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YUCCA MOUNTAIN PROJECT

# Low-Level Waste Management Plan

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# 1. PURPOSE

The purpose of this plan is to describe the management of low-level radioactive waste (LLW) at the Yucca Mountain Project (YMP) facilities, including LLW generation, handling, movement, storage, and processing. Additionally, it also describes the processes and capabilities associated with the Low-Level Waste Facility (LLWF).

# 2. SCOPE

This plan addresses management of low-level radioactive waste generated during the course of handling high-level radioactive waste (HLW) or spent nuclear fuel (SNF) in the applicable YMP facilities.

This plan does not address management of radioactive mixed waste covered by Resource Conservation and Recovery Act waste (RCRA), non-radioactive waste, and it does not address management of other hazardous wastes.

# 3. REQUIREMENTS

Requirements for the low-level waste management/generating system can be found in the *Project Design Criteria* document [BSC 2006f].

# 4. ASSUMPTIONS

4.1 Movement of containers of LLW on-site within the GROA will be performed under the requirements of the NRC license and will not need to meet the DOT requirements for packaging and shipment of radioactive material. Movement of containers of LLW beyond the GROA will be subject to DOT radioactive material transport requirements.

4.2 It is assumed that low-level radioactive waste generation will be monitored so that Greater-Than Class C waste (GTCC waste) generation will be precluded. The area with the greatest potential to generate GTCC waste is in the Wet Handling Facility (WHF) pool treatment system. In this case, diligent monitoring of dose rates correlated to the waste characterization matrix for the resin and pool clean-up filters is required to ensure waste remains Class C and below. Another potential source of GTCC waste is from clean-up of a Category 1 or Category 2 event.

4.3 The development of the heating, ventilation, and air-conditioning (HVAC) systems for the various surface nuclear facilities is currently in progress. Therefore, any values provided regarding pre-filters or high-efficiency particulate air (HEPA) filters are assumed to be preliminary and are subject to change. Table 4.3 provides preliminary estimates for the number of HEPA filters by facility and the total number of pre-filters.

Table 4.3: Estimated Number of HEPA Filters by Facility.

| Facility | ITS Stage 1 | ITS Stage 2 | Non-ITS Stage 1 | Non-ITS Stage 2 | ITS Battery Room | Non-ITS Battery Room | Totals |
|---|---|---|---|---|---|---|---|
| WHF | 36 | 36 | 114 | NA | NA | 6 | 192 |
| IHF | NA | NA | 64 | NA | NA | 2 | 66 |
| CRCF-1 | 72 | 72 | 440 | NA | 4 | 16 | 604 |
| CRCF-2 | 72 | 72 | 440 | NA | 4 | 16 | 604 |
| CRCF-3 | 72 | 72 | 440 | NA | 4 | 16 | 604 |
| RF | 72 | 72 | 152 | NA | 4 | 12 | 312 |
| LLWF | NA | NA | 74 | 54 | NA | NA | 128 |
| **Total HEPA's** | **324** | **324** | **1,724** | **54** | **16** | **68** | **2,510** |
| **Total Pre-Filters** | **324** | NA | **1,724** | NA | NA | NA | **2,048** |

It is further assumed that there is one pre-filter for each 1st Stage HEPA filter and that the pre-filters are changed out every 4 months due to dust loading. This will result in a total of 6,144 pre-filters as LLW per year. If each pre-filter is 2'x 2'x 4" in size, then the annual volume of LLW would be 8,184 $ft^3$. Assuming the 1st Stage HEPA's are changed out every 18 months, there will be an average total of 2,048 HEPA's / 1.5 years = 1,365 HEPA's / yr as LLW. If it is assumed that the 2nd Stage HEPA's are changed out every 5 years, then the average annual number of 2nd Stage HEPA's as LLW (including the battery room HEPA's) is 462 HEPA's / 5 years = 92 HEPA's / yr. The grand total estimated average annual volume of HEPA LLW, at a HEPA size of 2'x 2'x 1', is = (1,365 + 92 ) x 4 $ft^3$ = 5,828 $ft^3$ / yr. The estimated total annual filter LLW volume is 14,012 $ft^3$.

4.4 Contamination levels on canisters containing SNF or HLW are assumed to be less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ [McKenzie, J.M. 2002]. These levels are reasonable when averaging is considered over the entire container surface area. There may be an occasional container with higher contamination levels, but such containers can be handled according to the normal facility operating procedures.

4.5 The estimates for dose rates provided in this plan are based on engineering judgement from first hand experience at operating nuclear power plants. Future project calculations, or other approved documents, may be developed which can then provide a basis for certain dose rate estimates currently provided in this plan.

4.6 It is assumed that off-site vendors will offer cost-effective means of processing and reducing low-level radioactive waste volumes so that methods of volume reduction, such as compaction or incineration, will not be addressed in this plan.

## 5. LOW-LEVEL RADIOACTIVE WASTE STREAMS

Solid: Any radioactive or contaminated object or item.

Examples are:

Dry solid LLW, also referred to as DAW (Dry Active Waste): HEPA filters, gaskets and seal material, ventilation plenums or ducting, rags, protective clothing, RP sample media, etc.

Wet solid LLW: Pool filters, resin, mop heads, etc.

Liquid: Any contaminated substance that is free-flowing.

Examples are:

Water LLW: Spent fuel pool treatment system effluent, decontamination system effluent, firewater discharge, etc.

Other liquid LLW: Contaminated oil, battery electrolyte, scintillator cocktail, paint, solvents, etc.

Gas: Airborne Radioactivity: Certain operations in the handling facilities may contaminate air with either radioactive noble gas, tritium, or radioactive particulate, or combination. For areas or rooms with potential for airborne radioactivity, HEPA filtration will be provided. HEPA filtration will remove the majority of radioactive particulate from the air, it will not remove radioactive noble gases nor all of the particulate. Following filtration, the air is released from the facility through a vent stack. The releases through the vent stack are monitored, but in the nuclear facilities design, the releases can not be held up and decayed, stopped, or prevented.

# 6. FACILITY DESCRIPTIONS

## 6.1 Wet Handling Facility

### 6.1.1 Facility Description

Current plans call for construction of one WHF. The WHF is an Important To Safety (ITS) facility that contains a spent nuclear fuel pool. The WHF will accommodate transfer of bare commercial spent nuclear fuel (CSNF) from transportation casks and dual purpose canisters (DPC's) into transport, aging, and disposal canisters (TAD's). ([BSC 2006b] Section 2.4.2.1) The fuel pool contains storage racks for temporary fuel storage to accommodate blending and loading requirements. DPC's will be cut open to facilitate removal of contents. Due to the opening of transportation casks in the pool along with the transfer of CSNF, there is expected to be significant amounts of contamination generated. There will be decontamination facilities to accommodate cask, TAD and equipment decon. The pool water clean-up and cooling systems will be sized to maintain water radioactivity concentration levels that ensure worker doses are maintained ALARA.

Incoming transportation casks will be surveyed for radiation and contamination levels when they are received at the Cask Receipt Security Station, 30B. Since the entire transportation cask surface is not accessible for this initial contamination survey, it is possible that some minor levels of contamination may be discovered during cask handling operations in the WHF. It is likely that removable contamination levels would be low and the cask could be manually decontaminated after its contents are removed, thereby reducing the doses to the workers performing the decon.

Even though the bare CSNF is highly contaminated, all of the work involving any contaminated surfaces is performed under water so there is expected to be minimal airborne radioactivity. Previous experience concludes that the majority of the radioactivity will remain in the pool and that the airborne concentrations due to any evaporation of pool water will be low and not require the pool room to be posted as Airborne Radioactivity Area. Airborne radioactivity levels and air (gaseous) effluent radioactivity levels will be monitored.

