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327 Building Liquid Waste Handling Options Modification Project Plan

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327 Building Liquid Waste Handling Options Modification Project Plan

March 28, 1998

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Table of Contents

Table of Contents (Continued)

List of Tables

List of Supplemental Data

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1.0 OBJECTIVE AND BACKGROUND

1.1 BACKGROUND

The overall objective of the 327 Facility Stabilization Project is to establish a passively safe and environmentally secure configuration of the 327 Facility [Refer to *324/327 Facility Deactivation Plan*]. In order to accomplish this goal, liquid decontamination has been proposed for specified areas within the facility. The liquid waste generated from this decontamination effort is anticipated to contain levels of radioactivity that would, without treatment, pose as low as reasonably achievable (ALARA) concerns and transportation issues, and storage or disposal issues.

In the past, these issues were mitigated by collecting the liquid waste in the 327 Facility Radioactive Liquid Waste System (RLWS) and transferring the liquid through a series of piping to the 340 Facility. The liquid waste would be staged at the 340 Facility until it was loaded into a rail tanker and transported to the 200 Area Tank Farm system through the 204-AR Facility.

The 340 Facility is over 40 years old and not permitted, and current planning baseline forecasts closure of the 340 Facility by the end of FY 1998. Consequently, the 340 Facility will not be available to accept radioactive liquid waste (RLW) generated during the deactivation of the 327 Facility. The issue of handling of radioactive RLW from the 327 Facility (assuming the 340 Facility is not available to accept the RLW) has been conceptually examined in at least two earlier engineering studies (Parsons 1997a and Hobart 1997). Each study identified a similar preferred alternative that included modifying the 327 Facility RLWS handling systems to provide a truck load-out station, either within the confines of the facility or exterior to the facility. The alternatives also maximized the use of existing piping, tanks, instrumentation, controls and other features to minimize costs and physical changes.

An issue discussed in each study involved the anticipated volume of the RLW stream. Estimates ranged between 113,550 and 387,500 liters (30,000 and 100,000 gallons) in the earlier studies. During the development of the *324/327 Building Stabilization/Deactivation Project Management Plan* (HNF-IP-1289), the lower estimate of approximately 113,550 liters (30,000 gallons) was confirmed and has been adopted as the baseline for the 327 Facility RLW stream.

It has been proposed that up to 95% of the RLW stream can be dispositioned, following a treatment process, as process water. This 95% constitutes the volume of liquid in the 327 Facility Spent Fuel Storage Basin. The spent fuel storage basin contains approximately 90,045 liters (23,790 gallons) of water that is cleaned on a continual basis. Current plans assume that the spent fuel storage basin water will be treated, if necessary, and routed to the process water system for disposition. The remaining radioactive liquid waste inventory (mostly from deactivation activities), approximately 4,000 liters (1,100 gallons), will be dispositioned by the proposed modifications of the 327 Facility RLWS handling systems identified in the earlier studies.

The volume reduction of the radioactive liquid waste stream may influence the decision to select the preferred alternative identified in earlier studies. The goal of this engineering study is to re-evaluate the existing preferred alternative and select a new preferred alternative, if appropriate.

Based on the new or confirmed preferred alternative, this study will also provide a conceptual design and cost estimate for required modifications to the 327 Facility to allow removal of RLWS and treatment of the RLW generated during deactivation.

1.2 OBJECTIVE

Select the preferred alternative to enable removal of RLW generated during the deactivation of the 327 Facility. It is anticipated that the reduced volume of the RLW stream, predicted in earlier studies, may influence the final recommendation. Based on the re-evaluation of the existing recommendations or selection of a new preferred alternative, provide a conceptual design and cost estimate for dispositioning the 327 Facility RLW.

2.0 EXECUTIVE SUMMARY

Two goals for the deactivation of the 327 Facility are to eliminate, reduce, shield, or isolate radiation fields, and to eliminate hazards, nuclear and non-nuclear, by removing, isolating, draining, and minimizing hazardous materials. This engineering study evaluates three alternatives and recommends a preferred alternative, that best meets the 327 Facility deactivation goals and objectives.

The three alternatives reviewed in this study are as follows:

- Alterntaive 1: Truck load-out station located in the facility truck bay 1;
- Alternative 2: Truck load-out station located outside of the facility; and
- Alternative 3: Drum load-out with treatment.

Alternatives 1 & 2 were the preferred approach from earlier studies, but a location had not been selected. The preferred alternative, Alternative 3, will provide a temporary treatment skid assembly and system to process the radioactive RLW from remote- handled conditions to contact handled conditions. The treated RLW will then be transferred to 55 gallon drums. Once filled, the 55 gallon drums will be transported to the 324 Facility or another on-site facility where the RLW will eventually be transferred for disposition at the 200 Area Tank Farms.

The selection of the preferred alternative is accomplished by comparing each alternative against the other. To accomplish this comparison, a selection process was created to measure the degree to which each alternative satisfied certain decision criteria. The selection process was derived from a discussion by personnel involved in the study. The selection process included the performance of each alternative to certain criteria, i.e., safety, cost, schedule, portability, waste stream, operability/maintainability, liquid waste disposal acceptance criteria, and program integration.

The preliminary cost estimate for the preferred alternative (Alternative 3) is approximately $425,000 . The details of this estimate are included in Supplemental Data B. The estimate includes costs for engineering, project management, site work, procurement of a temporary 300 gallon tank, procurement of a vendor supplied treatment skid, and accessories for drum loading and storage.

3.0 RECOMMENDATIONS AND CONCLUSIONS

3.1 RECOMMENDATIONS

This study recommends that B&W Hanford Company (BWHC) install a vendor supplied treatment skid in the southeast corner of the 327 Facility basement. The treatment skid will consist of disposable filters and ion exchange columns to remove the radioactive cesium, barium, and strontium. Minor modifications to RLWS header/piping will be required as well as procurement of a shielded 300 gallon storage tank and required shielding to accommodate the treatment skid.

