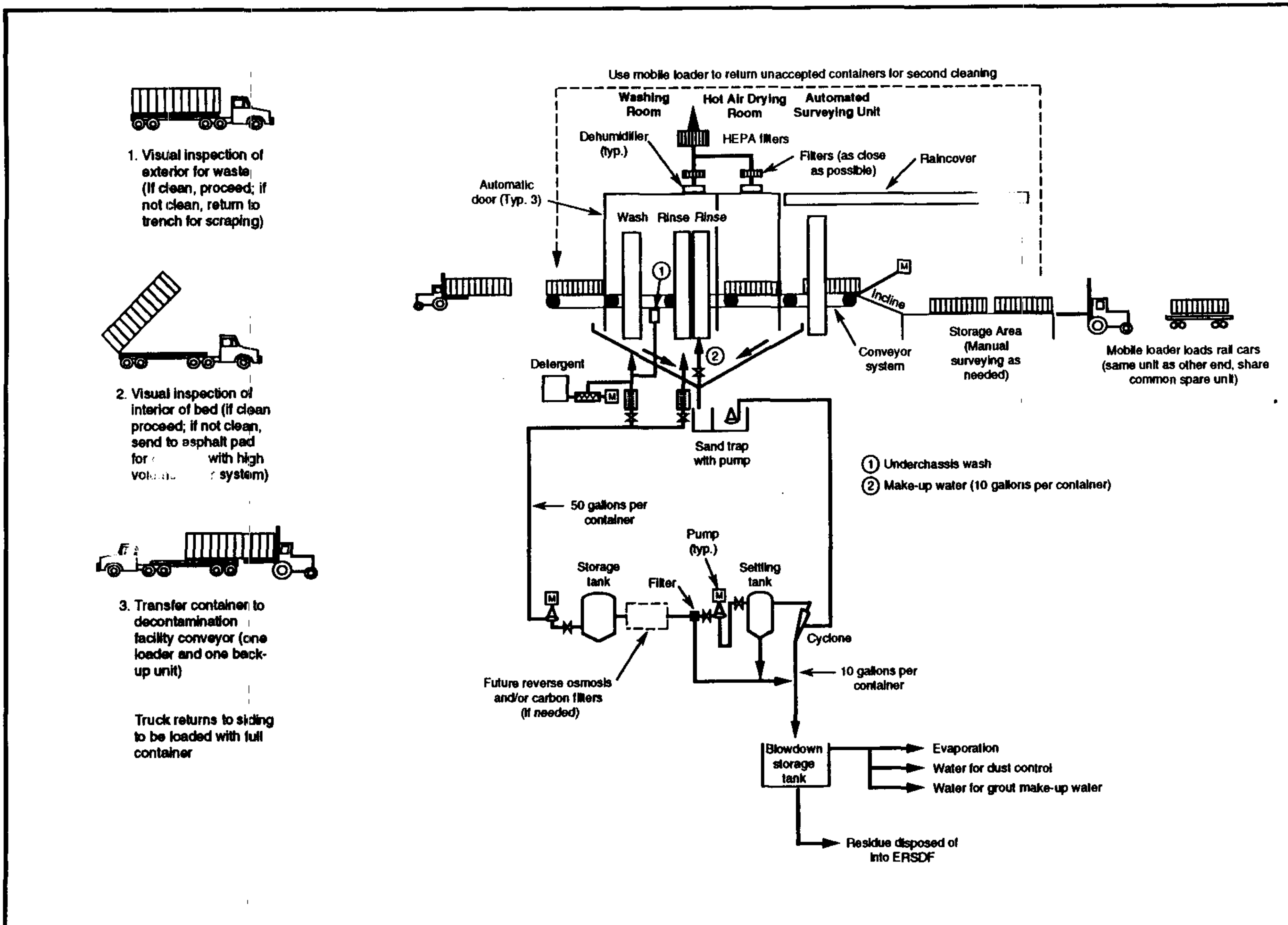
4.1.1 Process Description

The following is a description of the Process Flow Schematic for a low-volume, high-pressure water system as shown in Figure 2:

1. The exterior of the container is inspected for waste. If the container has significant amounts of material, it is returned to the disposal cell for scraping. Once it is visually acceptable, the container proceeds to Step 2.

2. The interior of the container is inspected for waste. If the interior has significant amounts of material (greater than 2.5 cm or 0.3 percent of the rated capacity, which is approximately 2.6 cubic feet in a 32 cubic-yard container), it will be cleaned with a mechanized hoe or sent to a separate pad for washing. Once it is visually acceptable, the container proceeds to Step 3.

3. The container is transferred from the truck to the decontamination facility. The truck then returns to the incoming transfer site to be reloaded with a full container. The empty container is placed onto a conveyor that carries it through the automatic decontamination facility.



ERSDF EQUIPMENT DECONTAM''ATION 0PROCESS FLOW DIAGRAM

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4. In the automatic decontamination facility, the exterior of the container is washed, rinsed twice, and dried with hot air. This process includes washing the underside of the container. The wash liquid can be either water and detergent mix, water and detergent/chemical mix, or water and chemical only. It is recommended that the water and detergent mix be used; however, provisions will be included for the addition of a chemical. The first rinse is recycled water and the second rinse is fresh water. By doing this, there would be no contamination of the containers from the recycled water. The water is treated and recycled as discussed in Section 4.1.4.

5. In the drying room are two air dryers. The first dryer blows off the majority of the water with room temperature air. The second dryer uses hot air to remove the remaining moisture. (During dry summers, it may be possible to turn off the second air dryer and allow atmospheric drying to occur.) After drying, the containers pass through an automated radiological survey unit to determine if the level of activity is acceptable. Based on a statistical analysis of the containers, only a small percent of the containers will be manually surveyed to verify that the automated radiological survey units are accurate and functioning properly. It may be necessary to dry the container area to be surveyed with a portable air dryer before the sample is taken.

6. Containers that do not meet decontamination criteria will be returned for a second cleaning.

7. Containers that are acceptable may be stored on a loading dock before being loaded onto rail cars or trucks for return to the remediation sites to be reused.

8. A back-up supply of hot water should be provided for occasional use.

4.1.2 Water Balance

Based on research into the use of a package automatic water-washing decontamination facility, the following water balance was developed:

1. A recycling system can reduce water usage by 80 percent. Of the remaining 20 percent, half is carried away on the wet vehicle and half goes into system blowdown water (the water that is in the bottom of tanks that contains the removed solids). With a hot air drying option, the carry-away portion will be evaporated.

2. Data from two manufacturers suggests that a minimum of 30 to 40 gallons of water is required to clean one container. Therefore, 50 gallons per container is a conservative estimate. The carry-away/evaporation will be approximately 10 percent, or 5 gallons and the blowdown 5 gallons, requiring a make-up volume of approximately 10 gallons per container. This is the total volume of make-up water for both rinses.

3. One shift per day for six months and two shifts per day for six months equals 390 shifts per year. With holidays and occasional shutdowns, assume 380 shifts per year. The facility will operate 5 days per week.

4. With 175 containers per shift, (ignoring the 1.7 percent of containers that may be single use containers) there will be 66,500 containers per year that will need to be decontaminated.

5. Based on 10 gallons per container of make-up water, approximately 665,000 gallons of water will be needed per year (based on 175 containers per shift).

The above water balance assumes that 50 gallons of water would be used per container. More water (up to 100 gallons) would be required to decontaminate both the truck and the container, should that be required.

4.1.3 Sources of Make-up Water

Based on the above calculations, 665,000 gallons of make-up water per year will be required. This water may come from the ERSDF water supply system or it may be reused from on-site systems such as personnel's shower water. If this water comes from personnel showers and 20 people shower per shift at an average water use of 16.3 gallons per person and 380 shifts per year, then 124,000 gallons of water would be available. Use of the shower water would reduce the amount of water required for decontamination of containers, but another 541,000 gallons of make-up water would still be needed.

4.1.4 Recycling of Decontamination Water

In order to treat the water so that it can be recycled, certain steps are recommended. Package systems that provide this treatment are available. The water and contaminants flow by gravity into a sand trap where heavy materials are captured. This sand trap will need to be cleaned daily. The overflow water is pumped through a cyclone to remove the remaining heavy materials and into a settling tank where the remaining suspended particles are removed. The overflow is pumped through a filter to remove materials larger than 40 microns and into a storage tank. Make-up water is added either to the storage tank or as the final rinse of the containers. Provisions are included for the future polishing steps of reverse osmosis and/or carbon filters. The water is then pumped back into the washing units. The solids that are removed in the cyclone, settling tank, and filters are stored in the blowdown storage tank. Disposal of this material is discussed in Section 4.1.5.

Future polishing steps of reverse osmosis and/or carbon filters are provided in case radioactivity builds up in the recycled water and must be removed. It is anticipated that this will not be a problem as the water will only be reused four times (80 percent recycle) before it is lost either through blow-down or carry-away/evaporation. Another potential treatment alternative is lime softening in an up-flow clarifier. This process has been reported to remove radium and other contaminants.

The wastewater treatment process could not be determined due to the minimal amount of waste characterization data that was readily available and because the scope of the study was changed to include carbon dioxide pellet blasting. During the next phase of the design, it is proposed that in depth characterization of the wastewater be performed and applicable treatment processes defined. Leachate tests in particular would be of benefit to determine what materials would pass through the 40 micron filter. Estimates will be made to quantify the amount of material that will be removed from each container. Then potential treatment processes can be determined.

4.1.5 Disposal of Excess Water and Materials

The blowdown of the solids will concentrate the removed solids in approximately 332,500 to 665,000 gallons per year. With five gallons of blowdown water per container, 332,500 gallons per year will be produced. If for conservative calculations, the carry-away/evaporation is also included, then 665,000 gallons of water per year will need to be disposed. This excess material can be used in many ways. Some operating facilities use the water for dust control around the trenches. At least one operating facility uses the water to optimize the water content of the fill material to obtain optimum compaction. Other operating facilities evaporate the excess water and dispose of the solids as a solid waste, while other operating facilities treat and dispose the entire volume of liquid. Under each of the following alternatives, all of the removed solids will be disposed of in the ERSDF.

4.1.5.1 Dust Control. US Ecology uses around 3 million gallons of water per year as dust control at a site smaller than the ERSDF. If used as dust control for the roads at the ERSDF, the 665,000 gallons of water would be insufficient, so either supplemental water or other dust control measures would be necessary. Since minimal water is needed for dust control in the winter, storage for four months is proposed. During this time, only one shift per day would operate. Therefore storage of 151,700 gallons of water is required. If this water is used as dust control, in eight 3,000-gallon applications per day, then 151,700 gallons will be exhausted in just over 6 days. The entire year's production of 665,000 gallons would be used in 28 days. If used as dust control, two tanks (one plus a standby) approximately 80,000 gallons in size should be provided for storage. If selected for implementation, the tank volumes can be refined to match predicted water uses.

The use of the blowdown water for dust control will add contaminates to the road surfaces. It is anticipated that the road surfaces will also receive contaminates from traffic and wind borne dusts. These road surfaces will be periodically surveyed, and as needed, removed and disposed of in the ERSDF. The contaminates from the blowdown water will accelerate the frequency of this removal. At the time, no estimate can be made of the increased frequency of road surface maintenance.

4.1.5.2 Compaction. EnviroCare of Utah uses decontamination water as a compaction aid. The excess water is sprayed into the railroad cars as they enter the site. The water then acts as a dust control agent when the cars are dumped and provides optimum moisture content for compaction in trenches. This approach may be applicable to the ERSDF. However, the indications are that water would not be allowed inside the trenches due to concerns of leaching contaminates into the ground water.

4.1.5.3 Evaporation. To evaporate the free liquid and dispose of the remaining residue in the ERSDF, enough surface area must be provided to evaporate all of the liquid during summer months. A net evaporation rate of 20 inches per year is calculated from a 70 percent correction factor applied to the 40 inches of pan evaporation shown on the National Weather Service charts for Richland, WA and an average annual rainfall of eight inches. Therefore, evaporation of 665,000 gallons would require an area of 53,400 square feet. Since this is a relatively large area, three tanks at 17,800 square feet each, plus one additional tank to facilitate cleaning, are recommended. Each tank should be approximately three feet deep and 150 feet in diameter. These tanks could be Modutanks similar those used at Morton Thiokol near Brigham City, Utah or similar tanks made by Envirometics, Inc., or equivalent manufacturers.

As an option to using atmospheric evaporation, an active evaporator at the ERSDF site was considered. However, the construction and operation costs would be significantly higher than atmospheric evaporation. Also, permitting of an active evaporator at the site may not be easily achieved.

As an option to using atmospheric evaporation, it could be possible to use the 241A evaporation facility. However, it has been reported that there is insufficient capacity in this facility to handle additional wastewater. The site capability evaluation will further pursue the use of this facility.

4.1.5.4 Other Treatment Processes. There are other ways to dispose of or reuse the blowdown water. It could also be used as make-up water in the grout plant, if grouting is used to fill the voids in containers and around large, incompressible objects, or treated at the Waste Receiving and Processing (WRAP) facility. However, since the blowdown water can be beneficially used as either dust control, compaction water, or evaporated, the need to pay for treatment at the WRAP is unnecessary.

The blowdown water could also be treated in a now or existing treatment plant such as C-018H. However, the construction and generation costs of a new treatment plant could be significantly higher than atmospheric evaporation. Treatment in the 300 Area Treated Effluent Disposal Facility (TEDF), which is under construction, may be a consideration. The TEDF is designed to treat non-contact cooling waters which contain very low levels of hazardous and dangerous contaminants. It may not be capable of treating the ERSDF decontamination facility blowdown water.