There is a high potential for the spread of contamination in the WHF due to several factors:

- Equipment being placed in and then removed from the pool (casks, TADs, DPCs, hoists, fuel transfer machine, tools, lights, etc.)
- Potential for splashing of pool water landing outside of the pool boundary
- Water leaks from the pool water treatment system (valves, pumps, filters, tanks, etc.)
- Maintenance activities on the pool water treatment system.
- Transfer of contaminated resin and filters from pool water treatment system to transfer or disposal containers
- Due to the large number of originators of shipments to the monitored geologic repository (MGR), it is likely that there will be hot particles introduced into the pool water. Hot particles tend to be very mobile and can easily spread outside of the fuel pool.

There are no Category 1 event sequences for the WHF so there should be no significant releases of radioactivity to the ventilation system. ([BSC 2006a] Section 4.4.3) There currently are potential Category 2 events identified for the WHF. ([BSC 2006a] Table 4-6) By definition, Category 2 events have a very low frequency of occurrence and are not expected to occur during the facility's operating life. If a Category 2 event were to occur, and if there is a breach of a fuel assembly or a canister, the result would be a significant release of radioactivity to the environment of the immediate area/room, contamination of the room floors, walls and equipment. The ventilation system downstream of the affected room would become contaminated and the radioactivity levels on the 1st stage HEPA filters could be very high. Response to any Category 2 event would require detailed planning and execution and would result in facility down time. This response would likely result in an increased generation of LLW as a result of the clean-up and repair operations. Special considerations would need to be made at the time of incident response for any special handling needs or storage considerations of this LLW.

Ground Floor: The fuel pool in the WHF is in the central area of the ground floor. Since the pool will contain contaminated items and equipment and the pool water itself will be contaminated, it is zoned as contaminated; C3. The Pool Room is a very large area and also includes the transportation cask staging/preparation area. Normally this area would be designated as having a potential for contamination; C2, but since there is no physical separation from the pool area, it shares the C3 classification. During operations the cask staging area will be controlled as clean with a potential for contamination. In addition to the Pool Room, the Pool Treatment Equipment Room is also zoned as contaminated; C3. Due to the layout of the rooms and areas within WHF, there wasn't a way to segregate a number of the areas or rooms into a grouping of non-controlled clean rooms, designated as C1, separate from the potentially contaminated areas or rooms, designated as C2 or C3. Typically, clean rooms would not require contamination control measures, examples of these types of rooms are; electrical rooms, battery rooms, operating galleries, restrooms, etc. The majority of the support area, the aging cask vestibule and a stairwell are designated as C1. Any trash collected within the C2 and C3 areas will be considered DAW until it is subsequently successfully surveyed for unconditional release and determined to be releasable. DAW includes items such as protective clothing, protective equipment, decontamination media, sample media such as filters, or broken equipment and tools. In addition to DAW there will be contaminated wet mop heads that will be collected separately from the DAW.

Second Floor: The rooms on the south end including the communications room and the operations monitoring room are each designated as C1. The remaining areas or rooms on the second floor are designated as C2. Areas that are open to below are not zoned since they maintain the zoning of the space below.

Basement: The rooms in the basement of the WHF are designated as C3. The current plan for these rooms is to contain floor drain collection tanks and pool water holding tanks and support equipment. The tanks will contain contaminated water.

The DAW will be collected from various areas throughout the facility and will be taken directly to the LLWF or moved to a holding area at the rear (west end) of the facility in the LLW room until the LLWF handlers remove it and transfer it to the LLWF for segregation. Typically, when work is conducted in areas or rooms where there is contaminated material, workers wear protective clothing to a degree based on the potential contamination levels. In the C2 areas of the facility the contamination levels are expected to be low, thus minimal protective clothing would be required. Radiation protection technicians (RPT's) normally wear gloves when performing contamination surveys as a precaution. Personnel working with transportation casks may wear gloves and a disposable paper suit and booties as a precaution. The DAW is transported in bags (rad bags) or in 55 gallon drums. Dose rates from these bags and drums should be low, typically less than 1 mrem/hr on contact with the item. For work occurring in the C3 areas and rooms, personnel will be wearing protective clothing commensurate with the conditions. Work in the pool treatment equipment room would likely require waterproof plastic coveralls in addition to the normal protective clothing due to potential of water splashing. The DAW from these areas is also transported in bags (rad bags) or in 55 gallon drums. Dose rates from these bags and drums should still be low, typically less than 5 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should result in low dose rates, expected to be less than 10 mrem/hr overall.

In addition to the DAW, LLW will be generated from spent filters in the fuel pool water treatment system and from spent resin also contained in the fuel pool water treatment system. Due to the highly contaminated CSNF being handled in the fuel pool, it is anticipated that the filters will require change out frequently based on reaching pre-set dose rate levels. This could occur as often as once per week based on fuel pool activities. Since much of the contamination in the water comes from contamination that was plated onto the fuel assemblies, the majority of the contamination in the water should not be soluble. Therefore it is anticipated that the resin will not be changed out as frequently as the filters and is likely to be on the order of once per two or three weeks. It has not yet been determined what configuration of filtration will be used in the WHF. The method or process for change-out of the filters will be based on the design of the filtering portion of the clean-up system. The resin may be sluiced to a HIC within a shield cask, or may be removed as a cartridge type assembly and for deposit into a shielded overpack and placed in the LLW staging area prior to transfer to the LLWF.

There are processes that utilize significant amounts of water in this facility. In addition to the spent fuel pool and associated treatment equipment and tanks, there are two additional sources of contaminated liquid in the facility. One potential source is from decontamination of personnel and equipment. Space and appropriate equipment has been provided in the facility health physics (HP) support area to perform personnel and small equipment decontamination. Water used for decontamination purposes will be collected in a holding tank and transferred to the LLWF for further processing. It is expected that the need to decontaminate personnel will be low and the need to decontaminate equipment will make up the majority of use for the decontamination facilities. Decontamination water will also be generated in the decontamination pit where large items such as TADs, casks, etc. will be decontaminated. Another potential source of contaminated water will be from cleaning, or mopping, of C2 through C5 areas. This water will be sent to the contaminated water hold-up tank. One other potential source of contaminated liquid in the facility is from the use of the fire suppression system in contaminated and potentially contaminated areas and rooms. If the fire suppression system is activated the firewater will need to be considered contaminated and handled as such. This water will need to be sampled and analyzed for radioactivity to confirm whether or not it is contaminated prior to disposition.

### 6.1.2 Applicable Waste Streams

Solid LLW: DAW will consist of contaminated resin, contaminated pool water filters, protective clothing, radiation protection sample media, such as air sampler filters, smears, etc., respirator cartridges if used, HEPA filters, paper products, plastic, mop heads, rags, various equipment, tape, empty DPC's, etc.

Liquid LLW: There are major uses of water for the various processes in this facility. The primary source of liquid LLW in this facility will be waste water from the fuel pool water treatment system including resin processing. A potential source of contaminated water would be from discharge of the fire suppression system in any area designated as C2 through C5. Any liquid (water) from specific or general cleaning in the potentially contaminated areas will be disposed of in the facility drains. Water from personnel and small equipment decontamination in the support area will need to be contained in a hold-up tank. WHF holding tank water may be sampled and analyzed prior to being transferred to the LLWF holding tank for disposition.