Disposition of the RLW would begin by filling the staging tank with radioactive RLW, treating the waste with the vendor supplied treatment skid, and then loading the treated liquid waste into 55 gallon drums. The waste water would be treated to a level that would allow contact handling of the drums, less than 30 Rem/hr on contact. This would require the liquid to be processed to a minimum level of 0.00012 Ci/l. The treated waste water could then be transported to the 324 Facility for load-out to tanks farms, sent directly to tank farms or sent to 340 Facility for load-out to tank farms or the Effluent Treatment Facility (ETF).

3.2 CONCLUSIONS

Alternative 3 is the preferred alternative. Using the treatment skid and loading treated radioactive liquid waste into 55 gallon drums is safer, less costly, portable, easier to operate and maintain, and is more likely to result in the treated liquid radioactive waste being accepted at its final disposition location (tank farms or ETF). Alternatives 1 and 2 can provide the means of dispositioning the liquid radioactive waste, however, the characteristics and costs of these alternatives are less desirable than Alternative 3.

This study concludes that the preferred alternative (Alternatives 1 & 2) identified in earlier studies is no longer desirable due to the reduced volume of RLW that is now anticipated to be generated during deactivation activities.

4.0 UNCERTAINTIES AND ASSUMPTIONS

The following is a list of uncertainties generated during the writing of this report. For each uncertainty, there is an explanation of the reasons for the uncertainty or why an assumption is justified, followed by the enabling assumption.

Uncertainty 1

Can the water in the spent fuel storage basin be treated and routed to the process water system for disposition?

The total amount of radioactive RLW to be generated is estimated to be approximately 113,550 liters (30,000 gallons). The spent fuel storage basin contains approximately 90,045 liters (23,790 gallons) that is cleaned on a continuous basis. It has been proposed that up to 95% of the RLWS waste stream can be dispositioned, following a treatment process, as process water. This 95% constitutes the volume of liquid in the 327 Facility Spent Fuel Storage Basin. There is some uncertainty whether the wastewater could be treated to the level necessary for release to the 300 Area Process Sewer. Discussions with plant personnel and treatment consultants confirmed that this is a viable option and has been adopted as the baseline for the 327 Facility RLW stream.

Assumption 1

The water in the spent fuel storage basin, following treatment, will be routed to the process water system for disposition.

Uncertainty 2

What will be the volume of radioactive liquid waste generated from various deactivation activities?

Estimates for the volumes of liquid waste generated can be found in the *324/327 Buildings Stabilization/Deactivation Project Management Plan*, HNF-IP-1289, and are summarized in Table 1.0. Liquid waste removal/disposal is integral in achieving the deactivation goals and objectives. In the Project Management Plan (PMP), it has been estimated that as much as 113,550 liters (30,000 gallons) of radioactive waste water may require disposal. Of which, the largest single source is currently contained in the 327 Facility Spent Fuel Storage Basin which contains approximately 90,045 liters (23,790 gallons).

Assumption 2

The volumes listed in Table 1 will be used as the basis for the volume of radioactive liquid waste generated from various deactivation activities.

Table 1. Estimated Liquid Waste Volumes generated by Deactivation by Building Area.

Liquid Waste Source by Area	**BOE Reference [1]**	**RLW Volume**
327 Radiological Basement Area	1K7Z010A01	322 liters (85 gal)
327 Facility Canyon A-Cell	1K7Z020A01	114 liters (30 gal)
327 Facility Canyon B-Cell	1K7Z020C01	114 liters (30 gal)
327 Facility Canyon C-Cell	1K7Z020E01	114 liters (30 gal)
327 Facility Canyon D-Cell	1K7Z020G01	114 liters (30 gal)
327 Facility Canyon E-Cell	1K7Z020J01	114 liters (30 gal)
327 Facility Canyon F-Cell	1K7Z020L01	114 liters (30 gal)
327 Facility Canyon G-Cell	1K7Z020N01	114 liters (30 gal)
327 Facility Canyon H-Cell	1K7Z020P01	114 liters (30 gal)
327 Facility Canyon I-Cell	1K7Z020R01	114 liters (30 gal)
327 Facility SERF Cell	1K7Z020T01	379 liters (100 gal)
327 Facility SERF Storage Cell	1K7Z020T03	379 liters (100 gal)
327 Facility RPS/RLWS	1K7Z040A05	379 liters (100 gal)
327 Facility Decon Chamber/Water Storage Basin Clean out	1K7Z020V01	1506 liters (398 gal)
Total		**3991 liters (1053 gal)**
327 Facility Decon Chamber/Water Storage Basin	1K7Z020V01	90,045 liters (23,790[2] gal)

[1] 300 Area Deactivation Project Management Plan
[2] not included in this project waste estimate

Uncertainty 3

What will the liquid radioactive waste characterization and curie concentration be following the various deactivation activities?

Table 2 provides the estimated radioactive holdup after equipment and dispersible removal by building area. Based on discussions with plant personnel, the main constituents of radioactive material holdup is predicted to be Cesium-137 (Cs-137), and Strontium-90 (Sr-90). Curie estimates in Table 2 are for Cs-137. The estimated values in the Table 2 have been developed based on conversations with plant personnel. Based on the estimated volume of 3,991liters (1053 gallons), (Table 1.0), and the estimated 1045 curies of radioactivity the resulting waste water will average 0.26 Ci/l (1.0 Ci/gal). The estimated maximum concentration is 1.3 Ci/l (5.1 Ci/gal). The estimated maximum was determined by using the projected liquid volume generated in the Shielded Envirnomental Radiometallurgy Facility (SERF) Cell divided by the estimated curie content from that cell. A 327 Facility Characterization study is being conducted by facility staff, these estimates will be refined as facility characterization data becomes available.