4.1.5.5 Summary of Excess Water Treatment Process. At this time, the final selection of disposal and reuse is not complete. The use as dust control is the suggested alternative. The second alternative is to utilize atmospheric evaporation. Since atmospheric evaporation has fewer concerns, it is shown on the site plan and in the cost estimate. If dust control is chosen, the tank area shown in the site plan will be reduced significantly.

4.1.6 Additional Considerations

Additional considerations for the design of the decontamination are discussed below.

4.1.6.1 Container Dimensions. The containers are expected to be 8 feet wide, 15 feet long, and 8 feet high, with an open top, and a ribbed steel end door that is 8 feet by 8 feet in dimension (as per

April 15, 1993 Meeting Minutes of "Transportation Meeting Minutes for ERSDF Project W-296"). The ribbed steel exterior makes the decontamination process more difficult as there will be more surfaces and corners to clean. A modification to the design to include a sandwich coating of fiberglass or steel would make the decontamination procedure more efficient and effective at each of the remediation and ERSDF sites.

4.1.6.2 Number of Systems. Based on information provided by vendors, washing takes approximately two minutes per container. Including the time required to bring the container into the room, wash it, and move it out of the room on to a continuous conveyor, the total time required to complete one cycle is approximately four minutes per container. At this rate, 120 containers per shift can be cleaned by one washing unit. To clean 175 containers per shift, two washing units plus one stand-by unit for backup will be required. In lieu of a standby unit, decontamination could be performed during weekends or by overtime work when an active unit needs repairs. However, the provision of a stand-by unit will minimize labor and maximize reliability.

4.1.6.3 Use of Power. It is anticipated that approximately 630 hp (three systems at 210 hp per system) will be connected.

4.1.6.4 Consumables. Approximately, 1,750 gallons of water per shift will be consumed by this process. In addition, 44 gallons of detergent/chemical per shift will be consumed at a cost of approximately $7.00 per gallon.

4.1.6.5 Automation. This type of decontamination system can readily be automated, requiring one person to provide oversight and keep the detergent and chemical-additive tanks full, and one other person to operate the blowdown system.

4.1.6.6 Cold Weather Operations. By enclosing the facility, the process will not be affected by cold weather.

4.1.6.7 Staffing. A minimum of six people per shift will be required to operate the main decontamination facility: two to operate the loaders or other systems that transfer containers to and from the decontamination facility, one to inspect the exterior of the containers, and one to inspect the interior of the containers prior to decontamination. Two additional operators will be required to oversee the automated decontamination process and manage the blowdown water. The number of personnel needed to survey the container is not included.

4.1.6.8 Principal Hazards and Risks. It is anticipated that this system will meet all regulations for decontaminating containers. However, it may be necessary to return some containers for a second cleaning, if they do not pass inspection.

Since the system recycles used water, some build-up of radioactivity will occur over time. A second rinse using fresh water should minimize this build-up. Since the containers have been previously decontaminated at the remediation site, this build-up of radioactivity is expected to be minor. If levels become too high, additional treatment steps such as reverse osmosis and/or carbon filtration may be required.

Because water is used for the decontamination process, containers must be dried prior to performing the radiological survey. A dual drying system is proposed, but some hand drying may still be needed to obtain accurate readings.

4.1.6.9 Cost. Table 1 presents the estimated construction costs for a water-washing facility designed to handle 175 containers per shift. The cost estimate is based on prices quoted by vendors in previous construction bids. This estimate is a Reconnaissance Grade Estimate (Order-of-Magnitude) as defined by the American Cost Estimators Association and has an accuracy of plus 50 percent to minus 30 percent.

Table 2 presents the estimated operation and maintenance costs for a water-washing facility to handle 175 containers per shift.

Table 1. Estimated Construction Costs For Water-Washing System

	Quantity	Unit Cost	Cost
Washing System			
Basic System	3	$60,000 x 1.4	$252,000
Reclamation System[a]	3	$40,000 x 1.4	$168,000
Drying System	3	$40,000 x 1.4	$168,000
Hot Water System	1	$30,000	$30,000
(1.4 includes installation cost)			
Building (each bay is 20 ft wide by 100 ft long)			
Wash Bays	3-2000 sf	$75/sf	$450,000
Equipment Bay	1-2000 sf	$75/sf	$150,000
Ventilation System	1	$100,000	$100,000
Loaders for transferring containers (2 + 1 Backup)	3	$100,000	$300,000
Automatic Conveyors	3	$50,000	$150,000
Portable washer	1	$30,000	$30,000
Automatic radiological survey units	3	$50,000	$150,000
Exterior covered storage area (for 40 containers)	9,600 sf	$ 50/sf	$480,000
Washdown area for container interiors			$40,000
Evaporation tanks for blowdown water[a]	4	$120,000	$480,000
Subtotal			$2,948,000
Site work, yard piping, grading		30%	$884,000
Electrical and Instrumentation		20%	$590,000
Engineering and Contingencies		30%	$884,000
TOTAL ESTIMATED CONSTRUCTION COST			$5,306,000

[a]Represents costs for wastewater treatment portion of decontamination facility.

Table 2. Estimated Operation And Maintenance Costs For Water-Washing System

	Number of Units Per Shift	Unit Description	Unit Cost	Cost Per Shift
Loaders				
Fuel	80	gallons	$1.00	$80
Maintenance	--	--	--	$30
Conveyers				
Maintenance	--	--	--	$15
Washing System				
Water	1,750	gallons	$0.01	$18*
Detergent/Chemical	44	gallons	$7.00	$308
Maintenance	--	--	--	$15
Automatic Radiological Survey Units				
Maintenance	--	--	--	$15
Evaporation Tanks				
Solids Removal	0.5	Dry Tons	$50.00	$25
Maintenance	--	--	--	$40
Power	650	kWhr	$0.027	$18
Staffing	48	hours	$15.00	$720
Cost Per Shift				$1,284
ANNUAL ESTIMATED O & M COST (380 SHIFTS/YEAR)				$487,920

*Assumed value. Definitive information on water cost is not currently available.

4.2 CARBON DIOXIDE PELLETS

In this section, a blasting method using frozen carbon dioxide pellets is described and evaluated. The blasting process uses small particles to physically remove material from the surfaces of the containers. Sand or silica particles are used most commonly, but variations of this process use frozen carbon dioxide pellets or ice particles. Sand or silica increases the amount of material to be disposed and would eventually remove enough of the container's surface to make it unusable. Blasting with frozen carbon dioxide pellets is used at a number of industrial facilities and has been investigated at some hazardous waste sites. The 2706-T Plant investigated its use, but has opted to use ice instead of carbon dioxide because of a concern for worker safety due to the accumulation of carbon dioxide in washer bays and the formation of fog.

4.2.1 Process Description

The following is a narrative description of the frozen carbon dioxide pellet blasting system. It is similar to the process depicted in the Process Flow Schematic shown in Figure 2, except as noted below:

1. The exterior of the container is inspected for waste (same as water washing).
2. The interior of the container is inspected for waste (same as water washing).
3. The container is transferred from the truck to the decontamination facility (same as water washing).
4. In the automatic decontamination facility, the exterior of the container is blasted with frozen carbon dioxide pellets to remove contaminants. After use, the carbon dioxide pellets evaporate into the atmosphere. Material dislodged from the containers will accumulate in a trench in the floor of the decontamination facility. This material can be removed either with a vacuum system or manually or by flushing into the drain system with water. Manual removal is not recommended due to the potential for contamination of the worker. The use of water to flush the contaminants into the drain system is contrary to the intent of minimizing the amount of both water used and waste generated. Therefore, this option includes a vacuum system for removing the material. The vacuum system should be a high-volume air-ventilation system that will separate the dislodged material in filters prior to the HEPA filters. Since the carbon dioxide evaporates, there will not be significant amounts of moisture to blind the HEPA filters.
5. After blasting, the containers pass through an automatic surveying unit to determine if the containers are acceptably decontaminated. Containers do not need to be dried since this is a dry decontamination process. Approximately five to ten percent of the containers should be manually surveyed to verify that the automated surveying unit is accurate and functioning properly.
6. Containers that were not suitably decontaminated are returned for a second cleaning (same as water washing).
7. Containers that were suitably decontaminated may stored on a loading dock before being reloaded onto rail cars or trucks for return to the remediation sites (same as water washing).
8. A back-up supply of hot water should be provided for occasional use (same as water washing).

4.2.2 Process Criteria

Based on research on the use of a package frozen carbon dioxide pellet blasting decontamination facility, the following process criteria were developed:

1. The manufacturer and a contractor familiar with the equipment estimated that each nozzle can clean approximately four square feet of container per minute. Given the container configuration and the need to automate the facility, it was determined that four sets of nozzles will be required. There will be one fixed set of nozzles to spray each side (total of two sets) and one fixed set to spray the bottom of the container. A fourth set will be mounted on a robotic arm to spray the front and back ends of the container. Each nozzle cleans a six-inch-wide area. Due to the eight foot height and width of the containers, 16 nozzles will be required in each set. If the operation is staggered, only one set of 16 nozzles will be required at any one time. One pelletizer is required for every pair of nozzles. Therefore, only eight pelletizers, instead of 32, will be needed. With this approach, the time to complete one cleaning cycle will be ten minutes per container.

2. Manufacturer's data indicate that 1,500 pounds of carbon dioxide will be required to clean each container. Since the carbon dioxide cannot be reused, this is highly consumptive.

3. With one shift per day for half a year and two shifts per day for half a year, there will be 390 shifts a year. With holidays and occasional shutdowns, assume 380 shifts per year. The facility will operate five days per week.

4. With 175 containers per shift, there will be 66,500 containers per year that will need to be decontaminated.

5. Based on 1,500 pounds of carbon dioxide per container, 99,750,000 pounds of carbon dioxide would be needed each year.

4.2.3 Sources of Carbon Dioxide

Based on the above calculations, this process will consume 99,750,000 pounds of carbon dioxide per year. This carbon dioxide will have to be shipped to the site in 50,000-pound tanker trucks; however, the use of rail car shipments could be considered. This would be 1,995 tanker trucks per year or 5.25 tanker trucks per shift.

4.2.4 Disposal of Excess Materials

The cleaning of containers using this process will generate some waste material. The carbon dioxide pellets will melt and diffuse into the atmosphere. Material dislodged from the containers will need to be disposed of either in the ERSDF or in another disposal facility. Since the ERSDF is equipped to dispose of this type of material, this would be the preferred alternative.

4.2.5 Additional Considerations

4.2.5.1 Container Dimensions. The containers are expected to be 8 feet wide, 15 feet long, and 8 feet high in dimension, with an open top, and a ribbed steel end door that is 8 feet by 8 feet in dimension (as per April 15, 1993 Meeting Minutes of "Transportation Meeting Minutes for ER-SDF Project W-296".) The ribbed steel exterior makes the decontamination process more difficult as there will be more surfaces and corners to clean. Due to the flat spray pattern of the frozen carbon dioxide pellets, the trailing corners of the ribs may not be adequately cleaned. A modification to the design of the containers to include a sandwich coating of fiberglass or steel would make the decontamination procedure more effective.

4.2.5.2 Number of Systems. Based on information provided by vendors, blasting takes approximately eight minutes per container. Including the time required to bring the container into the room, blast it, and move it out of the room on to a continuous conveyor, the total time required to complete one cycle is approximately ten minutes per container. At this rate, 48 containers per shift can be cleaned by one blasting bay. To clean 175 containers per shift, four blasting bays plus one stand-by bay for back-up will be required. In lieu of a stand-by unit, decontamination could be performed during weekends or by overtime work when an active unit needs repairs. However, the provision of a stand-by unit will minimize labor and maximize reliability.

4.2.5.3 Use of Power. It is anticipated that approximately 2,100 hp (five systems at 420 hp per system) will be connected.

4.2.5.4 Consumables. Approximately 262,500 pounds of carbon dioxide per shift will be consumed in this process. Liquid carbon dioxide costs approximately $0.03 per pound.

4.2.5.5 Automation. This type of decontamination system can readily be automated, requiring one person to provide oversight and keep the carbon dioxide tanks filled and one person will be responsible for managing the dislodged material.

4.2.5.6 Cold Weather Operation. By enclosing the facility, the process will not be affected by cold weather.

4.2.5.7 Staffing. It is anticipated that six people will be required per shift. Two will operate the loaders or other systems to transfer containers to and from the decontamination facility. One will inspect the exterior of containers and one will inspect the interior of the containers prior to decontamination. One will oversee the actual decontamination process and one will manage the waste produced. The number of personnel needed to survey the containers is not included.

4.2.5.8 Principal Hazards and Risks. It is anticipated that this system will meet all the regulations for decontaminating the containers. However, it may be necessary to occasionally return containers for a second cleaning if the container does not pass inspection.

The flat carbon dioxide pellet sprays may not clean the trailing corners of the container ribs. This may require more nozzles, a second cleaning, or an alternative container design such as a sandwich cover.

The storage tanks for liquid carbon dioxide are assumed to be the tanker trucks. There are safety concerns with the shipping, handling, and storage of liquid carbon dioxide.

The 1,995 tanker trucks per year provide significant traffic concerns with safety and movement of vehicles.

Carbon dioxide is a simple asphyxiant (the NIOSH limit is 50,000 ppm), therefore, care must be exercised so that operators are not exposed to excessive volumes of this gas. With the automated system, this concern will be minimized.

4.2.5.9 Costs. Table 3 presents the expected costs for a frozen carbon dioxide pellet blasting facility to handle 175 containers per shift. These costs are based on currently available equipment as quoted by vendors in previous construction bids. The estimate is a Reconnaissance Grade Estimate (Order-of-Magnitude) as defined by the American Association of Cost Engineers and has an accuracy of plus 50 percent to minus 30 percent. By working with equipment vendors, special equipment can be developed which may reduce the project cost by 25 to 50 percent.