Gaseous Waste: The majority of the facility is zoned as C2 and C3. It is likely for contamination from the spent fuel pool and treatment system to contaminate surrounding floors and walls. Since the contamination levels are expected to be low to moderate, it is unlikely that any measurable airborne radioactivity levels would occur. Since tritium contamination will be present on the CSNF, tritium will migrate to the pool water and will evaporate into the atmosphere surrounding the pool. The levels of tritium in the air are expected to be very low and not cause an inhalation concern for workers. The majority of the tritium will pass through the HEPA filters and out the ventilation exhaust stack. The exhaust air from the C2 and C3 rooms and areas will be filtered through HEPA filters. The exhaust from the facility will be monitored by effluent monitors in the facility stack. Another potential source of gaseous radioactivity is from transportation cask sampling and purging. As long as the fuel integrity is maintained during transport and receipt at the YMP, the cask void space should contain minimal airborne radioactivity. Regardless, the cask void space gases will be exhausted through the facility ventilation system and monitored at the stack. If there has been any CSNF damage during transport and radioactivity levels in the cask void space are elevated, a sample will be analyzed and if levels are acceptable the void space can be released through the facility ventilation system.

### 6.1.3 Waste Characterization

Waste streams should be sampled for waste characterization analysis as required by project procedures prior to transfer to the LLWF. Smears of general areas are typically used for characterization of DAW and solid LLW. Methods should be incorporated to accommodate HEPA filter sampling. Fuel pool treatment system resin and pool water filter sampling will be needed for characterization purposes. This sampling will need to be accommodated in the design. Gaseous releases are monitored and sampled in stack.

### 6.1.4 Estimated Volumes

Solid LLW- 5 large bags of LLW will be generated per day for the WHF. Preliminary design of the pool filters and resin is obtained from the WHF Pool Treatment and Cooling Study ([BSC 2006c]). According to the desired option, there will be 2 operating trains and one standby for normal pool treatment and cooling. There are two sets of filters for each operating train. If these filters are changed out every week, then this would result in 52 x 2 x 2 = 208 filters per year. There will also be 2 in-pool filter trains for intermittent operation during unloading and DPC cutting operations. The in-pool filter assemblies contain 6 filters each. If these filters are changed out once every 2 weeks, then this would result in 26 x 6 x 2 = 312 filters per year. There is one resin bed per treatment train. If the resin beds are changed out once every two weeks, then this would result in 26 x 2 = 52 resin beds per year. Until the pool clean-up system is established, actual volumes of filters and resin cannot be determined. On average, 6 DPC's [BSC 2006d] will be opened in the WHF each year. The filters and resin will be moved out of the WHF to the LLWF once they are emptied and will not require space in the LLW staging area. Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total average volume of filter LLW generated per year.

Liquid LLW- Not including fire suppression water, approximately 1,000 gallons per week.

Gaseous – N/A.

### 6.1.5 Dose Rate Expectations

Solid LLW- Normally < 5 mrem/hr on contact with the surface of the bagged LLW, including mop heads. HEPA filters should be < 25 mrem/hr on contact with surface. Dose rate action levels used to determine when filters and resin beds are changed out will be based on waste stream characterization and will be determined once the facility becomes operational. Typically, pool filters should be maintained less than 5,000 mrem/hr on contact with its housing. Pool water treatment resin should be less than 10,000 mrem/hr on contact with the vessel. As long as the DPC's are empty, any dose rates should be less than 100 mrem/hr.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.1.6 Necessary Staging Requirements

Solid LLW- One week of generation of solid LLW, excluding HEPA filters, would be thirty-five bags, or thirty-five 55 gallon drums. Assumption 4.3 contains the estimated change-out frequency for pre-filters and HEPA filters. Pre-filters and HEPA filters can be temporarily staged in the room in which they originate. One week's worth of pool filters is approximately equivalent to 8 filters, which is eight 55 gallon shielded drums. Space also needs to be included for a shielded overpack for a HIC for resin, unless a cartridge system is used.

Liquid LLW- Holding tank should be sufficiently sized to contain a release of fire suppression water plus one week's worth of liquid LLW generation.

Gaseous – N/A.

## 6.2 Initial Handling Facility

### 6.2.1 Facility Description

Current plans call for construction of one Initial Handling Facility (IHF). The IHF is an ITS structure that will receive and handle canistered DOE HLW and Naval SNF in rail casks. The canisters will be transferred to waste packages and welded closed in the closure cell. Upon waste package closure the waste packages will be transferred in a TEV and emplaced in the subsurface. The canisters will not be opened in the facility thereby eliminating a potential large source of contamination from the facility operations. ([BSC 2006b] Section A3.2) The canisters are expected to have low levels of contamination, normally less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ (Assumption 4.4). There is a potential for occasionally receiving a canister with higher levels of surface contamination. In addition to the canisters, there is likely no way to predetermine the contamination levels on the interior surfaces of arriving transportation casks prior to opening them. It is also unlikely that the shipment paperwork will provide this information. Thus, it will be assumed that the interior of transportation casks used for canister transport will have low levels of contamination and should not present unusual handling concerns. During gas sampling of the casks it will be determined if there has been a canister breach during the shipment. Canister breaches will likely result in high levels of contamination on the exterior of the canister and the interior of the transport cask. Canister breaches during shipment are not expected to occur.

Incoming transportation casks are surveyed for radiation levels and external contamination when they are received at the GROA security station. Since not all areas of the transportation cask surface are accessible for this initial contamination survey, it is possible that some minor levels of contamination may be discovered during cask handling operations in the IHF. It is likely that contamination levels, if any, would be low and the external surfaces of the cask could be decontaminated after its contents are removed, thereby reducing the doses to the workers performing the decon.

Considering the expected low levels of contamination, there is minor risk for contamination of floors or large areas from normal canister and cask handling operations. Items most likely to be contaminated would be limited to those that could come in contact with the canister exterior and cask interior and these items can be controlled to minimize any spread of contamination beyond the immediate work area. There should be no airborne radioactivity associated with these levels of contamination.

Handling of bare canisters will occur in confined areas, so the spread of any contamination should be minor and contained, as stated previously. There are no Category 1 event sequences for the IHF so there should be no significant releases of radioactivity to the ventilation system. ([BSC 2006b] Section A6.2.1.2) Even though there is not expected to be detectable airborne radioactivity, it is inevitable that minor, very low undetectable levels of radioactivity can become airborne during the course of operations over time. The HEPA filters will accumulate this radioactivity and over a period of time the radioactivity levels may become detectable. The 1$^{st}$ stage HEPA filters should be treated as contaminated, yet any direct radiation levels should be very low.

There currently are potential Category 2 events identified for IHF ([BSC 2006b] Section A6.2.1.2). By definition, Category 2 events have a very low frequency of occurrence and are not expected to occur during the facility's operating life. If a Category 2 event were to occur, and if there is a breach of a canister, the result would be a significant release of radioactivity to the environment of the immediate area/room, contamination of the room floors, walls and equipment. The ventilation system downstream of the affected room would become contaminated and the radioactivity levels on the 1$^{st}$ stage HEPA filters could be very high resulting in very high dose rates. Response to any Category 2 event would require detailed planning and execution and would result in facility down time. This response would likely result in an increased generation of LLW as a result of the clean-up and repair operations. Special considerations would need to be made at the time of incident response for any special handling needs or storage considerations of this LLW.

Due to the layout of the rooms and areas within IHF, there wasn't any way to segregate any of the areas or rooms of the facility into a group of non-controlled clean rooms, designated as C1 (non-contaminated), separate from the potentially contaminated areas or rooms, designated as C2 (potentially contaminated). Typically, clean rooms would not require contamination control measures, examples of these types of rooms are; electrical rooms, battery rooms, operating galleries, restrooms, etc. Therefore, within the ITS structure of the facility, all areas are designated as C2. Exceptions include the entrance vestibule, the control room and the clean side of the support area that is designated as C1. Any trash collected within these C2 areas will be considered DAW unless it is subsequently successfully surveyed for unconditional release and determined to be free of detectable radioactivity. In addition to trash, this material includes items such as protective clothing, protective equipment, decontamination media, sample media such as filters, or equipment and tools that are removed from the facility.