Assumption 3

The radioactive liquid waste, generated from deactivation activities, will have an average and maximum curie concentration of 0.26 ci/l (1.0 ci/gal) and 1.3 ci/l (5.1 ci/gal), respectively.

Table 2. Estimated Radioactive Holdup and Flush Water Activity.

Facility Area	Estimated Cs-137 Holdup Before Decontamination*	Estimated Radioactivity in flush water**
327 Radiological Basement Area	2 Curie	0.4 Curie
327 Facility Canyon A-Cell	10 Curie	2 Curie
327 Facility Canyon B-Cell	2 Curie	0.4 Curie
327 Facility Canyon C-Cell	10 Curie	2 Curie
327 Facility Canyon D-Cell	10 Curie	2 Curie
327 Facility Canyon E-Cell	10 Curie	2 Curie
327 Facility Canyon F- Cell	10 Curie	2 Curie
327 Facility Canyon G-Cell	2 Curie	0.4 Curie
327 Facility Canyon H-Cell	2 Curie	0.4 Curie
327 Facility Canyon I-Cell	10 Curie	2 Curie
327 Facility SERF Cell and SERF Storage***	5054 Curie	1011 Curie
327 Facility RPS/RLWS	2 Curie	0.4 Curie
327 Facility Decon Chamber/Water Storage Basin Sludge	100 Curie	20 Curie
Total	**5224 Curie**	**1045 Curie**

* Based on most prevalent contaminate, Cs-137.

** Assumes a 80% removal efficiency by dry foaming alkaline decontamination and wipe and 20% removal by the flush water.

*** Based on 1 curie/100 cm^2surface area.

5.0 RADIOACTIVE LIQUID WASTE SYSTEM AND ASSOCIATED SYSTEMS DESCRIPTION

5.1 RADIOACTIVE LIQUID WASTE SYSTEM (RLWS)

The 327 Facility is equipped with a RLWS drain header in the basement which runs the entire length of the facility. Entry points to the RLWS drain header include several hood, sink, and floor locations; as well as cell drains for each hot cell. For areas which drain lower than the header (mostly floor drains), a sump, also located in the basement, lifts the waste water into the RLWS header using a pump. The sump is located between the A and B-Cells on the southwest end of the building. The header gravity drains to the southeast corner of the building and joins the building Retention Process Water System (RPS). The facility RLWS header is covered with lead shielding.

The Retention RPS and RLWS waste streams are combined in a common header where they exit the 327 Facility and are routed to the 340 Facility. The RLWS system is comprised of several sizes of stainless steel piping ranging from 1 inch to 3 inches in diameter. The pipe is typically supported directly to columns and floor by tube steel pipe hangers. The RLWS piping is not encased except where it passes through concrete structures such as walls and floors. However, the exposed piping in the basement is lead shielded to reduce exposure. The method for leak detection is limited to visual observation.

A pump is used to transfer RLW from the RLWS sump, for those areas which drain lower than the header, and all other inputs gravity drain to the 340 Facility. There are no storage tanks in the 327 Facility to collect RLW. Radioactive liquid waste is accumulated in containers and then analyzed to determine its acceptability for transfer to 340 Facility. Following approval, the waste is emptied into one of the RLWS drains and is transferred by gravity to the 340 Facility.

5.2 RETENTION PROCESS SEWER

The RPS system collects water from potentially contaminated sources. Many floor drains in the canyon and process areas are connected to the RPS system. The RPS system gravity drains to the southeast corner of the building where it joins the RLWS. Waste water in the RPS system is monitored for radioactivity levels. Waste water with detectable radioactivity is diverted to the RLWS. Liquids free from radioactivity are discharged to the 300 Area Process Sewer.

5.3 TRUCK LOCK

The 327 Truck Bay is located on the west end of the facility canyon. The truck lock is approximately 50 ft deep and the width of the canyon. The door is sufficiently large to allow tanker truck access. In the past, truck tankers have been moved into the facility and disconnected from the tractor in order to close the door. The truck lock is located at the opposite end of the building from which the RLWS header drains.

5.4 WASTEWATER CHARACTERIZATION

The current planning basis, found in the PMP, for the deactivation of the 327 Facility Hot Cells and Canyon is an application of "dry" chemical foam, wipe down and a water flush. The water flush contributes 100% of the waste stream volume estimated in Table 1.0. Table 1.1 provides the estimated radioactive holdup after equipment and dispersible removal by building area. Based on discussions with plant personnel, the main constituents of radioactive material holdup is predicted to be Cesium-137(Cs-137) and Strontium-90 (Sr-90). Curie estimates in the table are for Cs-137 and Ba-m137 in equal proportions. The estimated values in the table have been developed based on conversations with plant personnel.

Based on the estimated volume of 3,991liters (1053 gallons), (Table 1.0), and the estimated 1045 curies of radioactivity the resulting waste water will average 0.26 Ci/l (1.0 ci/gal).

The estimated maximum concentration is 1.3 Ci/l (5.1 Ci/gal). The estimated maximum was determined by using the projected liquid volume generated in the SERF Cell divided by the estimated curie content from that cell. A 327 Facility Characterization study is currently being conducted by facility staff. These estimates will be refined as facility characterization data becomes available.

Other factors that affect the wastewater and possible treatment options include pH, total dissolved solids (TDS), decontamination solution chemistry, etc. For the purpose of this plan and estimate it is assumed that the TDS will not exceed 5000 ppm, the pH will be in the range of 5-8, and all decontamination solutions are neutralized prior to discharge to the collection system.