Table 4 presents the estimated operation and maintenance costs for a carbon dioxide pellet blasting facility to handle 175 containers per shift.

Table 3. Estimated Construction Costs For Frozen Carbon Dioxide Pellet Blasting System

	Quantity	Unit Cost	Cost
Carbon Dioxide System			
Spray nozzles	320	$35,000 x 1.4	$15,700,000
Pelletizing System	40	$90,000 x 1.4	$5,100,000
Air compressor system	5	$45,000 x 1.4	$315,000
(1.4 includes installation cost)			
Building (each bay is 20 ft wide by 100 ft long)			
CO_2 Bays	5 at 1,600 sf	$90/sf	$720,000
Equipment Bay	1 at 1,600 sf	$75/sf	$120,000
Ventilation System	1	$100,000	$100,000
Hot Water System	1	$30,000	$30,000
Loaders for transferring containers	3	$100,000	$300,000
Automatic Conveyors	5	$50,000	$250,000
Portable washer	1	$30,000	$30,000
Automatic radiological survey units	5	$50,000	$250,000
Exterior covered storage area (for 40 containers)	9,600 sf	$50/sf	$480,000
Washdown area for container interiors			$40,000
Subtotal			$23,435,000
Site work, yard piping, grading		30%	$7,030,000
Electrical and Instrumentation		20%	$4,685,000
Engineering and Contingencies		30%	$7,030,000
TOTAL ESTIMATED CONSTRUCTION COST			$42,180,000

Table 4. Estimated Operation and Maintenance Costs for Frozen Carbon Dioxide Pellet Blasting System

	Number of Units Per Shift	Unit Description	Unit Cost	Cost Per Shift
Loaders				
Fuel	80	gallons	$1.00	$80
Maintenance	--	--	--	$30
Conveyers				
Maintenance	--	--	--	$20
Blasting System				
Carbon Dioxide	262,500	pounds	$0.03	$7,875
Maintenance	--	--	--	$1,200
Automatic Radiological Survey Units				
Maintenance	--	--	--	$20
Power	2,255	kWhr	$0.027	$61
Staffing	48	hours	$15.00	$720
Cost Per Shift				$10,006
ANNUAL ESTIMATED O & M COST (380 SHIFTS/YEAR)				$3,802,000

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5.0. SELECTION OF PREFERRED ALTERNATIVE

The evaluation of alternatives is fairly straightforward in that the blasting system is more costly and requires more power and consumables than the water-washing system. Therefore, the water washing system is the preferred alternative.

5.1 SITE PLAN FOR PREFERRED ALTERNATIVE

A preliminary site plan for the decontamination facility is shown in Figure 3. The facility is proposed to be located in the northwest corner of the ERSDF so that prevailing winds do not influence background readings during surveys and do not contaminate clean containers.

Each complete operating system can handle 15 containers per hour or 120 containers per shift, therefore, two operating systems can handle a total of 240 containers per shift.

In order to provide reliability and redundancy, the water washing process described herein includes one complete spare system. Since two systems are required to clean 175 containers per shift, a total of three complete systems are included.

A mobile unit will be provided to decontaminate the dedicated on-site vehicles for maintenance purposes and if occasional radiological surveys dictate. This mobile unit will also be used to decontaminate the interior of containers as needed or the exterior of containers that transported Dangerous LLRW or Dangerous, Non-Radioactive Wastes.

A separate water wash decontamination facility will be provided to decontaminate dedicated vehicles before they can leave the site to go to 2706-T plant for complete decontamination and to decontaminate any emergency vehicles that need to enter the site.

The main decontamination facility will be heated to meet minimum requirements as stated in various design guidelines (i.e., approximately 50 degrees in the winter). The control room, where the operator will oversee the decontamination process, will be heated to 68 degrees in the winter and cooled in the summer.

The decontamination facility will be negatively ventilated as required to meet safety concerns and in accordance with Hanford Plant Standards SDC-5.1 "Standard Design Criteria for Heating, Ventilation, and Air Conditioning" and with NFPA 90 "Air Conditioning and Ventilation Systems". The air from the water washing and drying rooms will be filtered.

Potable water will be used for the make-up water as it is the only water supply to the ERSDF. Cross-connection of the water-washing system with the potable water system will be controlled to meet WAC 248-54 guidelines either by use of air gaps with a repumping system or by using the potable water only in the second rinse, which is totally disconnected from the remainder of the system.

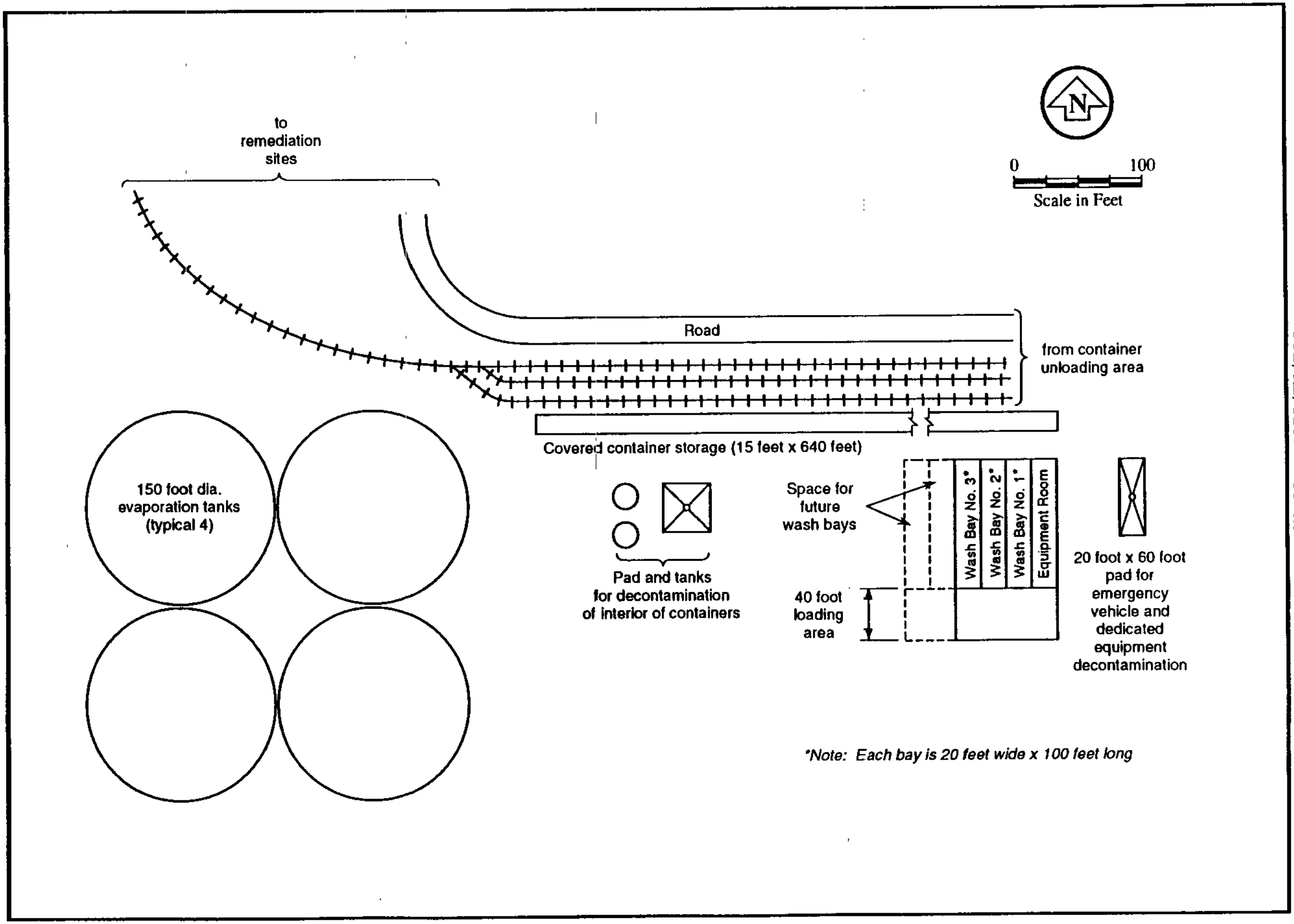
Fire protection will be provided to meet all applicable codes.

Ground-water protection will be provided by installing secondary containment under the washing and water storage areas of the facility with a sump for collection of any water that is captured.

All other design requirements listed in the FDC will also be met.

5.2 UNCERTAINTIES AND ASSUMPTIONS

If foam is used for dust control at the disposal cell area instead of water, the foam will be splashed onto the container. This foam may not be easily removed by water washing. Steam or chemical agents



PRELIMIN 'Y SITE PLAN
F. JRE 3

may be required to thoroughly remove foam residue from containers. Chemical agents can probably be applied more easily and safely than steam or hot water in this system.

Since the containers are decontaminated at the remediation site and will accumulate little dust during transport to the ERSDF for unloading, it may not be necessary to decontaminate the containers. This will not be known until the facility is in operation. If decontamination is not required, the facility can be bypassed and containers loaded directly on to railcars or trucks. By passing them through the decontamination facility without operating the water wash, the containers can be automatically surveyed for radiation and any contaminated containers returned for washing.

Assumptions made during the development of this study are evaluated below to determine their impact, if any, on the final decision:

- Exterior surfaces of containers are adequately decontaminated at the remediation site(s) to meet DOT requirements. (Assumption still valid.)
- Since the exterior surfaces already meet DOT requirements and since the containers are exposed only to road and wind-borne dust, there is no need to extensively decontaminate the container when it reaches the ERSDF. (Assumption still valid.)
- Visual inspection of interiors to ensure that RCRA requirements are met will be performed. If reusable containers are used to transport acute hazardous waste or more than one type of waste, additional regulatory requirements will be applicable. (Assumption still valid. To prevent the use of a container to transport more than one waste type, either a color code or an alpha or numeric code could be implemented.)
- Trucks dedicated to the ERSDF will not be decontaminated every trip. The trucks and other dedicated equipment will be decontaminated daily or as needed based on periodic surveys, and prior to maintenance. (Assumption still valid.)
- All containers will be decontaminated before they leave the ERSDF site. (Assumption still valid. If it is found that the containers do not need to be decontaminated on a regular basis, the water-wash system can be deactivated and the containers can still be handled in the facility.)
- HLRW and Dangerous HLRW may be disposed in single-use containers that do require decontamination. (Assumption still valid. This affects an average of four containers per shift. If reusable containers are used, a separate decontamination facility may be required to eliminate contamination of containers with recycled wash water or spillage.)
- Due to revised estimates of the volume of material to be placed in the ERSDF, the facility was designed to decontaminate 175 containers per shift. This requires two wash bays plus a third stand-by bay.
- Decontamination of personnel will be handled separately in the Maintenance Building. (Assumption still valid.)
- Decontaminated containers will not be used to back-haul soil. (Assumption still valid. If the containers are used to back-haul soil, the interior of the containers may need to be thoroughly decontaminated before reuse in order to meet more stringent regulations.)
- An exterior skin on the containers would improve decontamination efficiency. (This assumption is suggested for implementation. If not implemented, the washing process will take slightly more time to ensure that the corners of the containers are thoroughly cleaned.)
- The time taken to perform radiation surveys is not part of this study but may affect the overall cycle time of the process. Radiation surveys take five to eight minutes at US Ecology and approximately five minutes at UMTRA (where only ten percent of containers are surveyed).

Hanford site surveys may require approximately 30 minutes per conversation with Mark Flatland of WHC. If it is determined that additional time is required, the overall cycle time for the system will be increased, requiring more containers and more storage area.

- Containers must be dried prior to radiological surveying. (Assumption still valid.)

5.3 REQUIRED CHANGES TO IMPLEMENT PREFERRED ALTERNATIVE

It is recommended that a sandwich skin be investigated for the outside of the containers to smooth over the ribbed surfaces, thereby improving the overall efficiency of the decontamination process.

6.0 SUMMARY AND CONCLUSIONS

The results of this investigation suggest:

- Water washing is significantly less expensive to construct and operate than frozen carbon dioxide pellet blasting.
- The proposed system is sized to handle 175 containers per shift. This system will include three water-washing bays and is estimated to cost $5,306,000.
- The proposed water-washing system includes a standard, off-the-shelf available reclamation system. An additional study is needed to determine if this reclamation system is sufficient or if additional treatment processes such as reverse osmosis, carbon filtration, or line softening are needed.
- The proposed system will also include a mobile decontamination unit for the dedicated equipment, a pad to decontaminate emergency vehicles, and a pad to decontaminate the interior of containers that contain excessive amounts of material.
- Various methods of treating the generated wastewater are suggested. Use of the wastewater as dust control on the roads at the ERSDF is the preferred alternative. Concerns associated with the accumulation of contaminates in the road surface may make the alternative unacceptable. Atmospheric evaporation with disposal of the residue in the ERSDF, is the next best treatment process.
- It is recommended that the design of the containers be reviewed. A sandwich type coating to provide a more uniform surface will improve the decontamination process reliability.

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Appendix A

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MONTGOMERY WATSON

To:	FILE	**Date:**	June 4, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies		

This is a summary of my research into items referenced in the Functional Design Criteria:

FEDERAL CODES

10-CFR-20 "Standards for Protection Against Radiation" (Jan. 1, 1993)

- Sets exposure limits.
- Similar to a DOE Manual.
- Discusses manifests for shipping.
- Discusses personnel protection.
- Discusses surveys.

10-CFR-834 "Radiation Protection of the Public and the Environment" (Draft published in the March 25, 1993 Federal Register for review with review comments due by June 22, 1993)

- This proposed rule covers four basic areas relating to radiation protection of the public and the environment.
- Codifies ALARA and DOE Order 5480.11.
- Establishes dose limits (100 mrem/year) and reporting limits (10 mrem/year).
- Affects ERSDF permitting.
- The limits in Table 2 are less stringent than DOE Order 5480.11.