The DAW will be collected from various areas throughout the facility and moved to a holding area within the facility until the LLWF handlers remove it and transfer it to the LLWF for segregation. Typically, when work is conducted in areas or rooms where there is contaminated material, workers wear protective clothing to a degree based on the potential contamination levels. Since the contamination levels in this facility are expected to be low, there normally would be minimal protective clothing worn. RPT's would wear gloves when performing contamination surveys as a precaution. Personnel working with transportation casks as a precaution may wear gloves and a disposable paper suit and booties. The DAW is contained and transported in bags (rad bags) or in 55 gallon drums. Since the contamination levels are expected to be low, any dose rates from the trash, bags, and drums should also be low, typically less than 1 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should also result in low dose rates, again expected to be less than 5 mrem/hr.

There are no processes that utilize significant amounts of water in this facility. There are two potential sources of contaminated liquid in the facility. The first potential source is from decontamination of personnel and equipment. Space and appropriate equipment has been provided in the facility HP support area to perform personnel and small equipment decontamination. Water used for decontamination purposes will be collected in a holding tank and transferred to the LLWF for further processing. It is expected that the need to decontaminate personnel will be quite low and the need to decontaminate equipment will make up the majority of use for the decontamination facilities. A potential source of contaminated water will be from cleaning, or mopping, of C2 areas. This water should be sent to the contaminated water hold-up tank. The other potential source of contaminated liquid in the facility is from the use of the fire suppression system in potentially contaminated areas and rooms. If the fire suppression system is activated, and if it affects rooms or areas with potential for contamination, the firewater will need to be considered potentially contaminated and handled as such. This water should be sampled and analyzed for radioactivity to confirm whether or not it is contaminated prior to disposition.

### 6.2.2 Applicable Waste Streams

Solid LLW: DAW will consist of radiation protection sample media, such as air sampler filters, smears, etc., respirator cartridges if used, HEPA filters, paper products, plastic, mop heads, rags, various equipment, tape, etc.

Liquid LLW: There are no major uses of water for the various processes in this facility. One potential source of contaminated water would be from discharge of the fire suppression system in any area designated as C2 through C5. Any liquid (water) from specific or general cleaning in the potentially contaminated areas will be disposed of in the facility drains. Water from personnel and small equipment decontamination in the support area will need to be contained in a hold-up tank. IHF holding tank water may be sampled and analyzed prior to being transferred to the LLWF holding tank for disposition.

Gaseous Waste: This facility is essentially a clean facility. The majority of the facility is zoned as C2, or potentially contaminated, since it is likely that canisters received at the facility will have low levels of contamination with an occasional high contamination canister. The transfer of any surface contamination from a canister to facility floors, walls or equipment should be minimal, but can occur. Since the contamination levels are expected to be low, any airborne radioactivity levels should be very low or non-existent. The exhaust air from the C2 rooms and areas will be filtered through HEPA filters. The exhaust from the facility will be monitored by effluent monitors in the facility ventilation stack. Another potential source of gaseous radioactivity is from transportation cask sampling and purging. As long as the canisters remain intact during transport the cask void space should contain minimal to no gaseous radioactivity. Regardless, the void space gases will be exhausted through the facility ventilation system and monitored at the stack. If there has been a breach of a canister and radioactivity levels in the cask void space are elevated, a sample is analyzed and if levels are acceptable the void space can be released through the facility ventilation system.

### 6.2.3 Waste Characterization

Waste streams should be sampled for waste characterization analysis as required by project procedures prior to transfer to the LLWF. Smears of general areas typically used for characterization of DAW and solid LLW. Methods should be incorporated to accommodate HEPA filter sampling. Water sampling may be needed for characterization purposes and should be accommodated. Gaseous releases are monitored and sampled in the ventilation stack.

### 6.2.4 Estimated LLW Volumes

Solid LLW- 2 large bags of LLW per week for IHF. Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total average volume of filter LLW generated per year.

Liquid LLW- Not including fire suppression water, approximately 25 gallons per week.

Gaseous – N/A.

### 6.2.5 Dose Rate Expectations

Solid LLW- Normally < 1 mrem/hr on contact with surface for bagged LLW. HEPA filters should be < 2 mrem/hr on contact with surface.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.2.6 Necessary Staging Requirements

Solid LLW- One week of generation of solid LLW, excluding HEPA filters, would be 2 bags, or two 55 gallon drums. Assumption 4.3 contains the estimated change-out frequency for pre-filters and HEPA filters. Pre-filters and HEPA filters can be temporarily staged in the room in which they originate.

Liquid LLW- Holding tank should be sized sufficiently to contain a release of fire suppression water plus one month's worth of liquid LLW generation. (fire suppression + 100 gallons).

Gaseous – N/A.

## 6.3 Surface Aging Facility

### 6.3.1 Facility Description

Current plans call for construction of five aging pads at the Surface Aging Facility (SA). The SA will receive and place TADs and DPCs in aging overpacks. The overpacks will be placed on the aging pads in rows. The overpacks are not expected to have any external levels of contamination, and should be less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ (Assumption 4.4). There is likely no way to predetermine the contamination levels on the interior surfaces of aging overpacks or the external surfaces of the TADs or DPCs. Since the overpacks will not be opened at the SA, it will be assumed that the interior of the aging overpacks will not be contaminated. There are no Category 1 event sequences for SA so there should be no significant releases of radioactivity to the environment. ([BSC 2006a] Section 4.4.3) There are no potential Category 2 event sequences for SA. ([BSC 2006a] Table 4-6)

Considering that there is not expected to be any significant levels of contamination, there is no expected DAW generated at the SA.

If any DAW is generated, it will be collected and moved to a holding area until the LLWF handlers remove it and transfer it to the LLWF for segregation. Since no contamination is expected at this facility, no protective clothing is expected to be worn. Any DAW is transported in bags (rad bags) or in 55 gallon drums. Since the contamination levels are expected to be low, any dose rates from the trash, bags, and drums should also be low, typically less than 1 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should also result in low dose rates, again expected to be less than 1 mrem/hr.

There are no processes that utilize water at this facility.

### 6.3.2 Applicable Waste Streams

Solid LLW: DAW will consist of small quantities of radiation protection sample media, such as air sampler filters, smears, etc., paper products, plastic, rags, etc. There are no HEPA's or pre-filters in this facility.

Liquid LLW: There are no major uses of water for any processes at this facility.

Gaseous Waste: This facility is essentially a clean facility. There are no expected gaseous radioactive wastes.

### 6.3.3 Waste Characterization

Waste stream sampling will not be necessary for this facility

### 6.3.4 Estimated Volumes

Solid LLW- 1 large bag of LLW per month for SA.

Liquid LLW- None.

Gaseous – None.

### 6.3.5 Dose Rate Expectations

Solid LLW- Normally < 1 mrem/hr on contact with surface for bagged LLW.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.3.6 Necessary Staging Requirements

Solid LLW- One month of generation of solid LLW, excluding HEPA filters, would be one bag, or one 55 gallon drum.

Liquid LLW- N/A

Gaseous – N/A.

## 6.4 Subsurface Facility

### 6.4.1 Facility Description

The Subsurface Facility (SS) will receive and handle loaded and sealed waste packages (WPs). The WPs will be removed from the transport and emplacement vehicle (TEV) and emplaced in drifts. The WPs are not expected to have contamination, but if any is present it is expected to be less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ (Assumption 4.4). There are no expected breaches of the WPs during movement or emplacement. If any WP is contaminated, the interior surface of the TEV may become contaminated, but that contamination would not be expected to spread since the TEV is closed during movement, both when loaded and when empty. Air movement in the emplacement drifts is in the direction from the access main towards the exhaust drift at the opposite end of the emplacement drift, this would direct any airborne radioactivity, if any were present, away from the access main where workers may be located.

Considering these low levels of contamination, there is minor risk for contamination of floors or large areas from normal waste package handling operations. Items most likely to be contaminated would be limited to those that could come in contact with the waste package exterior and TEV interior and these items can be controlled to minimize any spread of contamination beyond the immediate work area. There should be no airborne radioactivity associated with these levels of contamination.