5.5 WASTEWATER DISPOSAL

Three facilities currently exist on the Hanford Site which could treat, store and/or dispose of the liquid waste generated by the 327 Facility deactivation activities. They are the 300 Area Treated Effluent Disposal Facility (TEDF), the 200 Area ETF and the 200 Area Tank Farms. Disposition of wastewater to any of these facilities is dependent on the waste characterization.

The 300 Area TEDF is the most restrictive facility for waste acceptance. The 300 Area TEDF cannot dispose radioactive material which exceeds 15 pCi/l alpha and 50 pCi/l beta. Batch waivers are available for this facility but the radioactivity can not exceed the facility Derived Concentration Guide (DCG) limits. The 327 Building is currently connected to this facility through the 300 Area Process Sewer system.

The 200 Area ETF has a larger design envelope than the TEDF and can be adapted to accommodate certain waste streams as long as the waste is compatible with the Liquid Effluent Retention Facility (LERF) liners, the waste does not exceed the facility's bounding source term and the waste stream is within the limits of the facility's operating permit. The ETF has capability of receiving truck tanker transfer. Liquid waste received at the ETF is transferred from the load-out station and staged in the LERF prior to processing.

The 200 Area Tank Farms has the least restrictive waste acceptance criteria. Waste is transferred to the tank farms via the 204-AR Facility by rail tanker. Because the 204-AR Facility is non-shielded, it is the limiting factor for the waste that can be accepted by the tank farms.

This facility is currently being modified to accept truck tanker transfers. The tank farms can accept most liquid waste provided characterization and compatibility evaluations have been properly performed.
Actual acceptance criteria for these facilities can be found in the following documents:

TEDF	HNF-IP-1000
ETF	ETF Treatability Envelop
200 Area Tank Farms	WHC-SD-WM-EV-053

5.6 TRANSPORTATION OPTIONS

The Hanford Site is in possession of various truck tankers to transfer the liquid for treatment, storage and/or disposal. A brief description of some of the available transfer systems follows.

LR-56 is a shielded, self contained tanker which can carry up to 1000 gallons of radioactive liquid. This tanker is designed for transporting liquid waste up to 1 Ci/l of radioactivity. Actual licensed and administrative controls are much lower, 0.5 Ci/l. Modifications to the 204 AR Facility to receive shipments from the LR-56 are currently underway.

There are three non-shielded 5000 gallon tankers on site owned by the Liquid Effluents Organization. These tankers are built and operated to Department of Transportation (DOT) Standards and can carry Low Specific Activity Category II wastes (LSA II). This equates to approximately 0.13 Ci/l of Cs-137 and 0.027 Ci/l of Sr-90, which is substantially lower than the LR-56 tank trailer. They are capable of transporting liquid to the 200 Area ETF and off loaded.

Two 4000 gallon tanks used to ship nitric acid from Plutonium Uranium Extraction Facility (PUREX) to England are currently located at B-Plant and are potentially available to the project. The tanks are DOT certified and have trailers which allow for transportation both loaded and empty. Restrictions for weight and percent fill exist for the transportation of these tankers. The radioactive limit for these tanks is assumed to be LSA II.

6.0 DESCRIPTION OF ALTERNATIVES AND SOLUTIONS

6.1 CRITERIA

6.1.1 Selection Criteria

A criterion is a factor or attribute that is used to distinguish alternatives and allow for the selection of a preferred alternative. Selection criteria are required to further evaluate viable alternatives. Various alternatives for dispositioning the 327 Facility RLW are described in Section 6.3. Each alternative includes modifying the 327 Facility RLWS handling systems, making maximum use of existing piping, tanks, instrumentation, controls, and other features to minimize costs and physical changes. This section is devoted to the development of the criteria that provide the mechanism for evaluation of the alternatives.

Eight criteria were established that best provide a basis for alternative comparison. They are as follows: (1) Safety, (2) Cost, (3) Schedule, (4) Portability, (5) Waste Stream, (6) Operability/Maintainability, (7) Liquid Waste Disposal Acceptance Criteria, and (8) Program Integration.

1. **Safety** was defined as mission and property protection. This includes worker and environmental protection, public safety and a comparison of associated hazards during construction, maintenance, and operation.

2. **Costs** included capital costs, development costs, and life-cycle costs.

3. **Schedule** was defined as design, installation, start-up time, and impact on system or *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1994)

4. **Portability** included ease of equipment removal, following completion of RLWS deactivation activities. This includes the capability of the installed and modified equipment to be available for reuse in other deactivation programs or its ease of disposal as waste.

5. **Waste Stream** was identified as secondary waste generated from the operation of the selected system. An example of this waste stream includes the non-construction related wastes such as filters and ion exchange resins.

6. **Operability/Maintainability** includes preventive maintenance routines, exposure to the elements and complexity of the system from an operations and maintenance perspective.

7. **Liquid Waste Disposal Acceptance Criteria** considered the acceptability of the waste stream to on-site storage or treatment facilities. This included an assessment of any additional costs for treatment versus storage costs for the waste stream.

8. **Program Integration** considered a variety of interfaces within a specific project as well as interfaces among other projects included in the *324/327 Buildings Stabilization/Deactivation Project Management Plan* (HNF-IP-1289). The PMP includes plans and strategies that accomplish the 300 Area Stabilization Project mission within overall scope, cost, and schedule constraints.

6.1.2 Weighing of Selection Criteria

The selection criteria were weighted according to their degree of importance in determining the effectiveness of the alternatives and were assigned numerical values. The performance of each alternative was estimated with respect to each criterion. The performance level was judged as below average, average, or above average with a corresponding score of 1, 2, or 3, respectively. The weighted score is the product of each weighted criterion and the corresponding performance level score. The total score of each alternative is the summation of these products. The specific weight for each alternative was derived from a discussion among personnel involved in this study. The corresponding weight factors are shown in Section 7.0, Table 3.