40-CFR-50 "National Primary and Secondary Ambient Air Quality Standards" (July 1, 1992)

- Sets standards for SO2, Particulates, CO, ozone, NO2, and lead.
- Particulates shall be less than 150 micrograms/cubic meter (peak day) and less than 50 micrograms/cubic meter on an annual average.

40-CFR-61 "National Emission Standards for Hazardous Air Pollutants" (July 1, 1992)

- Subpart H is specifically for DOE facilities.
- Lists the controlled pollutants except Radon (covered in subpart Q).
- Limits DOE to less than 10 mrem/year on the public.

40-CFR-122 "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System" (July 1, 1992)

- Does not cover groundwater discharge.

40-CFR-191 "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Radioactive Wastes"

- Since we are only temporarily storing these and using single use containers at that, decontamination is not affected.

40-CFR-192 "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings"

- Curie (Ci) = 37 billion nuclear transformations/second.
- Picocurie = 10 to the minus 12 curies (agrees with "Cember") (10 to the minus 10 curies in WAC 173-340 pg 13).
- Need to control site emissions to less than or equal to 20 picocuries/meter squared/second.
- Otherwise, does not affect decontamination process.

40-CFR-260 "Corrective Action Management Units and Temporary Units; Corrective Action Provisions; Final Rule"

- Not referenced in FDC.
- 264.553 Tanks may be physically located within a CAMU but will not actually be part of the CAMU and all applicable Subtitle C requirements will continue to apply to the tanks.

40-CFR-261 "Identification and Listing of Hazardous Waste" (July 1, 1992)

- Not referenced in FDC.
- Section 261.7 (Residues and Hazardous Waste in Empty Containers)
  - Provides the definition of an empty cylinder:
    - (a)(1) if empty, not subject to these regulations;
    - (b)(1) its empty if:
      - (i) all is remov that can be removed by practices commonly emplc and either
      - (ii) no e than 2.5 cm of residue on the bottom; or
      - (iii)(b) more than 0.3% of weight of total capacity remains for containers over 100 gallons.

40-CFR-264 "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities"

- Nothing on decontamination of vehicles or containers.

40-CFR-268 "Land Disposal Restrictions"

- We are not doing land disposal, so does not apply.

49-CFR-173 "Research and Special Programs, DOT" (December 31, 1991)

- Not referenced in FDC.
- See 4/14/93 meeting minutes
- Subpart I covers Radioactive Materials

  - Subpart 173.411 (e) and (f) states the external surface of containers, as far a practical, may be easily decontaminated and will avoid, as far as practical, pockets or crevices where water might collect.

  - Subpart 173.421 requires the radiation level on the external surface not exceed 0.5 millirem per hour; the nonfixed contamination on the external surface does not exceed the limits in 173.443; and the outside of the package to be marked "Radioactive".

  - Subpart 173.427 defines empty containers as having an internal contamination of less than 100 times 173.443.

  - Subpart 173.441 sets radiation level limits on the full container.

  - Subpart 173.443 defines exterior contamination as beta-gamma of 10 to the minus 5 micro Ci/sq. cm and 22 dpm/sq cm and alpha of 10 to the minus 6 micro Ci/ sq cm and 2.2 dpm/ sq cm.

  - Also, the vehicle use and radiation is controlled (0.5 millirem per hour on the accessible surfaces with no significant removable surface contamination; and the interior surfaces of the empty vehicle (container?) is less than 10 millirems per hour at the surface).

DOE ORDERS

1540.1 "Materials Transportation and Traffic Management" (updated July 20, 1990).

- Not referenced in FDC.
- This order covers "for other than intrabuilding and intrasite transfers".
- Nothing on decontamination (except than its the shipper's responsibility).

5400.1 "General Environmental Protection Program" (updated June 29. 1990)

- Sets general policy.
- Chapter II, Paragraph 5 covers radioactive effluent discharge reporting (would this include use of decontamination blowdown as dust control?)

5400.5 "Radiation Protection of the Public and Environment" (updated June 5, 1990)

- Chapter II Section 5.c.1 The release for sale of equipment is allowed if contamination is less than the values in Table IV-1. Since this covers sale to the public, it is more restrictive than we must meet.

5440.1D "National Environmental Policy Act Compliance Program" (Feb. 22, 1991)

- Nothing on decontamination.

5480.1B "Environment, Safety, and Health Program for Development of Energy Operations" (updated March 1990)

- Not referenced in FDC.
- Nothing on decontamination.

5480.3 "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Substances, and Hazardous Wastes" (July 9. 1985)

- Covers construction and testing of containers and transportation of hazardous materials.
- Refers to 49-CFR-173.
- Nothing on decontamination.

5480.4 "Environmental Protection, Safety, and Health Protection Standards" (updated Sept. 20, 1991)

- Lists the related standards.
- Nothing pertinent to decontamination.

5480.7A "Fire Protection" (February 17, 1993)

- Use 8 inch mains.
- Sets schedule for hazard analysis.
- Design shall at least meet NFPA.
- Other items affect final design.

5480.9 "Construction Safety and Health Program"

- Nothing pertinent to decontamination.

5480.11 "Radiation Protection for Occupational Workers" (Change No. 3 dated June 17, 1992)

- Clean as thoroughly as possible and must have:

  a. Total or removeable less than Attachment 2 (see Appendix A);
  b. Prior use suggest won't pass Attachment 2 levels.

5480.23 "Nuclear Safety Analysis Reports" (April 30, 1992)

- Nothing pertinent to decontamination.

5484.1 "Environmental Protection, Safety, and Health Protection Information Reporting Requirements" (Change No. 6, updated June 29, 1990)

- Sets requirements for investigating accidents, etc.
- Nothing pertinent to decontamination.

5632.6 "Physical Protection of DOE Property and Unclassified Facilities"

- Sets requirements for overall site security.
- Nothing directly relevant to the decontamination facility.

5700.6C "Quality Assurance" (August 21, 1991)

- Nothing pertinent to decontamination.

5820.2A "Radioactive Waste Management" (Sept. 26, 1988)

- Decontamination defined as "the removal of radioactive contamination from facilities, equipment, or soils by washing, heating, chemical, or electrochemical action, mechanical cleaning, or other techniques." Nothing else of pertinence.

6430.1A "US Dept of Energy General Design Criteria"

- Section 0273-99 "Water Pollution Control"
    - General sanitary wastewater treatment and disposal guidelines.
    - Nothing onerous (recommends against package wastewater treatment systems).

- Section 0275-99 "Industrial Wastewater Treatment"
    - Refers to:

      40-CFR-264.192--design of new hazardous waste tanks;
      40-CFR-264.193--secondary containment on new and existing hazardous waste tanks systems;
      40-CFR-264.197 Groundwater monitoring;
      40-CFR-265.197 Groundwater monitoring;
      40-CFR-280.20 Covers piping materials and installation.

    - Page 2-51: "Radioactive waste collection, transfer, and storage systems shall be such as to avoid the dilution of radioactive waste by waste of lower level radioactivity or other waste. This may require the provision of multiple and parallel systems. Systems that involve the possible dilution of radioactive wastes shall only be used with the concurrence of the sponsoring DOE program office."

US DOE REPORTS

Department of Energy--June, 1992 "Radiological Control Manual"

- Not referenced in FDC.
- Personnel decontamination is covered.
- Refers to 49-CFR-170.180.
- Intra-site transport can be less stringent within certain guidelines (Section 423).
- Similar wording to other manuals.

Freeberg, Rodger D., Department of Energy, Environmental Restoration Division--January 20, 1993 "Environmental Restoration (ER) Storage & Disposal Facility (SDF): Minutes from December 18, 1992, Regulatory Strategy Meeting."

- Not referenced in FDC.
- If possible, reuse UMTRA equipment on this project.

U.S. Department of Energy--January 6, 1993 "Engineering Handbook"

- Not referenced in FDC.
- Pages 6-10 and 11 provide some design information referenced to DOE Orders.

DOE RICHLAND ORDERS

5400.1 "General Environmental Protection Program"

- Nothing pertinent to decon.

5440.1A "Implementation of the National Environmental Policy Act at the Richland Operations Office"

- Nothing pertinent to decontamination.

5480.1A "Environment, Safety, and Health Program for Department of Energy Operations for Richland Operations"

- Nothing pertinent to decontamination.

IP5480.4C "Environmental Protection, Safety, and Health Protection Standards for RL"

- Nothing pertinent to decontamination.

IP5480.7 "Fire Protection"

- Use 12 inch diameter mains.
- Defines locations of valves and redundancy.
- Utilize this information in final design.

IP5480.9 "Construction Safety and Health Program"

- Not referenced in FDC.
- Sets construction standards.
- Nothing pertinent to decontamination.

IP5480.11 "Radiation Protection for Occupational Workers"

- Not referenced in FDC.
- To be released, equipment must have no detectable radioactivity.

IP5483.1B "Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated (GOCO) Facilities"

- Nothing pertinent to decontamination.

5820.2A "Radioactive Waste Management" (8-15-90)

- Supplements DOE 5820.2A.
- Nothing pertinent to decontamination.

WASHINGTON ADMINISTRATIVE CODE

WAC 173-201 "Water Quality Standards for Surface Waters of the State of Washington"

- Defines surface water classifications.
- Sets toxic levels.
- Would affect the decontamination facility only if there is a discharge point.
- WAC 173-201A added radioactive substance controls.

WAC 173-240 "Submission of Plans and Reports for construction of Wastewater Facilities"

- Not referenced in FDC.
- Could possibly be construed to require submission of decontamination treatment facilities if classified as "industrial wastewater".
- Requires reports and plans to be prepared under guidance of PE and submitted to WA Ecology for review.
- Requires Operation and Maintenance Manuals.

WAC 173-303 "Dangerous Waste Regulations"

- Pertains to ERSDF permitting and operation.
- Section 160 "Containers" defines empty (similar regulations as 49-CFR-261.7).
- Section 395.4 Must provide facilities to "contain wash waters resulting from the cleaning of ...equipment."
- Section 395.6 Label containers to adequately identify risks.
- Section 640 "Tank Systems for Treatment" Could be enforced for the wash system so will be met during design.

- Section 655 Land treatment could be construed to be the land application of the waste material for dust control. Due to the site's overall use, probably not a concern.
- Section 665 is on landfills which covers the ERSDF but nothing pertinent to decontamination.

WAC 173-304 "Minimum Functional Standards for Solid Waste Handling"

- Nothing pertinent to decontamination.

WAC 173-340 "Model Toxics Control Act Cleanup Regulations"

- Not referenced in FDC.
- Pertains to site cleanup, not the ERSDF.
- Defines picocurie as 10 to the minus 10 curies (page 13). This differs from both 40-CFR-192 and "Cember".

WAC 173-400 "General Regulations for Air Pollution Services:

- Appears to cover dust control ("fugitive dust").
- Nothing pertinent to decontamination.

WAC 173-480 "Ambient Air Quality Standards and Emission Limits for Radionuclides"

- Best Available Radionuclide Control Technology (BARCT) is required.
- Sets acceptable limits.

WAC 246-221 "Radiation Protection Standards"

- Limits radiation doses to people.
- Buried in soil must be in accordance with WAC 246-221-180.

WAC 248-54 "Public Water Supplies"

- Section 035 requires plans and specifications to be prepared by a licensed Professional Engineer and a construction report to be submitted.
- Sections 105 through 155 covers design issues.
- Sections 165 through 190 covers monitoring and other water quality issues.
- Sections 195 through 285 covers water system operation.
- Section 285 sets requirements for backflow prevention to protect water supplies, if cross connections cannot be eliminated.

WAC 296-62 "Occupational Health Standards"

- Specific controls are set.

RCW 70.94 "Washington Clean Air Act"

- Nothing pertaining to decontamination.

RCW 70.95 "Solid Waste Management--Reduction and Recycling"

- Table of Contents indicated nothing pertinent to decontamination.

RCW 90.48 "Radiation Protection Standards"

- Includes groundwater protection.
- Permit required to discharge to groundwater.

NATIONAL CODES

NFPA 90 "Air Conditioning and Ventilation Systems"

- Pertinent to final design.

National Fire Code

- Pertinent to final design.

Uniform Fire Code

- Pertinent to final design.

Fire Hazards Analysis EF-31.3

- Pertinent to final design.

HANFORD SITE MANUALS

HSRCM-1 "Hanford Site Radiological Control Manual"

- Not referenced in FDC.
- Pages 2-11 through 13 sets contamination levels. Table 2-3 is similar to DOE 5480.11 Table in Appendix A except the second line (Transuranics) for Total is 500 dpm/sq cm instead of 300 dpm/sq cm and the HRSCM includes a line for tritium organic compounds with Removables of 10,000 dpm/100 sq cm and Total of 10,000 dpm/100 sq cm.
- Pages 3-41 through 43 covers restoration construction.
- Also provides info on personnel decontamination.
- Chapter 4, Part 4, Paragraph 442 covers "Waste Minimization"
  - It states that "A radioactive waste minimization program shall be in effect to reduce the generation of radioactive wastes...", "Substitute recyclable or incineratable items in place of disposable ones...", and "reserve an assortment of tools primarily for use in contamination...areas."

- Chapter 4, Part 6, Paragraph 463 covers "Decontamination"
  - "4. Water and steam should normally be used as decontamination agents. Other cleaning agents should be selected based upon their effectiveness, hazardous properties, amount of waste generated, and ease of disposal."