There are no Category 1 event sequences for the SS so there should be no significant releases of radioactivity to the SS environment. ([BSC 2006a] Section 4.4.3) There currently are potential Category 2 events identified for SS. ([BSC 2006a] Table 4-6) By definition, Category 2 events have a very low frequency of occurrence and are not expected to occur during the facility's operating life. If a Category 2 event were to occur, there would be a breach of a waste package resulting in a significant release of radioactivity to the environment of the immediate area, contamination of the drift floors, walls and equipment. The ventilation system downstream of the affected area would become contaminated. Response to any Category 2 event would require detailed planning and execution and would result in facility down time. This response would likely result in an increased generation of LLW as a result of the clean-up and repair operations. Special considerations would need to be made at the time of incident response for any special handling needs or storage considerations of this LLW.

Since the only potential contamination that workers could come in contact with is the TEV, there is likely to be very little LLW generated in the SS. Any trash collected within active emplacement drifts or from TEV decontamination will be considered DAW unless it is subsequently successfully surveyed for unconditional release and determined to be free of detectable radioactivity. In addition to trash, this material includes items such as protective clothing, protective equipment, decontamination media, sample media such as filters, or equipment and tools that are removed from the facility.

The DAW will be collected from various areas throughout the facility and moved to a holding area until the LLWF handlers remove it and transfer it to the LLWF for segregation. Typically, when work is conducted in areas where there is contaminated material, workers wear protective clothing based on the potential contamination levels. Since the contamination levels in this facility are expected to be low or non-existent, there normally would be minimal protective clothing worn. RPT's would wear gloves when performing contamination surveys as a precaution. Personnel working with the TEV as a precaution may wear gloves and a disposable paper suit and booties. The DAW is transported in bags (rad bags) or in 55 gallon drums. Since the contamination levels are expected to be low, any dose rates from the trash, bags, and drums should also be low, typically less than 1 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should also result in low dose rates, again expected to be less than 1 mrem/hr.

There are no processes involving the waste packages that utilize significant amounts of water in this facility. One potential source of contaminated liquid in the facility is from decontamination of the TEV if required and potentially any personnel that might become contaminated. Water used for decontamination purposes will be collected and transferred to the LLWF. Once at the LLWF the water will be placed into the holding tank for further processing. It is expected that the need to decontaminate the TEV or personnel will be quite low.

### 6.4.2 Applicable Waste Streams

Solid LLW: DAW will consist of radiation protection sample media, such as air sampler filters, smears, etc., paper products, plastic, mop heads, rags, various equipment, tape, etc.

Liquid LLW: There are no major uses of water for the various processes in this facility. One potential source of contaminated water would be from minor decontamination of the TEV. Any liquid (water) from specific or general cleaning in the potentially contaminated areas should be detained and sampling performed prior to release. Water from personnel and small equipment decontamination will need to be contained.

Gaseous Waste: This facility is essentially a clean facility. The majority of the facility is zoned as C2, or potentially contaminated, since it is possible that some of the waste packages may have low levels of contamination with an occasional high contamination waste package. Due to the configuration of the subsurface, there is no HEPA filtering of the exhaust air. The exhaust air from the facility will be monitored by effluent monitors in the exhaust raises.

### 6.4.3 Waste Characterization

Waste streams should be sampled for waste characterization analysis as required by project procedures prior to transfer to the LLWF. Smears of general areas are typically used for characterization of DAW and solid LLW. Water sampling may be needed for characterization purposes and may need to be accommodated. Gaseous releases are monitored and sampled in stack.

### 6.4.4 Estimated Volumes

Solid LLW- 1 large bag of LLW per month for SS. There are no HEPA's or pre-filters for this facility.

Liquid LLW- Approximately 5 gallons per week.

Gaseous – N/A.

### 6.4.5 Dose Rate Expectations

Solid LLW- Normally < 1 mrem/hr on contact with surface for bagged LLW.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.4.6 Necessary Staging Requirements

Solid LLW- Due to the very low expected volumes, no special holding area is required.

Liquid LLW- Due to the very low expected volumes, no special holding area is required.

Gaseous – N/A.

## 6.5 Canister Receipt and Closure Facility

### 6.5.1 Facility Description

Current plans call for construction of three CRCFs. The CRCFs are ITS structures that will receive and handle TADs, HLW canisters, and DOE SNF canisters. The canisters will not be opened in the facility thereby eliminating a potential large source of contamination from the facility operations. The canisters are expected to have low levels of contamination, normally less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ (Assumption 4.4). Without formal agreements between DOE and the originators of the canisters, there is a potential for occasionally receiving a canister with higher levels of surface contamination. In addition to the canisters, there is likely no way to predetermine the contamination levels on the interior surfaces of arriving transportation casks prior to opening them. It is also unlikely that the shipment paperwork will provide this information. Thus, it will be assumed that the interior of transportation casks used for canister transport will have low levels of contamination and should not present unusual handling concerns. During gas sampling of the casks it will be determined if there has been a canister breach during the shipment. Canister breaches will likely result in high levels of contamination on the exterior of the canister and the interior of the transport cask. Canister breaches during shipment are not expected to occur.

Incoming transportation casks are surveyed for radiation levels and contamination when they are received at the GROA security station. Since not all areas of the transportation cask surface are accessible for this initial contamination survey, it is possible that some minor levels of contamination may be discovered during cask handling operations in the CRCF. It is likely that contamination levels would be low and the cask could be decontaminated manually after its contents are removed, thereby reducing the dose rates to the workers performing the decon.

Considering these low levels of contamination, there is minor risk for contamination of floors or large areas from normal canister and cask handling operations. Items most likely to be contaminated would be limited to those that could come in contact with the canister exterior and cask interior and these items can be controlled to minimize any spread of contamination beyond the immediate work area. There should be no airborne radioactivity associated with these levels of contamination.

Handling of bare canisters will occur in confined areas, so the spread of any contamination should be minor and contained, as stated previously. There are no Category 1 event sequences for CRCF so there should be no significant releases of radioactivity to the ventilation system. ([BSC 2006a] Section 4.4.3) Even though there is not expected to be detectable airborne radioactivity, it is inevitable that minor, very low undetectable levels of radioactivity can become airborne during the course of operations over time. The HEPA filters will accumulate any of this radioactivity and over a period of time the cumulative radioactivity levels may become detectable. The 1$^{st}$ stage HEPA filters should be treated as contaminated, yet any direct radiation levels should be very low.

There currently are five potential Category 2 events identified for CRCF. ([BSC 2006a] Table 4-6) By definition, Category 2 events have a very low frequency of occurrence and are not expected to occur during the facility's operating life. If a Category 2 event were to occur, there would be a breach of a canister resulting in a significant release of radioactivity to the environment of the immediate room, contamination of the room floors, walls and equipment. The ventilation system downstream of the affected room would become contaminated and the radioactivity levels on the 1$^{st}$ stage HEPA filters could be very high. Response to any Category 2 event would require detailed planning and execution and would result in facility down time. This response would likely result in an increased generation of LLW as a result of the clean-up and repair operations. Special considerations would need to be made at the time of incident response for any special handling needs or storage considerations of this LLW. Due to the layout of the rooms and areas within CRCF, there wasn't any way to segregate any of the areas or rooms of the facility into a group of non-controlled clean rooms, designated as C1, separate from the potentially contaminated areas or rooms, designated as C2. Typically, clean rooms would not require contamination control measures, examples of these types of rooms are; electrical rooms, battery rooms, operating galleries, restrooms, etc. Therefore, within the ITS structure of the facility, all areas, except for the entrance vestibules, are designated as C2. Any trash collected within these areas will be considered DAW unless it is subsequently successfully surveyed for unconditional release and determined to be free of detectable radioactivity. In addition to trash, this material includes items such as protective clothing, protective equipment, decontamination media, sample media such as filters, or equipment and tools that are removed from the facility.