6.2 ALTERNATIVES

Alternatives 1 and 2 closely match the preferred alternatives discussed in earlier studies. Both alternatives utilize the LR-56 tank trailer system for transporting the waste from the 327 Facility to the 200 Area Tank Farms. The difference between Alternatives 1 and 2 center around the location of the load-out station. However, as previously discussed, the reduction of the anticipated waste volume predicates the need for further consideration of the alternatives. Alternative 3 is a new alternative, not discussed in the previous studies, providing an approach to handling the changed waste volume criteria.

6.2.1 Alternative 1 -- Direct Disposal Using the Facility Truck Bay

Alternative 1 modifies the RLWS header, installs three 400 gallon batch tank(s), and install a pump and transfer (piping) from the batch tanks to the truck bay for load-out into a LR-56 tank trailer. Alternative 1 also modifies the truck bay to accommodate load-out to the LR-56 tank trailer. A LR-56 tanker trailer will be used to handle the estimated average and maximum activity of the waste stream. The LR-56 tanker trailer allows the RLW to be transported without any treatment. All work would be performed in radioactive control areas (RCA). Approximately three loads of the LR-56 tanker trailer would be required to remove the facility inventory. The specifics of this alternative are listed below:

- Deactivate the RLWS feed to the 340 Facility by capping the RLWS header in the basement. This is to be accomplished at an existing flange at the header's low point.

- A 1000 gallon capacity batch tank system is required. Due to size limitations within the basement, a single shielded 1000 gallon tank cannot be installed. Therefore, three shielded 400 gallon tanks will be installed in the basement near the RLWS header low point.

- Install a pump and piping system to transfer the radioactive liquid waste from the batch tanks to the load-out station, located in the truck bay.
- Modify the truck bay to facilitate load-out activities. The modifications would include construction of a load-out station with the LR-56 tank trailer compatible connections; installation of remote monitoring and control for the batch tank pumping operations.

6.2.2 Alternative 2 -- Direct Disposal with loadout station on SE corner of facility

Alternative 2 is similar to Alternative 1 except for the location of the load-out station. Alternative 2 will locate the load-out station on the exterior southeast corner of the facility.

Alternative 2 modifies the RLWS header, installs three 400 gallon batch tank(s), and installs a pump and transfer (piping) from the batch tanks to the truck bay for load-out into a LR-56 tank trailer. Construction of a load station is required to accommodate load-out to the LR-56 tank trailer. A LR-56 tanker trailer will be used to handle the estimated average and maximum activity of the waste stream. The LR-56 tanker trailer allows the RLW to be transported without any treatment. All work would be performed in radioactive control areas (RCA). Approximately three loads of the LR-56 tanker trailer would be required to remove the facility inventory. The specifics of this alternative are listed below:

- Deactivate the RLWS feed to the 340 Facility by capping the RLWS header in the basement. This is to be accomplished at an existing flange at the header's low point.
- A 1000 gallon capacity batch tank system is required. Due to size limitations within the basement, a single shielded 1000 gallon tank cannot be installed. Therefore, three shielded 400 gallon tanks will be installed in the basement near the RLWS header low point.
- Install a pump and piping system to transfer the RLW from the batch tanks to the load-out station, located on the southeast corner of the facility.
- Construct a load-out station on the exterior southeast corner of the facility. The new load-out station would include LR-56 tank trailer compatible connections; remote monitoring and control for the batch tank pumping operations; platforms; piping; spill containment barriers; and associated hardware to support the free standing load-out station.

6.2.3 Alternative 3 -- Pretreat Wastewater and Dispose Via Drum

Alternative 3 installs a vendor supplied treatment skid consisting of disposable filters and ion exchange columns at the southeast corner of the 327 Facility basement. Radioactive liquid waste is then collected in a temporarily shielded 300 gallon staging tank. Once the staging tank is full, the vendor supplied treatment skid would remove the radioactive cesium, barium, and strontium, then load the treated liquid waste into 55 gallon drums. The pretreated radioactive waste will allow for contact handling of the drums. Filled drums are then transported to the 324 Facility or another on-site facility and transferred from the drums to a designated liquid waste handling facility. The RLW will eventually be transferred to the 200 Area Tank Farms. The specifics of this alternative are listed below:

- Deactivate the RLWS feed to the 340 Facility by capping the RLWS header in the basement. This is to be accomplished at an existing flange at the header's low point.

- A 300 gallon capacity batch tank system is required. Size limitations within the basement will allow the installation of a single temporarily shielded 300 gallon tank near the RLWS header low point.

- Install a piping system to transfer the radioactive liquid waste from the batch tank to the vendor supplied treatment skid.

- Procure and install a vendor supplied treatment skid. From discussions with the vendors and past experience in similar applications, it is anticipated that the skid will include disposable filters and ion exchange columns that remove radioactive Cs-137, Ba-137m, and Sr-90. The treatment skid will reduce the RLW activity levels to contact handled levels. This would require the radioactive liquid waste to be processed from .026 Ci/l (average) to a level of 0.00012 Ci/l (average). The skid will also pump the treated radioactive liquid waste to a 55 gallon drum. The skid will be operated by a control panel located on or near the skid.

- Filled 55 gallon drums are transported to the 324 Facility and transferred from the drums to designated tanks for storage prior to transfer to tank farms.

6.2.4 Alternative 4 -- No Action Alternative

The 327 Facility will require a method to collect and disposition RLW. Therefore, the no action alternative is not viable and was screened from evaluation.