"Hanford Plant Standards"

- SDC-1.2 "General Design Criteria"
  - Contains standard details for Mech, Elect, Inst, Arch-Civil.
- SDC-1.3 "Preparation and Control of Engineering and Fabrication Drawings"
  - Contains info on standardization of all drawings and drawing number system.
  - "F" size drawings (28 inch by 40 inch) are preferred size.
- SDC-1.4 "Preparation and Control of Multiple Use Hanford Specifications"
  - Pertinent to Final Design.
- SDC-3.1 "Railroads"
  - Nothing pertinent to the decontamination study.
- SDC-3.2 "Depth of Bury of Pipelines"
  - Pertinent to Final Design.
- SDC-4.1 "Standard Architectural-Civil Design Criteria"
  - Pertinent to Final Design.
- SDC-5.1 "Standard Design Criteria for Heating, Ventilation, and Air Conditioning"
  - Pertinent for Final Design.
  - Design for 9 degrees F minimum and 101 degrees F db/68 degrees F wet bulb.
  - Design for minimum of 50 degrees F interior in winter.
  - Use U of 0.0921 for Decontamination Facility.
  - Ventilate at more than 5 cfm/person.
- SDC-7.2 "Standard Electrical Design Criteria for Outside Lighting and Aerial Dist. System"
  - Pertinent for Final Design.

- SDC-7.4 "Standard Electrical Design Criteria for Underground Power Distribution System"
    - Pertinent for Final Design.
- SDC-7.5 "Standard Electrical Design Criteria for Interior Power and Lighting Systems"
    - Pertinent for Final Design.
- SDC-7.7 "Standard Electrical Design Criteria for Communications, Signaling, and Low Voltage Control Systems"
    - Pertinent for Final Design.
- SDC-7.8 "Standard Electrical Design Criteria for Alarm Systems"
    - Pertinent for Final Design.
- Other Volumes provide Electrical, Instrumentation, and Mechanical specifications and details
    - Pertinent for Final Design.

WHC-CM-1-3 "Management Requirements and Procedures"

- Policy and Procedures.
- MRP 5.20 "Packaging and Transportation of Hazardous Wastes."
    - "Transportation and Packaging" has overall responsibility for implementing rules.
    - Lists other responsible groups.
    - Paragraph 5.7 refers to MRP 5.37 for "on-site radiological controls" and to 49-CFR-173.441 and .443.
- MRP 5.37 "ALARA Program"
    - Sets duties and refers to other documents.
- MRP 5.46 "Safety Classification of Systems, Components, and Structures."
    - Defines safety levels (Safety Class 1 is most safe and Class 4 is least safe.)

WHC-CM-2-14 "Hazardous Material Packaging and Shipping"

- Not referenced in FDC.
- It refers to other documents.
- Part III 1.2 Hazardous Materials/Hazardous Waste transport must meet DOT.
- Part IV 1.2.2 Rad waste transport, where possible, must meet DOT.
- Part IV 2.2 Rad mixed waste transport must meet DOT.

WHC-CM-4-2 "Level II Quality Assurance"

- Not referenced in FDC.
- Provides general QA procedures.
- Nothing pertinent to decontamination.

WHC-CM-4-3 "Industrial Safety Manuals"

- Vol 1. "Safety Standards"
  - In general, it sets design and operational guidelines.
  - Std G-7 Elevated Walkway and Working Surfaces.
  - PP-2 Eye and face protection.

- Vol. 2 "Safety Guides"
  - In general, it supplements Vol. 1.

- Vol. 3 "Safety Programs"

  - Nothing pertinent to decontamination.

- Vol. 4 "Health and Safety Programs for Hazardous Waste Operations"

  - 3.2.11 "Decontamination"--discusses procedures.
  - Appendix K "Decontamination Guidance"

    Provides guidance on decontamination control. Page K-9 recommends "equipment decontamination to consist of washing or steam cleaning with a detergent/water or other decontamination solution. Rinsing with dilute nitric acid solution may be necessary to remove metal oxides and hydroxides. Field decontamination shall be performed inside impoundments ... to ensure that all wash liquids are captured."

    Page K-12 recommends different types of personnel protection based on use of steam jets or other special high humidity situations.

WHC-CM-4-9 "Radiological Design".

- Pages 3-1 through 4 discusses contamination control.
- Section 3.4 discusses "Equipment Decontamination and Control" but does not provide detailed guidance.
- Pages 5-7 through 14 provides workplace isolation based on radiation levels.

WHC-CM-4-10 "Radiological Protection"--has been recalled and will be reissued in June.

- Section 11 "Control and Storage of Radioactive Materials and Equipment"

  - Per FDC pages 8 and 12--vehicles that leave site must be released for "unrestricted use" per Section 11. On site equipment will be "regulated equipment".

Paragraph 4.4.4 covers regulated vehicles and equipment.

"1. Loose surface contamination shall be maintained less than minimum detectable (as defined in 4.6.1 of this section) throughout the cab and on the tires, wheels, and accessible areas."

"2. Contamination surveys shall be performed before and during maintenance of regulated vehicles or equipment as necessary to establish contamination controls for the vehicles/equipment. "

"8. Regulated vehicles with empty, closed cargo areas (e.g., cargo vans) shall meet the following criteria before being removed from an SCA:

a. Loose surface contamination shall be less than minimum detectable on surfaces external to the enclosed cargo area

b. Radiation levels measured on contact with external surfaces (not including those external to the enclosed cargo area) shall be less than 0.5 mrem/hr

c. Radiation levels measured on contact with the cargo area surface shall be less than 10 mrem/hr, and less than 2 mrem/hr inside the vehicle cab

d. Loose surface contamination levels shall not excess 22,000 dpm/100 cm2 beta-gamma, or 2200 dpm/100 cm2 alpha for any interior surface (not including the vehicle cab)

e. Any cargo spaces that contain loose surface contamination shall be locked when not in use."

"9. Regulated vehicles shall be marked in accordance with Section 9.0 of this manual."

"10. the responsible manager shall maintain an inventory of all regulated vehicles and equipment."

"11. OHS shall ensure that all regulated equipment receives routine radiation and contamination surveys at a frequency commensurate with the vehicle's risk of exceeding the maximum allowable radiation and contamination levels established for the equipment in the RWP (as specified in WHC-IP-0718)."

"12. Regulated vehicles and equipment that exceeds the contamination or radiation criteria of this section shall be controlled as radioactive material and shall be shipped in accordance with WHC-CM-2-14."

"13. The number of regulated vehicles and amount of regulated equipment shall be minimized."

- Paragraph 4.6 covers "Unconditional Release from Radiological Controls"

  "2. Materials and equipment may be unconditionally released from radiological controls if they satisfy all the following criteria (a., b.(1) and b.(2)):

  a. No radioactive material is present on accessible surfaces in excess of the minimum detectable activity (MDA) levels

     NOTE: The MDA levels are as defined in 4.6.1. of this section, when surveyed by an HPT using WHC standard survey techniques to ensure that the amount of surface activity specified in Table 11-1 (same as table in Appendix A) can be detected.

  b. Radioactive material is not distributed within the matrix of the material in excess of the following limits:

     (1) Specific activity does not exceed:

       - 60 pCi/g gross alpha, and
       - 200 pCi/g total activity, or

     (2) The total quantity of radioactive material present does not exceed the "Exempt Quantities for Radioactive Materials" (Appendix F)."

- "4.6.1 1. For the purposes of detecting beta-gamma contamination, minimum detectable activity (MDA) is 100 counts per minute (cpm) above background where background is less than 160 cpm."

  "2. for the purposes of detecting alpha contamination, 20 cpm gross activity constitutes detectable activity (MDA is 20 cpm alpha)."

- Paragraph 4.8 covers "Release of Contaminated Materials and Equipment for Use Onsite"

  "1. Under exceptional conditions, material and equipment with fixed contamination above detectable levels or with internal contamination may be used in RCAs."

WHC-CM-4-11 "ALARA Program Manual"

- Pages 7-20 through 22 discusses personnel radiation doses.
- Nothing on equipment decontamination.

WHC-CM-4-29 "Nuclear Criticality Safety"

- Nothing pertinent to decontamination.

WHC-CM-4-33 "Security Manual"

- Defines security guidelines.
- Section 2.8 "Control of Special Nuclear Material" covers on-site transfers.
- Nothing pertinent to decontamination.

WHC-CM-4-41 "Fire Protection Program Manual"

- Defines fire protection guidelines.
- References design criteria in other manuals.
- Appendix discusses water systems for each area.
- Nothing pertinent to decontamination.

WHC-CM-4-46 "Non Reactor Facility Safety Analysis".

- Not referenced in FDC.
- Interesting information on safety analysis and classifications.
- May be a safety reference.
- Nothing on decontamination in particular.

WHC-CM-7-5 "Environmental Compliance Manual".

- Lots of information but nothing pertinent to decontamination.
- Section 7--Solid Waste Management.
- Section 8 Water Quality (evap ponds and disposal).

HANFORD REPORTS

R.G. Bauer; Westinghouse Hanford Company-Sept. 25, 1992 "Hanford Site Weather Enclosure 100-B/C Area Remediation Hazardous Waste Management Disposal Complex" WHC-SD-EN-ES-028.

- Not referenced in FDC.
- Eliminated need for dust enclosures with recommendation for dust control.

R.G. Bauer; Westinghouse Hanford Company-Sept. 28 1992 "Material Handling and Analytical System for the 100 B/C Area Macroengineering Prototype Report" WHC-SD-EN-FDC-003.

- Sections 1.3 and 1.4 .
- Page 36 covers construction requirements and use "a minimum quantity of water or decontamination solution."

Briefing Document--August 14, 1992 "Hanford Monitoring Waste Disposal System (200 Area TSD)"

- Not referenced in FDC.
- This is an earlier study on the ERSDF.

HS-BP-0041E (April 9, 1993) "Container, Metal Box for Shipping and Storage of Solid, Low Level Radioactive Material"

- Not referenced in FDC.
- Use forklift or sling for handling.
- Painted or galv. steel, aluminum coating, or stainless steel construction.

Los Alamos Technical Associates 'July 1992 "Final Value Engineering Study Report--Hanford Site Weather Enclosures 100 B/C Area" Prepared for Westinghouse Hanford Company.

- Not referenced in FDC.
- Use dust sprays instead of enclosures over excavation sites.

Los Alamos Technical Associates" August 1992 "Final Value Engineering Study Report--Hanford Site Weather Enclosures 100 B/C Area Remediation Hazardous Waste Management" Prepared for Westinghouse Hanford Company.

- Not referenced in FDC.
- Use dust sprays instead of enclosures over excavation sites.

Moore, R.T., "100-B/C Area Environmental Restoration Pre-Design Guidance Document," WHC-SD-EN-DGS-001, 5/7/93

- This document provides pre-design guidance and general information related to first environmental restoration project that will contribute waste to the ERSDF.

"Safety Analysis Report (SAR) for Packaging: Low Level Metal Box Containers, HCS-079-002", SD-RE-SAP-092, Dec. 13. 1988

- Not referenced in FDC.
- Package contact dose must not exceed 500 mrem/hr (with prior approval, this can be increased to 1,000 mrem/hr.)
- Must meet DOT requirements.
- Section 4.1.8 covers full containers. Exterior smear tests must be less than 2.2 dpm/cm2 for alpha and less than 22 dpm/cm2 for beta and gamma.
- Section 4.3.3 states that internal contamination must be less than 10 time levels of 4.1.8.
- Section 4.3.5 states that reuse of containers must meet levels of section 4.1.8.

•A revision dated 12/16/92 by Carlstom provided the following:

  - Section 4.3.3.7 limited external removeable contamination to 220 dpm/100 cm2 alpha and 2200 dpm/100 cm2 beta-gamma.
  - Section 4.3.5.4 limited external contamination to same as 4.3.3.7 and internal of bed for reuse to 10 time limits of 4.3.3.7.

W. E. Taylor: Westinghouse Hanford Company--April 9, 1993 "Hazard Assessment for Environmental restoration Storage and Disposal Facility, Project W-296" WHC-SD-EN-SAD-024.

- Not referenced in FDC.
- Looked at dust generation information.

Video Tape--July 27, 1992 UMTRA Project--Grand Junction, Colorado.

- Not referenced in FDC.
- Contains good information on the operation of that facility.

Westinghouse Hanford Company Environmental Engineering Group, Prepublished Sept 1991, "200 Area Hanford Past Practice Site Cleanup and Disposal Conceptual Study" WHC-EP-0454.

- Not referenced in FDC.
- Page 35--decon exterior with water, collect and treat for reuse, dry with hot air.
- Page 64--dedicated equipment.
  - Perform dry decontamination if radiological screening allows.
  - If gross contamination occurs--cover and remove to permanent decontamination station.
  - Daily decontamination of equipment with frequent monitoring for additional decontamination.
  - Treat decontamination waste water via slurry VRS.

Westinghouse Hanford Company, July 1992, "100 Areas Hanford Past Practice Site Cleanup and Restoration Conceptual Study" WHC-EP-0457

- Not referenced in FDC.
- The following are the relevant paragraphs:
- "6.8 CONSIDERATION OF DECONTAMINATABILITY
  - "Contamination will accumulate on heavy equipment during use. Preventive measures will be taken to reduce the rate of contaminant buildup. For example, at the end of each shift, equipment will be monitored and hot spots wiped clean. Hydraulic lines, motors, and other components of heavy equipment will be sealed with covers (e.g., flexible rubber sleeves or protective boots) that are easy to clean to facilitate decontamination and maintenance.

  - "Heavy equipment decontamination potentially would involve wiping, washing, and/or sandblasting. Decontamination operations will be conducted in a dedicated area designed to contain all wash solutions and particulates. Wiping will remove surface contamination; washing and/or sandblasting will provide more thorough contaminant removal. Sandblasting is the most extensive decontamination method and is generally followed by repainting the equipment."