The DAW will be collected from various areas throughout the facility and moved to a holding area on the north side of the facility near the equipment elevator until the LLWF handlers remove it and transfer it to the LLWF for segregation. Typically, when work is conducted in areas or rooms where there is contaminated material, workers wear protective clothing based on the potential contamination levels. Since the contamination levels in this facility are expected to be low, there normally would be minimal protective clothing worn. RPT's would wear gloves when performing contamination surveys as a precaution. Personnel working with transportation casks as a precaution may wear gloves and a disposable paper suit and booties. The DAW is transported in bags (rad bags) or in 55 gallon drums. Since the contamination levels are expected to be low, any dose rates from the trash, bags, and drums should also be low, typically less than 1 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should also result in low dose rates, again expected to be less than 5 mrem/hr.

There are no processes that utilize significant amounts of water in this facility. There are two potential sources of contaminated liquid in the facility. The first potential source is from decontamination of personnel and equipment. Space and appropriate equipment has been provided in the facility HP support area to perform personnel and small equipment decontamination. Water used for decontamination purposes will be collected in a holding tank and transferred to the LLWF for further processing. It is expected that the need to decontaminate personnel will be quite low and the need to decontaminate equipment will make up the majority of use for the decontamination facilities. Another potential source of contaminated water will be from cleaning, or mopping, of C2 areas. This water should be sent to the contaminated water hold-up tank. The other potential source of contaminated liquid in the facility is from the use of the fire suppression system in potentially contaminated areas and rooms. If the fire suppression system is activated, and if it affects rooms or areas with potential for contamination, the firewater will need to be considered potentially contaminated and handled as such. This water should be sampled and analyzed for radioactivity to confirm whether or not it is contaminated prior to disposition.

### 6.5.2 Applicable Waste Streams

Solid LLW: DAW will consist of radiation protection sample media, such as air sampler filters, smears, etc., respirator cartridges if used, HEPA filters, paper products, plastic, mop heads, rags, various equipment, tape, etc.

Liquid LLW: There are no major uses of water for the various processes in this facility. One potential source of contaminated water would be from discharge of the fire suppression system in any area designated as C2 through C5. Any liquid (water) from specific or general cleaning in the potentially contaminated areas will be disposed of in the facility drains. Water from personnel and small equipment decontamination in the support area will need to be contained in a hold-up tank. CRCF holding tank water may be sampled and analyzed prior to being transferred to the LLWF holding tank for disposition.

Gaseous Waste: This facility is essentially a clean facility. The majority of the facility is zoned as C2, or potentially contaminated, since it is likely that canisters received at the facility will have low levels of contamination with an occasional high contamination canister. The transfer of any surface contamination from a canister to facility floors, walls or equipment should be minimal, but can occur. Since the contamination levels are expected to be low, any airborne radioactivity levels should also be very low. The exhaust air from the C2 rooms and areas will be filtered through HEPA filters. The exhaust from the facility will be monitored by effluent monitors in the facility stack. Another potential source of gaseous radioactivity is from transportation cask sampling and purging. As long as the canisters remain intact during transport and receipt at the YMP, the cask void space should contain minimal radioactivity. Regardless, the void space gases will be exhausted through the facility ventilation system and monitored at the stack. If there has been a breach of a canister and radioactivity levels in the cask void space are elevated, a sample is analyzed and if levels are acceptable the void space can be released through the facility ventilation system.

### 6.5.3 Waste Characterization

Waste streams should be sampled for waste characterization analysis as required by project procedures prior to transfer to the LLWF. Smears of general areas typically used for characterization of DAW and solid LLW. Methods should be incorporated to accommodate HEPA filter sampling. Water sampling may be needed for characterization purposes and may need to be accommodated. Gaseous releases are monitored and sampled in stack.

### 6.5.4 Estimated Volumes

Solid LLW- 5 large bags of LLW per week for each CRCF. Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total average volume of filter LLW generated per year.

Liquid LLW- Not including fire suppression water, approximately 125 gallons per week for each CRCF.

Gaseous – N/A.

### 6.5.5 Dose Rate Expectations

Solid LLW- Normally < 1 mrem/hr on contact with surface for bagged LLW. HEPA filters should be < 25 mrem/hr on contact with surface.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.5.6 Necessary Staging Requirements

Solid LLW- One week of generation of solid LLW, excluding HEPA filters, would be five bags, or five 55 gallon drums. Assumption 4.3 contains the estimated change-out frequency for pre-filters and HEPA filters. Pre-filters and HEPA filters can be temporarily staged in the room in which they originate.

Liquid LLW- Holding tank should be sized sufficiently to contain a release of fire suppression water plus one week's worth of liquid LLW generation. (fire suppression + 125 gallons).

Gaseous – N/A.

## 6.6 Receipt Facility

### 6.6.1 Facility Description

Current plans call for construction of one Receipt Facility (RF). The RF is an ITS structure that will receive and handle TADs and DPCs in rail casks. The canisters will be transferred to shielded transfer casks (STCs) or aging overpacks. The canisters will not be opened in the facility thereby eliminating a potential large source of contamination from the facility operations. The canisters are expected to have low levels of contamination, normally less than 1,000 dpm/100 $cm^2$ for $\beta/\gamma$ and less than 110 dpm/100 $cm^2$ for $\alpha$ (Assumption 4.4). Without formal agreements between DOE and the originators of the canisters, there is a potential for occasional receiving a canister with higher levels of surface contamination. In addition to the canisters, there is likely no way to predetermine the contamination levels on the interior surfaces of arriving transportation casks prior to opening them. It is also unlikely that the shipment paperwork will provide this information. Thus, it will be assumed that the interior of transportation casks used for canister transport will have low levels of contamination and should not present unusual handling concerns. During gas sampling of the casks it will be determined if there has been a canister breach during the shipment. Canister breaches will likely result in high levels of contamination on the exterior of the canister and the interior of the transport cask. Canister breaches during shipment are not expected to occur.

Incoming transportation casks are surveyed for radiation levels and contamination when they are received at the GROA security station. Since not all areas of the transportation cask surface are accessible for this initial contamination survey, it is possible that some minor levels of contamination may be discovered during cask handling operations in the RF. It is likely that contamination levels would be low and the cask could be decontaminated manually after its contents are removed, thereby reducing the dose rates to the workers performing the decon.

Considering these low levels of contamination, there is minor risk for contamination of floors or large areas from normal canister and cask handling operations. Items most likely to be contaminated would be limited to those that could come in contact with the canister exterior and cask interior and these items can be controlled to minimize any spread of contamination beyond the immediate work area. There should be no airborne radioactivity associated with these levels of contamination.

Handling of bare canisters will occur in confined areas, so the spread of any contamination should be minor and contained, as stated previously. There are no Category 1 event sequences for the RF so there should be no significant releases of radioactivity to the ventilation system. ([BSC 2006a] Section 4.4.3) Even though there is not expected to be detectable airborne radioactivity, it is inevitable that minor, very low undetectable levels of radioactivity can become airborne during the course of operations over time. The HEPA filters will accumulate any of this radioactivity and over a period of time the cumulative radioactivity levels may become detectable. The 1$^{st}$ stage HEPA filters should be treated as contaminated, yet any direct radiation levels should be very low.

There currently are no identified potential Category 2 events identified for RF ([BSC 2006a] Table 4-6). However, once the RF is analyzed, there would be expected to be similar Category 2 events as those identified for the CRCF in the preparation area and in the canister transfer area. (See discussion in Section 6.5.1.)