7.0 DISCUSSION OF PREFERRED ALTERNATIVE/SOLUTION

Alternatives 1, 2, and 3 were compared against the decision criteria based on a discussion among personnel involved in the study. The results of the comparison are listed below and are summarized in Table 3. The preferred alternative is Alternative 3. Alternative 4 was not analyzed because it was screened out as not viable.

7.1 SAFETY

Based on a comparison of the overall safety between the systems, ALARA became the primary factor in determining the individual ranking. Alternative 1 and 2 would increase the risk of exposure due to the high field strength which could be associated with the wastewater. Without treatment the wastewater could range in field strength from 100 - 500 Rem/hr. This could cause problems during both truck loading and unloading. Shielding would have to be extensive and include all transfer piping and may not be feasible during off loading at 204-AR. Also, in a case of an unplanned release the risk of an off-site exposure would be much greater with the untreated waste water. Treatment of the water in the 327 Facility basement would mitigate the possibility of an off-site release and would limit the shielding requirements to only the collection tank and treatment skid. The concentrated radionuclides in the skid would require only periodic change out and decrease the overall exposure and risk potential. *For these reasons, a performance score of 2 is assigned to Alternatives 1 and 2. Alternative 3 includes a pretreatment process that will reduce the dose rate of the waste water thereby decreasing the risk of exposure. Subsequently, Alternative 3 was assigned a performance score of 3.*

7.2 COSTS

A preliminary cost estimate was performed on each alternative. Based on truck load-out stations existing or under construction the costs range from $500,000 - $1,000,000 depending on the amount of facility modifications required. This does not include any treatment of the waste water prior to load-out to the truck tanker. Alternative 1, which utilizes the existing truck bay and would require no modifications to the building structure, is estimated to be in the $500,000 range for direct construction costs. Alternative 2, which would require a load-out pad, secondary containment, and exterior load-out platform, is estimated to be in the $750,000 range for direct construction costs. Alternative 3, which includes on-site treatment and drum load-out, is estimated to be in the range of $350,000 direct construction costs. *Based on the estimated preliminary costs, Alternatives 1, 2, and 3 were assigned a performance score of 2, 1, and 3, respectively.*

7.3 SCHEDULE

Each alternative can be completed to support the current planning basis schedule. Therefore a performance score of 2 was assigned to each alternative.

7.4 PORTABILITY

The 300 Area Stabilization Project consists of more than one facility. Reuse of the equipment within the project is desirable. Alternatives 1 and 2 do not lend themselves to reuse and would substantially support only the 327 Facility deactivation. However, Alternative 2 being located outside the facility would lend itself for partial reuse. Alternative 3, could more easily be removed and reused within other facilities in the Project and also on the Hanford Site. *Therefore, Alternative 1 was assigned a score of 1; Alternative 2, a score of 2; and Alternative 3, a score of 3.*

7.5 WASTE STREAM

Alternatives 1 and 2 would produce no secondary waste. Alternative 3 would produce approximately 8 shielded drums of category 3 low level waste which would require disposal. This waste consists of filters and ion exchange resins. *For these reasons, Alternatives 1 and 2 were assigned a score of 3 and Alternative 3, a score of 1.*

7.6 OPERABILITY/MAINTAINABILITY

Alternative 2 would require the highest degree of Operation and Maintenance support. Being outside of the facility freeze protection and climatic issues would be of more concern. Also the remote location would require a higher degree of surveillance and remote monitoring for load-out operations. Alternative 2, being enclosed in the facility would not have the weather related issues but would require a higher degree of remote monitoring due to the distance of the truck load-out station from the RLWS header. Alternative 3 would be operated locally and would be substantially simpler to maintain and operate. Filter and ion exchange column change out is required and would add to the maintenance of this alternative. *Based on the above criteria the scoring was: Alternative 3, a score of 2, Alternative 1, a score of 2, and Alternative 2, a score of 1.*

7.7 LIQUID WASTE DISPOSAL ACCEPTANCE CRITERIA

Acceptance of the waste generated by the decontamination activities by the other on-site Treatment, Storage and Disposal facilities is a critical part of the final closure of the facility. By providing on-site treatment waste acceptance by the other facilities is more likely (Alternative 3). No treatment, Alternatives 1 and 2, places more risk to the program that the waste stream may not be accepted by the other on-site facilities. *Therefore, Alternatives 1 and 2 were asigned a score of 2, and Alternative 3 was assigned a score of 3.*

7.8 PROGRAM INTEGRATION

All alternatives support the 300 Area Deactivation Project and would achieve the project goals. Alternative 3, would lend itself for relocation and could more readily support other project areas. *However, all alternatives were rated equally, a 2.*

Table 3. Evaluation Criteria Results.

Evaluation Criterion	Weight	Alternative 1 Truck Bay		Alternative 2 Load-Out Station		Alternative 3 Pretreat/Drums	
		Performance Score	Weighted Score	Performance Score	Weighted Score	Performance Score	Weighted Score
Safety	0.2	2	0.40	2	0.40	3	0.60
Cost	0.15	2	0.30	1	0.15	3	0.45
Schedule	0.1	2	0.20	2	0.20	2	0.20
Portability	0.15	1	0.15	2	0.30	3	0.45
Waste Stream	0.1	3	0.30	3	0.30	1	0.10
O&M	0.05	2	0.10	1	0.05	2	0.10
Waste Acceptance Criteria	0.1	2	0.20	2	0.20	3	0.30
Program Integration	0.15	2	0.30	2	0.30	2	0.30
Total	1.00	Score	1.95	Score	1.90	Score	2.50

Scoring
1 - Below average
2 - Average
3 - Above average

8.0 CONCEPTUAL COST AND ESTIMATE

8.1 PROJECT SCOPE

As selected in the alternatives analysis, the on-site treatment and drummed disposal option is preferred. This option will be described in detail and a conceptual design and estimate is attached. The effort will consist of piping removal and modification, installation of a collection tank, installation of a vendor supplied treatment skid, installation of a drum loading station and minor electrical modifications.