- "Reusable containers (Type 1 and 2) can also be decontaminated, if necessary. The 50 yd3 containers that consist primarily of flat surfaces can be readily decontaminated by washing or sandblasting."

Willis and Triner; Westinghouse Hanford Company "Hanford Site Solid Waste Acceptance Criteria" WHC-EP-0063-3.

- Not referenced in FDC.
- Refers to 49-CFR-173.441.
- Also provides surface dose rates (which should be met by decontamination at originating site.)
- Triple rinse cleaning--see page 7-12 for reuse.

Kaiser-June 1988 (Conceptual Design Report) "Radioactive Mixed Waste Disposal Facilities (Projects W-025, W-031)" Prepared for Westinghouse Hanford Company, WHC-SD-W100-CDR-001 Rev. 0.

- Not referenced in FDC.
- Relevant to overall project.
- Nothing on decontamination.

Kaiser-April 1991 (Design Only Validation Report) "Waste Receiving and Processing Facility Module 2 (Project W-100)" Prepared for Westinghouse Hanford Company.

- Not referenced in FDC.
- Page 8: The facilities will include:

  - 22 foot wide by 120 foot long decontamination bay for flat bed trailer and rail car:
  - High pressure decontamination washing gear;
  - Wastewater will be cleaned for reuse.

- System aimed at full decontamination of equipment so much more involved than needed for ERSDF decontamination facility.

C.A. Rieck: Westinghouse Hanford Company-June 5, 1989 (Conceptual Design Report) "Waste Receiving and Processing Facility Module 1 (Project W-026)" WHC-SD-W026-CDR-004.

- Not referenced in FDC.
- This facility handles TRU and low level waste.
- Decontaminate with wipes and Turco solution and detergents.
- Decontaminate only brushes, tools and instruments (decontamination system aimed at high rad wastes on small items.)
- All decontamination done in a glovebox.
- Use steam, hot water, detergents, chemical solutions.
- Pages 35 through 37 present the decontamination system piping and waste collection.

OTHER

Cember, Herman, INTRODUCTION TO HEALTH PHYSICS, Pergammon Press, 1969.

- On page 84, the following were defined:
  - "The curie is a measure only of quantity of radioactive material."
  - "1 curie (Ci)=3.7×10^{10} dps"
  - "1 millicuri (mCi)=10^{-3} Ci" (therefore, 3.7×10^{7} dps.)
  - "1 picocuri (pCi)= 10^{-12} Ci." (therefore, 3.7×10^{-2} dps.)
  - Therefore, 1 pCi=2.2 dpm.

Cothern, C. Richard and Rebers, Paul A., (Editors) Radon, Radium and Uranium in Drinking Water, Lewis Publishers, Inc. 1990.

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SURFACE RADIOACTIVITY GUIDES

NUCLIDE1/	REMOVABLE2/4/	TOTAL2/3/ (FIXED PLUS REMOVABLE)
U-nat, U-235, U-238, and associated decay products	1,000 dpm α/100 cm²	5,000 dpm α/100 cm²
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20 dpm/100 cm²	300 dpm/100 cm²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200 dpm/100 cm²	1,000 dpm/100 cm²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.5/	1,000 dpm β-Γ/100 cm²	5,000 dpm β-Γ/100 cm²

1/ Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

2/ As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

3/ The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the guide values. For purposes of averaging, any square meter of surface shall be considered to be above the activity guide <u>G</u> if: (1) from measurements of a representative number n of sections it is determined that $1/n \Sigma_n S_i \geq G$, where S_i is the dis/min-100 cm^2 determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds 3G.

4/ The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-226, Ra-228, Ac-227, Th-228, Th-230, and Pa-231 alpha emitters, it is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

5/ This category of radionuclides includes mixed fission products, including the SR-90 which is present in them. It does not apply to SR-90 which has been separated from the other fission products or mixtures where the SR-90 has been enriched.

Appendix B

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MONTGOMERY WATSON

FILE COPY

To:	Distribution	Date:	May 24 1993
From:	Larry Bennett	Job No.:	1202.0252
Subject:	Hanford ERSDF Engineering Studies		

On Friday, May 21, 1993, Wendell Greenwald, Clark Hodge, Kevin Kelly, and Larry Bennett met with Jerry Faulk (Manager), Rick Millikan, and Bill Smith (Chief Operator) of the T Plant/340 Facility. They provided a 15 page brochure that describes their function. Bill Smith also gave us a tour of the facility. The 340 Facility was the original nuclear processing facility and was later remodeled to perform the current mission of both high and low level radioactive decontamination. Low level decontamination and repair occurs in 2706-T and high level decontamination and repair occurs in 221-T Canyon. They mainly decontaminate small pieces of equipment although they can decontaminate railcars with containers and locomotives. It is estimated that it would take four hours to decontaminate a railcar and one container to be ready for radiological surveying. However, not every railcar would pass on the first survey so multiple decontaminations may be needed. They currently use hand held wands that use excessive amounts of water (there is no recycle). They investigated the use of frozen CO_2 but determined that the dilution of the atmosphere with CO_2 would be unacceptable so they are converting to small ice pellets which will be used similar to sandblast sand. This should reduce their water demand to 10 gallons per hour. The ice makers will cost $250,000 each. They send all their water to the 200 West Area evaporator, but there is no capacity for more volume.

Our concept of an automated "car wash" type system intrigued them. They commented that an automated system would be needed due to the large quantity of containers that we will be processing.

Comments pertinent to our study:

1. Add a stainless steel exterior skin to the containers to speed the decontamination and frisking.
2. Need to dry the containers after cleaning to expedite the radiological survey.
3. Try to use automated radiological surveying equipment instead of HPT's to do surveying.
4. "Smear" tests are required by the regulations.
5. The use of permanent instruments to detect radiation on the containers as they leave the "car wash" similar to those used to survey personnel was discussed. They should be effective due to the low background radiological levels. To make this work, we should consider locating the decontamination facility on the leeward side of the ERSDF to minimize wind borne radioactive dust from increasing the background levels.
6. Need to have HEPA filters on the building exhaust since the facility is nuclear. The fan capacity needs to be set by the opening size (to maintain negative ventilation at all times). With the large door openings, may need to have variable speed fans (or multiple speed fans?) that

speed the fans when the doors are open. (We should also consider multiple fans with the large fans "on" when a door is open and to sequence operations so only one door is open at a time.)

7. Need to preheat the air since the high humidity will quickly foul the HEPA filters. The alternative of a dehumidifier was broached and might be beneficial. Kaiser Engineers tried to preheat the air but the system is not working properly.

8. Jay Bottenus did the research into the CO2 and ice cleaning systems. Larry Bennett will contact him to follow up on these systems.

Distribution: W. Greenwald
K. Kelly
File

M E M O R A N D U M

MONTGOMERY WATSON

To:	Distribution	**Date:**	May 25, 1993
From:	Kevin Kelly		
Subject:	USACE-Walla Walla District Hanford Site ERSDF-Engineering Studies and Design Analysis Minutes for Tour of U.S. Ecology Facility	**Reference:**	1202.0250/3.1.1

On May 21st, Wendell Greenwald (USACE), Clark Hogde (WHC), Larry Bennett (MW), and Kevin Kelly (WHC) met with Dan Tallman of U.S. Ecology to tour their disposal facility located on the Hanford site. U.S. Ecology operates a disposal facility encompassing approximately 1000 acres near the 200 East Area. U.S. Ecology is a subsidiary of American Ecology and operates a total of three sites throughout the country. The salient points of the tour are as follows:

-The facility has been designed in accordance with NRC and WAC requirements. The facility has been open since 1965, and operates under the following provisions:

-Can accept LLW and nonhazardous packaged waste,
-Capacity of 50 million cu. ft. (30,000 cu. yds.). Between 1986 and 1992, they accepted approximately 400,000 cu. ft. per year.
-Dispose of material in unlined trenches,
-Expect to be in operation for approximately 70 years.
-The operational limit for wind speeds is 20 to 25 mph for all activities, and 15 mph when working with open containers.
-The charge for disposal is approximately $50 per cu. ft.

-A description of the facility operation is as follows:

-The site is completely fenced with a remotely operated gate. There are also two inspection trailers and an administration building on site. The facility employs a total of 23 individuals. The state of Washington maintains one inspection trailer for an on site individual, who is responsible for verifying the waste characterization as it arrives on site.
-The trenches are 45 feet deep, 150 feet wide at the top, and 1000 feet long, with a 1:1 side slope. There is a distance of 10 feet between trenches, and two adjacent trenches are not open simultaneously. The trenches are oriented in a north-south direction to minimize exposure to sunlight, which reduces sloughing.
-The packaged waste arrives at the facility on truck and is off loaded onto site equipment for transportation to the trenches. The packaged waste is then off loaded using forklifts and lowered into the trench using a crane. The cranes have a 40,000 pound capacity and can reach up to 85 feet. The cranes are set back from the trench by about 45 feet. Larger cranes are brought in from Lampson for larger loads. The containers are released from the crane using a remote pull pins. Nobody is allowed into the trench during the waste placement operation. There are some protective cages for personnel to be lowered by the

crane into the trench, if required. On site, the facility has three trailers, two to three forklifts, one or two compactors, three cranes, and miscellaneous vans.
- The crane uses a large bucket to cover the containers with fill material following placement. The fill is loosely placed on the containers and there has not been a documented instance of subsidence. Backfill material is generally derived from on site excavation sources, although material has also been brought in from off site borrow sites.
-Cover material is placed on the trench following placement of the waste to within seven feet of the top of the trench. The cover is comprised of on site soil and is the same as the fill material. It was unclear whether this represents the final cover.
-The facility uses approximately 2.5 to 3 million gallons of water per year for dust control and to facilitate earth work. They occasionally have water standing on the surface, but this is generally restricted to one week during the year. They have a groundwater and vadose monitoring system in place which has not detected a release from the operation.
-They do not perform decontamination at the facility, since the equipment is dedicated to the site and they don't allow equipment into the trenches. However, they do perform radiological surveys of all equipment leaving the site. This activity takes approximately 5 minutes for a 45 foot long trailer.

Mr. Tallman was extremely helpful and provided significant insight into their operation. He also expressed a strong interest in being able to dispose of some of the LLW from the Hanford site. This option will be explored in more detail by WHC personnel.

Distribution:	W. Greenwald	J. Jacobson
	F. Shuri	L. Bennett
	D. Spencer	

MONTGOMERY WATSON

To:	File	**Date:**	June 30, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--UMTRA Decontamination		

The following is a summary of the audio only video tape (15:30 minutes) taken during a visit to the UMTRA (Uranium Mine Tailings Reclamation Act) site at Grand Junction, CO. Also, information from the June 30, 1993, telephone conversation with Mr. Gary Nelson of Western Transport Co. is included.

It appeared that water pumps and water trucks were available. If so, they were for dust control on the reclamation site. Lights were also visible similar to lights used for night work. Dozers were visible for moving material horizontally.

Large excavation type, mechanized hoes located on top of the mine tailings excavated the material and loaded the containers mounted on truck trailers. Some spillage of material occurred during loading. After loading, the trucks went through a decontamination procedure. The tops and sides were washed with high volumes of water from an overhead bridge. Then the wheels and sides were washed from ground level high volume hoses. Each of wash steps required two to three people to operate. After the water washing, the trucks went through another bridge where a liquid was sprayed onto the top of the containers contents, apparently for dust control during transportation.

The truck travels up to one mile to the rail head where the container was transferred to flat bed rail cars with two containers per rail car. The large mobile loader transferred a full container from the truck to the rail car in just under 1 minute and then transferred a returning container to the truck in about one more minute. The large loader cost about $400,000 each new. There are two large loaders and one small loader at each rail head. The trucks, trailers, containers and loaders are owned by Western Transport. The rail cars are owned by Santa Fe Railroad.

The containers were manufactured by MayFab. Spare containers were stored on the ground. A second, smaller loader was used to move the empty containers. The small loaders were purchased used for about $45,000 to 70,000 each.

The containers were shipped by rail about ten miles to a site where the containers were transferred to trucks and driven about eight miles to the permanent storage pit. The pit appeared to be lined. The material was dumped into the pit from the top of the excavation. A dozer moved the material into the pit. After dumping, the truck and container was again washed the same as after loading. Occasionally, materials hang up inside the container. The Contractor tried release agents but the release agents did not work consistently due to the variability of materials so they used a backhoe to scrape out the materials. The video then showed some containers being filled with what appeared to be soil for backhauling to the remediation site. About 10 to 20% of the containers carry backhauled material.

The project includes the moving of 4.4 million cubic yards of material over a 2.5 year period. The project will be complete in July 1993. Included in the material was about 1.5 million cubic yards of "vicinity property materials" which included soils, muck, concrete, etc. that had been contaminated by the mill tailings (eg., used as sand in concrete mixes). This is the material that hung up in the containers when dumped.

MONTGOMERY WATSON

MEMORANDUM

To: Distribution Date: June 8, 1993
From: Don Spencer
Reference: 1202.0255
Subject: EnviroCare of Utah, of Utah, Inc.
On-site visit to hazardous waste disposal facility located at Clive, Tooele County, Utah

On June 7, 1993, I met with Dan Owen, Site Manager at EnviroCare's waste disposal facility. The Clive site is located approximately 75 miles west of Salt Lake City at I-80 exit No. 49. Dan can be contacted by phone at (801) 566-3091 (mobile), (801) 521-9619 (Clive Utah Office), (810) 521-9630 (fax).

This meeting was set up through Steve Moynahan who is an EnviroCare employee working out of their Salt Lake City Office which is at 46 West Broadway, Suite 240, Salt Lake City Utah 84101. Salt Lake City telephone (801) 532-1330.