Due to the layout of the rooms and areas within RF, there wasn't any way to segregate any of the areas or rooms of the facility into a group of non-controlled clean rooms, designated as C1, separate from the potentially contaminated areas or rooms, designated as C2. Typically, clean rooms would not require contamination control measures, examples of these types of rooms are; electrical rooms, battery rooms, operating galleries, restrooms, etc. Therefore, within the ITS structure of the facility, all areas, except for the entrance vestibules, are designated as C2. Any trash collected within these areas will be considered DAW unless it is subsequently successfully surveyed for unconditional release and determined to be free of detectable radioactivity. In addition to trash, this material includes items such as protective clothing, protective equipment, decontamination media, sample media such as filters, or equipment and tools that are removed from the facility.

The DAW will be collected from various areas throughout the facility and moved to a holding area on the west side of the facility until the LLWF handlers remove it and transfer it to the LLWF for segregation. Typically, when work is conducted in areas or rooms where there is contaminated material, workers wear protective clothing to a degree based on the potential contamination levels. Since the contamination levels in this facility are expected to be low, there normally would be minimal protective clothing worn. RPT's would wear gloves when performing contamination surveys as a precaution. Personnel working with transportation casks as a precaution may wear gloves and a disposable paper suit and booties. The DAW is transported in bags (rad bags) or in 55 gallon drums. Since the contamination levels are expected to be low, any dose rates from the trash, bags, and drums should also be low, typically less than 1 mrem/hr on contact with the item. The holding area will be monitored for radiation levels, but the combination of drums and bags should also result in low dose rates, again expected to be less than 5 mrem/hr.

There are no processes that utilize significant amounts of water in this facility. There are three potential sources of contaminated liquid in the facility. The first potential source is from decontamination of personnel and equipment. Space and appropriate equipment has been provided in the facility HP support area to perform personnel and small equipment decontamination. Water used for decontamination purposes will be collected in a holding tank and transferred to the LLWF for further processing. It is expected that the need to decontaminate personnel will be quite low and the need to decontaminate equipment will make up the majority of use for the decontamination facilities. Another potential source of contaminated water will be from cleaning, or mopping, of C2 areas. This water should be sent to the contaminated water hold-up tank. The other potential source of contaminated liquid in the facility is from the use of the fire suppression system in potentially contaminated areas and rooms. If the fire suppression system is activated, and if it affects rooms or areas with potential for contamination, the firewater will need to be considered potentially contaminated and handled as such. This water should be sampled and analyzed for radioactivity to confirm whether or not it is contaminated prior to disposition.

### 6.6.2 Applicable Waste Streams

Solid LLW: DAW will consist of radiation protection sample media, such as air sampler filters, smears, etc., respirator cartridges if used, HEPA filters, paper products, plastic, mop heads, rags, various equipment, tape, etc.

Liquid LLW: There are no major uses of water for the various processes in this facility. One potential source of contaminated water would be from discharge of the fire suppression system in any area designated as C2 through C5. Any liquid (water) from specific or general cleaning in the potentially contaminated areas will be disposed of in the facility drains. Water from personnel and small equipment decontamination in the support area will need to be contained in a hold-up tank. RF holding tank water may be sampled and analyzed prior to being transferred to the LLWF holding tank for disposition.

Gaseous Waste: This facility is essentially a clean facility. The majority of the facility is zoned as C2, or potentially contaminated, since it is likely that canisters received at the facility will have low levels of contamination with an occasional high contamination canister. The transfer of any surface contamination from a canister to facility floors, walls or equipment should be minimal, but can occur. Since the contamination levels are expected to be low, any airborne radioactivity levels should also be very low. The exhaust air from the C2 rooms and areas will be filtered through HEPA filters. The exhaust from the facility will be monitored by effluent monitors in the facility stack. Another potential source of gaseous radioactivity is from transportation cask sampling and purging. As long as the canisters remain intact during transport and receipt at the YMP, the cask void space should contain minimal radioactivity. Regardless, the void space gases will be exhausted through the facility ventilation system and monitored at the stack. If there has been a breach of a canister and radioactivity levels in the cask void space are elevated, a sample is analyzed and if levels are acceptable the void space can be released through the facility ventilation system.

### 6.6.3 Waste Characterization

Waste streams should be sampled for waste characterization analysis as required by project procedures prior to transfer to the LLWF. Smears of general areas typically used for characterization of DAW and solid LLW. Methods should be incorporated to accommodate HEPA filter sampling. Water sampling may be needed for characterization purposes and may need to be accommodated. Gaseous releases are monitored and sampled in stack.

### 6.6.4 Estimated Volumes

Solid LLW- 5 large bags of LLW per week for RF. Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total average volume of filter LLW generated per year.

Liquid LLW- Not including fire suppression water, approximately 25 gallons per week.

Gaseous – N/A.

### 6.6.5 Dose Rate Expectations

Solid LLW- Normally < 1 mrem/hr on contact with surface for bagged LLW. HEPA filters should be < 25 mrem/hr on contact with surface.

Liquid LLW- N/A.

Gaseous – N/A.

### 6.6.6 Necessary Staging Requirements

Solid LLW- One week of generation of solid LLW, excluding HEPA filters, would be five bags, or five 55 gallon drums. Assumption 4.3 contains the estimated change-out frequency for pre-filters and HEPA filters. Pre-filters and HEPA filters can be temporarily staged in the room in which they originate.

Liquid LLW- Holding tank should be sized sufficiently to contain a release of fire suppression water plus one week's worth of liquid LLW generation. (fire suppression + 25 gallons).

Gaseous – N/A.

## 6.7 Low-Level Waste Facility

### 6.7.1 Facility Description

The Low-Level Waste Handling Facility (LLWF) is an ITS structure ([BSC 2006a] Table 4-10) that will receive and process and package DAW, other solid LLW, and liquid LLW, generated in the various YMP nuclear facilities, including the Subsurface and Aging facilities. The LLWF includes capability for short-term storage including LLW contained in 55 gallon drums, various sized metal containers, and high-integrity containers (HICs). Some of this storage is behind shield walls with crane access. The LLWF also has the capability to receive liquid LLW and contain it in holding tanks external to the building until it can be processed for disposal. There is a concrete pad behind the facility that may be used for staging LLW shipments or for storing new containers such as 55 gallon drums, metal boxes, HICs, etc.

There is a support area for facility staff including an HP control point, rest rooms, break room, office space. This area can be accessed directly from outside of the facility. Prior to entering this support area from inside of the facility, personnel must be surveyed for contamination. This area also contains various radiation detection instrumentation and appropriate check sources.

The LLWF will provide for any necessary capability for packaging of solid LLW and shipment of the LLW to a vendor for further processing and disposal, or directly to an approved disposal site.

There are no Category 1 event sequences for the LLWF so there should be no significant releases of radioactivity to the ventilation system ([BSC 2006a] Section 4.4.3). There are two potential Category 2 event sequences for LLWF. ([BSC 2006a] Table 4-6) By definition, Category 2 events have a very low frequency of occurrence and are not expected to occur during the facility's operating life. If a Category 2 event were to occur, there would be a breach of LLW containers resulting in a potentially significant release of radioactivity to the environment of the immediate area, contamination of the floors, walls and equipment. The ventilation system downstream of the affected area would become contaminated and the radioactivity levels on the HEPA filters could be elevated resulting in elevated dose rates. Response to any Category 2 event would require detailed planning and execution and would result in facility down time. This response would likely result in an increased generation of LLW as a result of the clean-up and repair operations. Special considerations would need to be made at the time of incident response for any special handling needs or storage considerations of this LLW.