8.1.1 Piping Modifications

The existing RLWS and RPS drain headers will be used, including the sump on the west end of the basement, to collect and direct the flush water from the hot cells and other points of origin to the collection tank and vendor supplied treatment skid. The fact that the existing RLWS line is lead shielded makes this line even more desirable for this operation. Tie in for the new equipment will occur at the point where the existing RPS and RLW systems join and the line exits the building to connect to the 300 Area RLWS. The existing RPS diverter will be tied into the new system to continue to provide diversion capability as required. New stainless steel piping will be added to divert water from the header to a 300 gallon collection tank.

8.1.2 Collection Tank

The collection tank is sized to contain the projected volume of flush water from most of the cells. Space limitations within the basement does not make it feasible to contain 100% of the flush water from each individual source. It is anticipated that a series of flushes for the larger areas will be required and that the 300 gallons will be sufficient to handle each flush. The tank will be stainless steel and vented to the basement through HEPA filters. The tank will have capability to be rinsed a will be equipped with a spray header. The tank will gravity drain from the bottom to a vendor supplied treatment skid. The tank will be equipped with level indicationand overfill protection. Shielding of the tank will be provided by temporary shielding blankets.

8.1.3 Vendor Supplied Treatment Skid

A vendor supplied treatment skid will provide the removal of radionuclides allowing the drummed waste water to be contact handled. The skid is anticipated to consist of filtration and ion exchange columns. The treatment skid will provide all pumping required to draw waste water from the collection tank and drum fill operation. The skid will also incorporate dripless construction and drip containment. The expected rate at which the skid will process waste water is 1 gpm. This allows treatment of the entire content of the collection tank in one shift and also minimizes the size requirements of the skid. The skid will be designed to allow simple removal and installation of filters and columns when they become plugged or when radiation field strength exceeds a set value. Shielding will be provided on areas where radionuclide concentration is expected, filters and ion exchange columns. The changeout process for the filters and ion exchange columns is anticipated to be a quick disconnect operation of the vessel from the skid and disposal of the vessel into shielded drums using temporary shielding.

8.1.4 Drum Load Station

A two drum load station will be provided. The system will switch fill from the first drum to the second automatically. The drum load station will also be provided with a decontaminatible spill protection deck. Drums will be manually removed from the basement by hand operated truck or pallet.

8.1.5 Electrical Modifications

Pump and control power will be extended from the existing switchgear. Local disconnect(s) and distribution panel(s) will be provided as necessary to power the skid and controls.

8.2 PERMITTING AND DOCUMENTATION

The 327 Facility currently is not permitted under Resource Conservation and Recovery Act (RCRA). Compliance to RCRA requirements only apply to the facility as a generator. It is assumed that the waste streams created from the flushing activities are not a dangerous waste under Washington State Administrative Codes (WAC) 173-303. The 327 Facility is permitted under the National Emission Standards for Hazardous Air Pollutants (NESHAPs) program and is considered a major stack.

8.2.1 NEPA

It is assumed that this effort will be performed under a NEPA Categorical Exclusion (CX). No other NEPA documentation will be required.

8.2.2 Air Permitting

A Notice of Construction under NESHAPs program will be required for this effort. It is assumed that this effort will require six months to complete.

8.3 SAFETY DOCUMENTATION

All facility modifications will require an Unreviewed Safety Question (USQ) evaluation. If determined by the USQ evaluation that modification to the safety basis is required an addendum to the Safety Analysis Report (SAR) will be completed. It is assumed that this effort will not require modifications to the safety basis or documentation.

8.4 QUALITY ASSURANCE

Project specific quality assurance requirements will be described in a PMP developed for these modifications. The governing Quality Assurance Program Plan (QAPP) (HNF-SD-SPJ-QAPP-002 Rev.1) will be used to develop these requirements. The quality requirements will be defined during detailed design and use a graded approach for setting Quality Assurance (QA) approval levels. The conceptual estimate for construction is based on industrial codes and standards. No safety class equipment or components are anticipated for this effort.

9.0 REFERENCES

BWHC 1997, *300 Area Waste Option Study*, B&W Hanford Company, Richland Washington

Parsons 1997a, *Modifications to Radioactive Liquid Waste Handling Systems for 324 and 327 Facilities*, Parsons Infrastructure and Technology Group, Inc., Richland, Washington.

HNF-IP-1000, *Waste Acceptance Criteria for the 300 Area Process Sewer and Treated Effluent Disposal Facility*,B&W Hanford Corporation, Richland, Washington.