Type of Waste

The Clive facility holds a number of permits for hazardous materials. Relevant to the Hanford facility, the Clive facility is permitted by the Utah Division of Radiation Control to disposal of radioactive waste have a level of 2,000 Picocuries/Gram. Utah is an agreement state with the NRC and the permit issued by Utah is therefore a NRC permit. Waste, including mill tailings and depleted uranium, is currently being processed from multiple uranium processing plants including Grand Junction, Colorado. Non radioactive hazardous wastes are also being processed.

Disposal Cells

Mill tailing are being placed in disposal cells which have a two foot clay liner with constructed permeability of 10^{-7} cm/sec. Other wastes are placed in cells which have the clay liner plus two synthetic liners. Cells are constructed to a depth of 9 feet and extent approximately 15 feet (my visual observation) above ground.

Transportation

All materials are transported to the facility by rail using ~~to~~ Two configurations.

- 50 foot long closed bottom and open top rail cars, fitted with a removable top lid. These cars are used for bagged and loose materials. Prior to unloading a moisture test is conducted and water is added to provide optimum compaction moisture content plus 2%. The cars are placed in a roll over rail car dumping facility manufactured by Heyl & Patterson Inc, P.O. Box 36, Pittsburgh, PA 15230, Tel (412) 788-6900. Dumped material is held in a hopper prior to being dumped into a 35 ton rock truck. This truck hauls directly into the disposal cell where the truck travels directly on previously dumped material. The truck is not decontaminated at any point in it's operating route. The entire truck route is inside the disposal site enclosure fence. Dan Owen indicates that this procedure is their preferred method of operation.

- Container designated as B-25 are commonly used. These containers hold approximately 7 tons of materials. Containers are dumped into a 35 ton rock truck using a FR-15 container loader. Prior to unloading the containers, a moisture test is conducted and water is added to provide optimum compaction moisture content plus 2%.

Decontamination
Two prefabricated metal buildings are provided for decontamination, one for rail cars and one for containers. Both buildings contain catwalks and hand held high pressure water ~~wasters~~ washers similar to a automobile car wash. Run off water from these facility is collected into a lined pond. The water is used in the water adding process described above for containers and rail cars. The wash water includes a product named Radiac Wash.

Dust Control
The water added to disposal material for compaction purposes is a major factor in providing dust control. A water containing a polymer material is applied to exposed surfaces in the disposal cells and on roadways.

DOE Affiliation
Dan Owen informed me that Brady Lester, DOE Oak Ridge, Tenn., Tel (615) 576-8354 recently visited the Clive facility and took length notes with reference to additional use of this facility by the DOE.

Photographs
Photographs were taken by me and will be available soon.

Distribution: K. Kelly, W. Greenwald, L. Bennet, J. Jacobson

MONTGOMERY WATSON

To:	File	**Date:**	June 10, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--ESI Decontamination		

The following is a summary of my June 7, 1993 phone conversation with Ms. Sharon Roberts (208-384-1500) of Envirosafe of Idaho (ESI) regarding decontamination of equipment at that site. She said that they do accept bulk shipments. All bulk containers are lined. They have a small car wash with handheld wand They rinse out liquid tankers for gross decontamination only.

Their operating theory is that the containers and vehicles are legal when they enter the site and they do not become contaminated on the site. Therefore, decontamination is not necessary.

They put down clean fill so the vehicles drive on clean material into the disposal trench. Containers are off-loaded onto dedicated vehicles for transport into the trench. Bulk material is transported by the same vehicle that brought it to the site.

They do not accept low level rad waste so do not frisk. for it They do frisk for PCB's if suspected.

See also contact with Dee Lloyd regarding this site.

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MONTGOMERY WATSON

To:	File	**Date:**	June 10, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--Chemwaste Decontamination		

The following is a summary of my meeting of June 9, 1993 with Mr. Dee Lloyd of Dames and Moore. He used to work with the US Army Corps of Engineers. Prior to that employment, he worked as Manager of the Chemwaste facility at Arlington, OR, and as Compliance Officer at Envirosafe of Idaho at Bruneau, ID. These are his comments about decontamination facilities at each location as applicable to the ERSDF.

ENVIROSAFE OF IDAHO

When he worked at Envirosafe of Idaho, it had an automatic decontamination facility similar to a car wash. This system recycled the water through carbon filters. The blowdown liquid went to an evaporation pond. Occasionally, the operators would muck out, stabilize, and landfill the solids from the pond. He believed that the automatic decontamination facility effluent would be classified as a leachate (F039) under 40-CFR-261 Part D.

CHEMWASTE

This facility has a truck wash for RCRA wastes only. The PCB trucks are not decontaminated. The official procedure is the following:

1. Inspect all vehicles before entering the site. If contaminated, the police and state environmental department are called and the vehicle is not allowed onto the site.
2. The vehicles are not allowed to drive on the waste. A blanket of clean fill is placed for the vehicle to drive on. This is to eliminate any possibility of contamination from the in-place wastes.
3. The vehicle dumps its load. Dust can collect on the vehicle. Also, in the process of dumping, waste can collect on either the bumper or the yokes on dual trailer vehicles. The operator checks the vehicle for contamination and manually removes the accumulated material. This material could contaminate the next vehicle. The official stand is that the vehicle is not contaminated so the vehicle wash is unneeded and is just provided for back-up.
4. The vehicle drives to the decon facility where the decon facility operator inspects the vehicle for visible waste accumulation. This is scraped off. Then the vehicle undercarriage, wheels, and tire flaps are washed (neither the body nor the bed interior are washed.) There is a very specific procedure used to wash the vehicles. Only the decon operator or a specially trained truck driver is allowed to wash the trucks. This facility decontaminates about 50 to 100 vehicles per day.

5. The truck wash is equipped with three systems. The most often used system is the fire hose system. A propane heater is available for producing either hot water or steam. Also a HOTSY high pressure, low volume system with water heater is available but seldom used.

6. All the water is used once (no recycle). The water is stored, sampled, and allowed to evaporate or used for dust control. According the his interpretation of codes, the only reasons that water can also be used inside the disposal site is for decon of dedicated vehicles and for dust control.

7. The vehicles are visually inspected after washing (they do not accept rad waste so there is no need to frisk the vehicles.) He noted that we need to have the ability to return a container for rewashing if the container does not pass inspection.

8. On-site (dedicated) equipment must be decontaminated before maintenance. They perform PCB smear tests first. If PCB's are not detected, then the vehicle can be washed.

He noted that he had tried to get an automatic truck wash system installed. This facility had had one such system but it had been vandalized. The company would not pay for the capital cost of installing the system. He also noted that we should proved capabilities for "contingency cleaning" to handle all other types of cleaning needs.

MONTGOMERY WATSON

To:	File	**Date:**	June 10, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--INEL Decontamination		

The following is a summary of my phone conversations with personnel associated with the Idaho National Engineering Laboratory (INEL) regarding decontamination of equipment at that site.

Mr. Tom Gazelle, Professor of Physics at Idaho State University (208-236-3669), on June 7, 1993 referred me to Ms. Karen Langly.

Ms. Karen Langly, Head of Health Physics at the Test Reactor Area (208-526-4141). On June 7, 1993, she said that "RadCon" performs the frisking. If something is found, laborers do the decontamination. She referred me to Keith Branter.

Mr. Keith Branter (208-526-2486) manages the waste storage sites. He was in meetings the first three times I called. On Jun 9, 1993, he provided much good information with the following being a summary:

We need to meet DOE 5400.5 which is currently being codified with changes and stricter limits in DOE 10-CFR-834 "Radiological Protection of Public and Environment-Proposed Rules". This rule was issued for review on Thursday March 25, 1993 in the Federal Register. It would require meeting DOE instead of DOT standards.

The RWMC facility now has low level waste acceptance criteria. It used to accept bulk but is switching to containerized or bagged materials only. They try to keep the vehicles from getting contaminated. They line the truck beds with "Herculite" liner which can then be taped shut to enclose the waste.

Last year, they used a belly scraper on one project. When they frisked it, they found low level counts on the oil and grease leaks and in the air filters and in all vented parts of the transmission. US DOE Radiation Control Manual, Chapter 3, requires an operating plan. Section 371 allows some flexibility. DOE Order 5400 requires total cleaning of the equipment. INEL had to buy the machine and now it is dedicated to on site use.

They are currently excavating TRU waste. First they survey incoming equipment as a precaution and to develop a baseline. They have already found an incoming crane that was contaminated from earlier work (approximately 1972). Second, they sampled the overburden and found no contamination but they expect that the contractor might hit some small contaminated areas. Therefore, they have a contingency plan that includes spot cleaning of buckets, etc. and the purchase of grossly contaminated equipment for dedicated use (since it is impossible to decontaminate the drive trains.)

During maintenance, they have found that even after decontaminating the exterior and unbolting flanges, they have found contamination so need radiological controls at that time too. The contamination is due to venting of the drive-train or other items.

He was surprised that we were just relocating the waste from various sites into one site. He fears that we will have to remediate the ERSDF in the future. He also mentioned that mixed waste is land disposal restricted (LDR). Also RCRA covered wastes cannot be land disposed without pretreatment.

To decontaminate our containers, he would wash them. They do not currently wash their containers or trucks because the waste is wrapped. He understands the limit to be 220,000 dpm if enclosed. He referred to 49-CFR for enclosed, exclusive use vehicles. (My review of 49-CFR-173 determined it to be 22,200 dpm/100 sq cm; not 220,000.) The waste would need to be shipped as "Low Specific Activity".

Other than water for decontaminating the containers, he has seen the following:

"Quadrex" markets the carbon dioxide beads. He believes that they would come very close to meeting DOT clean requirements.

Portable glass and sand blasting units.

Electrotech (not conducive to large objects.)

Hydroblasting (super high pressures of around 500,000 psi.)

Safety and Supply markets strippable latex paint (peel off after every use.)

He mentioned that each of these has its own special control problems.

If we use water, need to clean it as well as possible to maximize subsequent cleaning of the containers.

He was in the Navy and cleaned reactor coolant. It built up tritium. The cleaning system was comprised of strainers, two ion exchangers, carbon polishing filters, and holding tanks for sampling and testing. The water was cleaned to 6 x ten to the minus 8 micro Curies.

Appendix C

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MONTGOMERY WATSON

To:	File	**Date:**	June 14, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--Decontamination Methods		

The following is a summary of my conversations with various Montgomery Watson and Decon Environmental Services employees regarding decontamination of equipment.

May 28, 1993 phone conversation with Mr. Martin Steinpress (510-975-3476).

They decontaminate drill rigs and sampling equipment. They steam clean only. It takes two to three hours per drill rig so only decontaminate them at the end of the project. They decontaminate the drill auger after every hole They do rinse tests of all equipment.

Need a bermed, plastic lined area or inflatable pad that can contain all the liquid. They pump the water into 55 gallon drums or a Baker tank, sample the liquid, and determine what treatment is needed.

He referred me to Bruce Jacobsen of Decon Environmental Services (510-732-6444).

June 10, 1993 phone conversation with Bruce Jacobsen of Decon Environmental Services (510-732-6444).

Decon Environmental Services does remediation work, particularly in the lead paint removal and similar fields. They have done some low level radioactive waste remediation and would be interested in doing the actual remediation at Hanford.

For decontamination of equipment, they have used the following:

- For equipment with electronics, handwipe;
- Pressure washing;
- Steam cleaning;
- Vacuum for dry or dusty materials;
- Frozen carbon dioxide.

Normally, for truck size equipment, they would use scrape off excess material, then pressure wash, recycle the water, and treat the excess.

They have not yet used frozen carbon dioxide but have researched it. It seems to work well but, if not properly controlled, will remove some of the container metal. Need to collect the removed material (eg, HEPA vacuum). He will have his partner contact me (see notes under carbon dioxide research.)

May 20, 1993 meeting with Mr. Kevin Kelly.

He only has experience with small equipment so not applicable.

June 8, 1993 phone conversation with Mr. Don Azevedo (510-975-3483).

They steam clean decontaminate drill rigs and sampling equipment. They decontaminate the drill auger with a no-phosphate detergent after every hole. They decontaminate the drill rig as it comes onto the site so than it does not bring contaminates onto the site. They used to decontaminate the drill rig after every hole but are changing to decontamination as needed.

They investigate the use of high pressure washers (700 psi at 200 degrees F). They prefer steam since it is better at removing volatile material. He recommended having the stand-by capability of using steam.

They have used either decontamination pads, elevated racks with drip pans constructed by the driller, or a dedicated decontamination area. All the liquid is collected and pumped into two Baker tanks. Then they sample the liquid and determine what treatment is needed.

June 11, 1993 telephone conversation with Carol Fow (510-975-3517).

She used to work for Battelle NW at Hanford doing low level rad waste research. She attended a number of meetings on decontamination but does not have any firsthand experience. She referred me Bill Belk (510-375-3489) who has does decontamination but is out this week.

June 11, 1993 telephone conversation with Bill Belk (510-375-3489).

He has performed a number of hazardous waste decontaminations but has not done any with rad waste. He preference is the following order:

Dry wiping with manual removal of the chunks;
HEPA vacuums;
Finally, high pressure washing.

He does not like water washing as he tries to minimize waste generation. If we recycle water, then need to ultrafilter it to minimize radiation carry-back. Should install a meter to continuously monitor the water.

Telephone conversations with Lance Larsen (510-975-3400).

I tried at least four times to contact Lance and was unsuccessful. With the other contacts that I had made, the information received from Lance would probably be repetitive.

Appendix D

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M E M O R A N D U M

MONTGOMERY WATSON

To:	File	**Date:**	May 24, 1993
From:	Larry Bennett	**Reference:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies		

The following is a summary of Montgomery Watson's research into six vendors of automated wash units that could be used for decontamination units. Some vendor's provided catalogue information and some provided detailed information including schematics. The following is a summary of the information by vendor.