### 6.7.2 Processes

#### 6.7.2.1 Sorting

A low background room is included in the LLWF for performing sorting operations. DAW acceptable for sorting is normally comprised of low density material, such as cloth, paper products, plastics, etc. Radiation levels in this room must be near background levels to sufficiently ensure that there is no detectable radioactivity on items surveyed and concluded to be clean. This room contains a sorting table with a ventilation hood. Workers will bring bags of DAW with dose rates near background levels into the room and carefully survey the trash in a piecemeal fashion to identify any radioactive trash that may be mixed in with the clean trash. A final gross, or bulk, survey is performed once a container, or bag, of clean trash is filled to verify that there is still no detectable radioactivity. Bags of DAW, with measurable dose rates on the outside of the bag, are not normally sorted to identify clean trash due to the likelihood of cross-contamination of any clean trash in the bag and increased potential to contaminate the sorting table.

### 6.7.2.2 Material and Equipment Decontamination

The LLWF contains a decontamination room that is capable of accommodating small and large equipment decontamination. A large sink will be available for washing down small articles and equipment. A large booth will be available for high pressure washing of large items. Water from the decontamination activities will be collected in the holding tank outside the facility.

### 6.7.2.3 Liquid Low-Level Radioactive Waste Staging and Processing

There are three 25,000 gallon tanks located outside the LLWF for contaminated, or potentially contaminated, water staging and processing. The tanks are placed on a bermed concrete pad adjacent to the facility. One tank is for collecting the potentially contaminated water from the various facilities and from the LLWF decontamination room. Once enough water is collected, approximately 75% of the tank volume, then the water can be processed to remove as much of the contaminants as possible and transferred to the second holding tank. The third tank becomes the active tank accepting inputs from the various facilities when the other two tanks are being processed.

Processing of the contaminated water can be performed by a vendor on-site or by YMP personnel. When the radioactivity concentration in the water in the final holding tank is confirmed to be below release limits, the water is discharged to the evaporation pond. The release limits will be based on the lowest limit from 10 CFR 20 Appendix B, Table 2 *Effluent Concentrations - Water*, or from DOE O-5400.5 *Derived Concentration Guides for Water.* An alternative to releasing the water to the evaporation pond is to solidify and dispose of the water at an approved burial site.

Any water collected in the bermed area surrounding the water tanks will be sampled and analyzed for radioactivity content prior to determining its disposition. If found to be contaminated, it will be contained and handled appropriately.

### 6.7.2.4 Solid LLW Storage

There are four primary storage vaults within the LLWF. The vaults have 20' high shield walls. The exterior walls of the facility are 3' thick, the front wall of the vaults is 3' thick, and the common vault walls are 2' thick. This should provide sufficient shielding between vaults if there are occurrences where workers need to enter a vault for maintenance, repairs, or other approved activities.

Empty DPC Vault: This space has the capacity to store 24 empty DPCs.

HIC Vault: This space has the capacity to store 24 HICs.

Filter Vault: This space has the capacity to store 220 (55 gallon) drums containing 1 filter each. (Additional containers can be stored if they are stacked.)

Box/Drum Vault: This space has the capacity to store 88 drums and 24 boxes (B-25).

Table 6.7: LLW[1] to be sent to the LLWF on a weekly basis (unless noted otherwise).

| Facility | Bags/Drums DAW | Water[2] (gallons) | Resin | Pool Filters (drums) | DPC's (#/yr) |
|---|---|---|---|---|---|
| WHF | 35 | 1,000 | 1 | 10 | 6 |
| IHF | 2 | 25 | N/A | N/A | N/A |
| RF | 5 | 25 | N/A | N/A | N/A |
| SA[3] | 1 | N/A | N/A | N/A | N/A |
| SS[3] | 1 | 5 | N/A | N/A | N/A |
| CRCF-1 | 5 | 125 | N/A | N/A | N/A |
| CRCF-2 | 5 | 125 | N/A | N/A | N/A |
| CRCF-3 | 5 | 125 | N/A | N/A | N/A |
| LLWF | 2 | 50 | N/A | N/A | N/A |
| **Total** | **61** | **1,480** | **1** | **10** | **6** |

[1] Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total estimated annual average volume of filter LLW generated per year.
[2] Values listed do not account for fire water discharges.
[3] Values for DAW are rounded.

### 6.7.3 Waste Characterization

Any LLW that is to be packaged and shipped for burial at an approved disposal site must be characterized for all radionuclides present so that the waste can be properly quantified and classified. Since some radionuclides are difficult to identify and quantify with standard radio-analytic instruments and techniques, samples must be analyzed by laboratories with special processing techniques and equipment. In order to accomplish this, the waste must be sampled at either the point of origin, in the originating nuclear handling facility, or in the LLWF. If at all possible, the majority of solid waste characterization sampling will be performed in the various facilities prior to transfer to LLWF.

- Demineralizer resin will be sampled during the transfer to a holding tank in the WHF. (if a cartridge type system is used then some other means of sampling will be required.)
- Pool filters should be sampled when they are removed from the treatment system.
- HEPA filters will be sampled when they are pulled from the HVAC system.
- General DAW will be characterized by obtaining contamination smears in the facility of origin.

### 6.7.4 Generation of LLW in the LLWF

The LLWF itself will generate approximately 2 drums of DAW per week due to handling of contaminated waste. Assumption 4.3 contains the estimated number of HEPA's and pre-filters per facility and the total average volume of filter LLW generated per year. Due to decon, there is expected to be about 50 gallons per week of liquid LLW generated. The decontamination system may contain filters that will need to be disposed of as LLW. No gaseous waste is anticipated.

## 7. CONSTRUCTION SCHEDULE IMPACTS

Due to the timing of YMP facilities coming on line, the LLWF is not expected to be operational until after the IHF has started operation. This will result in the IHF needing to handle and store its LLW, including LLLW, on a temporary basis on an outdoor pad, in sea-land containers, or a similar arrangement.

## 8. RECOMMENDATIONS

- There is no definitive method for dealing with contaminated, or potentially contaminated, water transfer from the facilities to the LLWF water holding tank. The preferred method is to directly connect (hard pipe) the holding tanks at the various facilities directly to the LLWF holding tank. This would require double pipe with leak detection. The less desirable, but capable, solution is to use a tanker to transfer the water to the LLWF. This is less desirable due to increased chance of leakage or spillage during loading and transfer activities.
- Use the lowest value of water concentration limits from 10 CFR 20 App. B and from DOE O-5400.5 when releasing treated water from the LLWF to the on-site evaporation pond, or retention pond (even though these limits actually apply to release of water effluent off-site to unrestricted areas).
- The design of the nuclear facilities must ensure that all containers of LLW sent to the LLWF, including DPC's, must not contain SNF, pieces of SNF, such as fuel fragments, or HLW.
- At this preliminary stage of design, the facility drain systems are not well defined. It is expected that the drain systems will include pumps and filters which will need to be accounted for once the designs mature.

## 9. REFERENCES

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## 10. ACRONYMS and ABBREVIATIONS

| | |
|---|---|
| CRCF | Canister Receipt *and* Closure Facility |
| CSNF | Commercial Spent Nuclear Fuel |
| DAW | Dry Active Waste |
| DOE | Department of Energy |
| DPC | Dual Purpose Canister |
| dpm | disintegrations per minute |
| GROA | Geologic Repository Operations Area |
| HEPA | High-Efficiency Particulate Air *(filter)* |
| HIC | High-Integrity Container |
| HLW | High-Level *radioactive* Waste |
| HP | Health Physics |
| IHF | Initial Handling Facility |
| ITS | Important to Safety |
| LLLW | Liquid Low-Level *radioactive* Waste |
| LLW | Low-Level *radioactive* Waste |
| LLWF | Low-Level Waste Facility |
| RF | Receipt Facility |
| RPT | Radiation Protection Technician |
| SA | Surface Aging *Facility* |
| SNF | Spent Nuclear Fuel |
| SS | Subsurface *Facility* |
| TAD | Transport, Aging, *and* Disposal *canister* |
| TEV | Transport *and* emplacement vehicle |
| WHF | Wet Handling Facility |