Fleetwash

They claim to have an installed washing facility at Hanford (probably the 1100 bus wash). They claim to have installed a hazardous waste vehicle cleaning system for BFI in Adams County, Colorado.

System uses 95 gallons per truck, bus, or van With total reclamation of water, there will be a 10% loss due to carry-away (water on wet vehicle). Truck wash unit (brushless) is estimated to cost almost $47,000 (without building). Extras of water heaters and hand detail gun are estimated to add $10,000.

They provided two papers on water reclamation with lots of information. They can provide four different modes of reclamation (none, washwater only, wash and first rinse water, all water). Reclamation system comprised of sand trap, settling pit, cyclone, and reuse is estimated to cost $15,000. Additional reclamation with filter and charcoal polishing would increase cost by $28,000 (to $43,000).

Interclean Equipment Company (A division of Peerless Pump Company)

The first arch is a chemical detergent feed. The second arch uses 200 gpm for washing. The third arch is the final rinse and uses 60 gpm. The pump is 200 gpm, 75 hp, 525 psi. They estimate 30 to 40 gallons of water per 18 foot long container.

The reclamation system is a sump with pump, an above grade, 3,000 gallon conical tank, a cyclone, and the clean water tank. The cyclone discharges to a sludge tank. The system filters the water to 45 micron size and then aerates it.

They are constructing a radioactive decontamination facility for Kennecott, north of Salt Lake City. Information is being sent on this facility.

They provided four videos for our enjoyment. The first video was the "CentriSpinner Truck Wash System" (nine and one half minutes). The spinning nozzles work at up to seven feet so can get between the cab and the truck and can get the ends of the vehicle. Fully automatic except for the driver. It takes 90 seconds per large vehicle and uses 0.25 gallons of detergent per vehicle. The 525 psi is claimed to cause less damage than the 1,200 psi used in other systems. UL approved control panel. The reclamation system reduces water use by 80%. The conical bottom tank makes for easier blowdown. They also make Hazardous Waste Decontamination Systems.

The second video was the "Waste Industry Truck Wash" (four and one half minutes). This video was pertinent because it concentrated on waste trucks but does not contain as much information as the first video. This system can handle front end loaders, trucks, etc. It can provide under chassis cleaning. There is a three year warranty on the nozzles.

The third video was the "Step Van, Car, Bus Wash" (seven minutes). This video is not pertinent to our study. This system uses only two arches so there is no water reclamation. The first arch provides soap (0.1 to 0.2 gallons of detergent per minutes and 7 gpm of water) while the second arch is the rinse arch (110 gpm of water). An option is the chassis wash using two spinners in the trench. A car is washed in less than 90 seconds. Each arch operates for about 60 seconds. It works on all size of vehicles. Maintenance is the lubrication of pump and motor bearings twice a year. No other maintenance required.

The fourth video was the "Railcar, Boxcar, and Locomotive Cleaning Facility" (no time). This is a taller system than the others. The gantry moves instead of the vehicle. It has a totally enclosed recycling system. There is a cable system that pulls the car into the enclosure. The car is washed and then pulled out the same door it came in. It takes six minutes and two gallons of detergent to clean a rail car. Pretty impressive results.

N/S Corporation

They provided a video "Transit Wash System" (9:00 minutes). N/S Systems have over 30 years experience. Their systems have a one year warranty. The basic system has automatic start wands, presoaker nozzles, and wash. The wash can be either oscillating flaps of material and rotating brushes or oscillating nozzles of high pressure water. They have options of under carriage wash, liquid recovery systems (above ground tanks with filters to 40 microns that reduce water usage by 80 to 85%), reverse osmosis water softeners, and oscillating hot air dryers.

Uses a 20 foot wide by 16 foot high by 75 foot long bay. The washing equipment is estimated to cost $59,000 (FOB) (without the building).

Water recovery system is a Model WRS-3020 that is comprised of an oil separation sump, transfer pump and sump, three sedimentation/flocculation tanks, 250 micron filter, high pressure pump, and 40 micron filter. It recovers about 85% of the water. It is estimated to cost $25,000 without the building or the two underground tanks.

They have an automated rail car cleaning system that uses brushes. (it could be used with brushless system.) It has automatic activators, chemical arch with two different chemical spray systems, various brushes, and final high pressure rinse.

Rieskamp

Model 160 IV is estimated to cost $87,800 for the washer and $32,800 for the water reclamation system (without building). It uses 90 gallons per 55 foot long truck or 1.6 gallons per foot of length.

The XL040 system recycles 70% of the water. It is comprised of a sandtrap with pump to a cyclone that removes everything above 10 micron size. Then add chlorine before going to an above ground settling tank.

They provided a video that showed two facilities. The facility in Canada was operating at minus 19 degrees C. It had a heated pad on the exit to prevent ice build-up. This system is suitable for various sized vehicles. It takes about two minutes per vehicle. It provides undercarriage washing at three separate locations. The first arch provides a low pressure pre-soak. The second arch provides a 1200 psi wash using 60 gpm of 160 degree F water. The third arch rinses. The bay is 20 foot wide by 15 foot high by 90 foot long. The system has automatic controller, electronic eyes, and General Electric programmable controller. All field controls are 24 volt. It uses reusable chemical storage drums. It has a separate detail gun.

They can custom design a system.

RYKO

The Environmentalist IIA (EV IIA) reduces water use by 80%. Without the EV IIA, the truck wash uses 200 gpm of water. Water from the previous wash is stored in two underground tanks, then pumped through a cyclone separator, chlorination system, and used in the washing cycle. The rinse is clean water. They also provide a frost protection option.

The AS90 Saturn vehicle wash is a track mounted system using high pressure, oscillating streams in a 40 foot long, 20 foot wide and 20 foot high bay. The cycle contains a presoak, detergent, and wash cycles. There is a manual override for heavily soiled vehicles and on option for under chassis wash. It uses 200 gpm of water and 5 cfm of air (at least 100 psi).

The first video was the "Monarch II" (seven and one half minutes) which is a small package unit made for outdoor mounting. It has an undercarriage wash option and a hot air dryer option. It is not appropriate for our application.

The second video was the "AS90 Saturn" (four and one half minutes). It handles vehicles of unique and irregular design. It has a stainless steel frame and photoelectric eyes to wash according to the vehicle dimensions. UL listed control panel. The company's installations wash over a million vehicles a day.

The third video was the "Large Vehicle Wash" (four and one half minutes). It is a brush type unit and is not appropriate for our study. It takes seven to eight and a half minutes per tractor/trailer and 2 and a half minutes per car.

Touchless Autowash

An automatic, non-conveyor type wash would cost approximately $50,000 (without building). An automatic, conveyor type wash would cost at least $250,000 (without building).

They use a 16 foot wide by 28 foot long by 10 foot eight inch high bay for Turbo Tunnel 28 model and a 13 foot wide by 26 foot long by 10 foot eight inch high for Southern Pride model.

They did not provide any information on reclamation system.

Summary

1. Based on this research, a recycling system can reduce water usage by 80%. Of the remaining 20%, half is carried away on the wet vehicle and half goes into system blowdown.

2. Rieskamp clams that their system uses 1.6 gallons per foot of vehicle length. Therefore, the 18 foot long containers would use 29 gallons of water. Interclean estimates 30 to 40 gallons per container. For a safety factor, use 50 gallons per container. Therefore, the carry-away will be 5 gallons, the blowdown will be 5 gallons, and the make-up will be 10 gallons per container.

3. With one shift per day for half a year and two shifts per day for half a year, there will be 390 shifts a year. With holidays and occasional shutdowns, assume 380 shifts per year.

4. With 175 containers per shift, there will be 66,500 containers per year that will need to be decontaminated.

5. Based on 10 gallons per container of make-up water, then 665,000 gallons of water will be needed.

6. With five gallons per container of blowdown, then 332,500 gallons per year will be produced. If for conservative calculations, the carry-away is also included, then 665,000 gallons per year of water needs to be disposed.

MONTGOMERY WATSON

To:	File	**Date:**	June 16, 1993
From:	Larry Bennett	**Job No.:**	1202.0252
Subject:	Hanford ERSDF Engineering Studies--Decontamination with Frozen CO2 Pellets		

The following is a summary of my conversations with various people regarding frozen carbon dioxide (CO2) pellets for decontamination of equipment.

June 7, 1993 phone conversation with Mr. Jay Bottenus at the T-Plant.

They researched this system but have opted to proceed with use of frozen water (ice) pellets instead of frozen carbon dioxide. He said that Oak Ridge facility has made the same decision.

At the T-Plant, they decontaminate equipment either over or near pits that have occasional workers. They feared that the carbon dioxide, since it is heavier than air, would settle in these pits and could potentially cause life-threatening situations. Carbon dioxide pellets would require more ventilation than ice pellets. Carbon dioxide requires a more exotic system due to lower temperature required. Carbon dioxide could cause static electricity problems (they believed this could be overcome, if needed.) Carbon dioxide systems require shorter piping runs than allowable with ice. There are additional regulations and safety concerns with carbon dioxide storage than with water.

They investigated the vendors claims that carbon dioxide cleans better than ice but found both systems to be equally effective. They found ice pellets to be superior in that, after melting, the water acts as a medium to transport contaminants to the sumps. They would only be using seven to twelve gallons per hour of water.

There are three basic carbon dioxide pellet generation manufacturers but they are packaged by multiple vendors who can include sheds, booths, or other accessories.

He is skeptical of claims of filters removing heavy materials. These materials will accumulate on the floor and will need to be manually removed. With the water system, most of these materials will be carried into the sump.

June 7, 1993 phone conversation with Mr. Dave Hess of WHC Safety.

He reviewed this system for safety assessments regarding OSHA and ventilation. The prepackaged totally enclosed, batch system satisfies most of his concerns. The system he saw was for equipment the size of pumps or motors. There is a separate glovebox system for smaller items. The system used one air change per minute (60 air changes per hour) so all contaminants are caught on the filters and the enclosure is totally and completely flushed. The filter system is comprised of three sets of filters. The first filter is a three inch dust stop roughing filter that is changed two to three times a day. The second filter is another three inch dust stop that is changed every three to four weeks. The third filter is the HEPA filter which is changed every three to four months.

He understands that ice pellets melt and leave a film that interferes with cleaning. Therefore, frozen carbon dioxide pellets do a better job (remove material down to 25 microns in size.) He referred me to Ms. Terry Aldridge for more information.

We discussed the ERSDF facility. He believes that frozen carbon dioxide, although designed for smaller objects could work well at the ERSDF. The carbon dioxide system would need to be automated with a human staffed supervisory position. There is also a system that has a vacuum that could be used. He noted that we would need to be able to wipe the interior wall of the decontamination room before human access. This could be done using a master/slave manipulator and an air lock. The manipulator takes a wipe, wipes a wall, and sends the sample wipe out through the air lock for testing. This is currently being done at the hot cells and in 324 and 325 buildings. Also, with water, he noted that we would need to dry the containers before they could be tested. This is not needed with carbon dioxide. He also suggested decontaminating the containers every fourth or fifth cycle instead of every cycle.

He likes the down flow ventilation systems as they carry the contaminants into the sumps (especially true with carbon dioxide systems since water has gravity to assist it.)

Telephone conversations with Ms. Terry Aldridge of WHC (509-376-5865).

I telephoned ten times and was never able to make connections. With the information that I received from other sources, I do not need to contact her again.

June 10, 1993 phone conversation with Bruce Jacobsen of Decon Environmental Services (510-732-6444).

Decon Environmental Services does remediation work, particularly in the lead paint removal and similar fields. They have done some low level radioactive waste remediation and would be interested in doing the actual remediation at Hanford.

They have not yet used frozen carbon dioxide but have researched it. It seems to work well but, if not properly controlled, will remove some of the container metal. Need to collect the removed material (eg, HEPA vacuum). He will have his partner contact me with more information.

June 11, 1993 phone conversation with Mr. Chris Kawaka of Decon Environmental Services (510-732-6444).

Frozen carbon dioxide is good for removing surface contamination (similar to sandblasting) but not imbedded contamination. He believes it could be automated to meet our particular needs. The basic system costs about $300,000 which is too much for them to afford for the projects they perform.

He gave me the name of a system manufacturer that he was worked with:
Cold Jet Inc, Cincinnati, Ohio (513-831-3211).

June 11, 15, and 16 1993 phone conversations with Ms. Reva Losiewicz (513-831-3211) and Mr. Mike Lewis (316-686-6076), both of Cold Jet, Inc.

Cold Jet is a manufacturer of frozen carbon dioxide pelletizing and spraying systems.

Frozen carbon dioxide pellets have been used at a number of DOE sites along with manufacturing sites such as Ford Motors. One Contractor has used Cold Jet pelletizers at over 12 DOE sites for radiological decontamination.

A paper prepared for Martin Marietta Energy Systems on frozen carbon dioxide pellet blasting tests showed fixed radiological waste on an angle iron was reduced from 5,000 dpm/100 sq cm to "not detectable" with minimal air contamination. However, the production rate was very slow at 10 sq ft per hour.

Depending on the spray nozzle used, the spray pattern can be from 1/2 inch to 7 inches wide.

Production rates vary significantly with the type of material being removed and the substrate material. Cold Jet made an educated estimate of 2 square feet per minute for the ERSDF application.

A Contractor can provide a pilot test unit to the site at a cost of $2,500 per day.

A pelletizer and the two associated blasting units costs $160,000. Each system uses 32 KW of power and 1,400 pounds of liquid carbon dioxide per hour. Liquid carbon dioxide costs around $0.03/pound.

In addition, each unit needs 330 cfm of air at 50 to 100 psi.

For removal of the dislodged particles, a separate vacuum system that operates in unison with each nozzle would work well.

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