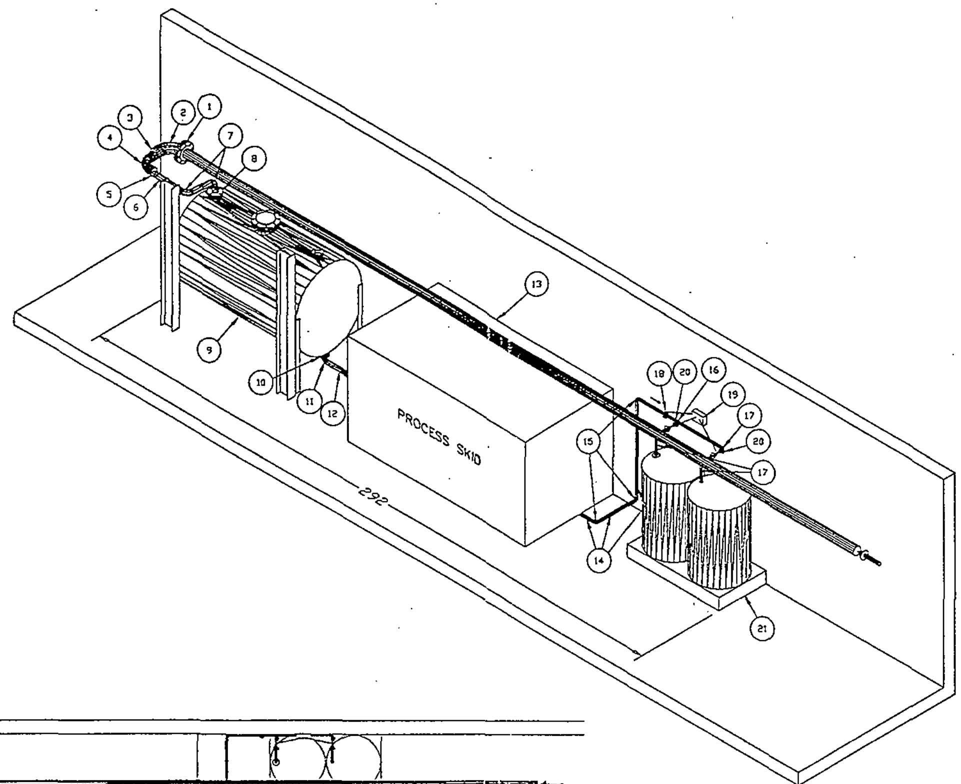
WMH 1997, *LERF/ETF Treatability Envelope,* Waste Management Federal Services of Hanford, Richland, Washington

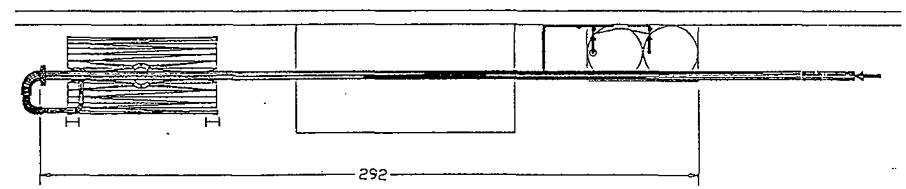
WHC-SD-WM-EV-053 *Double Shell Tank Waste Analysis Plan,* Westinghouse Hanford Company, Richland, Washington.

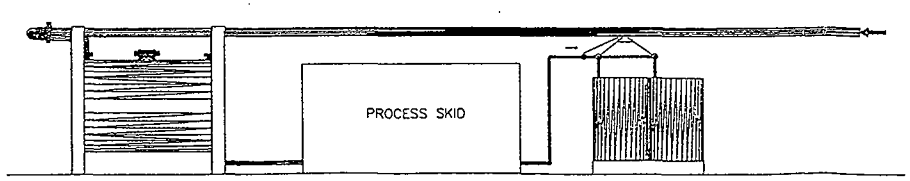
HNF-IP-1289, *324/327 Buildings Stabilization/Deactivation Project Management Plan,* B&W Hanford Corporation, Richland, Washington.

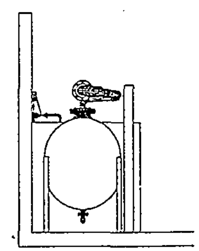
Supplemental Data A

Project Plan Conceptual Design









PARTS/MATERIAL LIST

QTY REQD -002	QTY REQD -001	DASH NUMBER	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	SHEET	ITEM NO.
	1		FLANGE, 4", 150# SLIP-ON, RAISED FACE	UNKNOWN	1	1
	1		ELBOW, LONG RADIUS, 4", SCHED. 40S	UNKNOWN	1	2
	1		REDUCER, ECCENTRIC, 4"x 3", SCHED. 40S	UNKNOWN	1	3
	1		ELBOW, LONG RADIUS, 3", SCHED. 40S	UNKNOWN	1	4
	1		REDUCER, ECCENTRIC, 3"x 2", SCHED. 40S	UNKNOWN	1	5
	AR		PIPE, SCHED. 40S, 2"x AR	UNKNOWN	1	6
	2		ELBOW, LONG RADIUS, 2", SCHED. 40S	UNKNOWN	1	7
	1		FLANGE, 2" 150# SLIP-ON, RAISED FACE	UNKNOWN	1	8
	1	-001	SST TANK, 317 GAL.	UNKNOWN	2	9
	1		FLANGE, 1-1/2" 150# SLIP-ON, RAISED FACE	UNKNOWN	1	10
	1		ELBOW, LONG RADIUS, 1-1/2", SCHED. 40S	UNKNOWN	1	11
	AR		PIPE, SCHED. 40S, 1-1/2"x AR	UNKNOWN	1	12
	1	-002	FILTER STATION	UNKNOWN	1	13
	AR		PIPE, SCHED. 40S, 1"x AR	UNKNOWN	1	14
	6		ELBOW, LONG RADIUS, 1", SCHED. 40S	UNKNOWN	1	15
	1		TEE, 1", SCHED. 40S	UNKNOWN	1	16
	AR		FLEXIBLE HOSE, 1"	UNKNOWN	1	17
	1		FLOW ELEMENT	OMEGA MODEL # FP-075P	1	18
	1		FLOW TRANSMITTER/TOTALIZER	OMEGA MODEL # DFP-77	1	19
	2		SOLENOID VALVES, 1", 120V AC, <10 AMPS	OMEGA MODEL #	1	20
	1		ULTRA SPILL DECK, 2 DRUM, POLYETHYLENE	LAB SAFETY SUPPLY	1	21
						22

DWG NO	TITLE	REF NUMBER	TITLE
DRAWING TRACEABILITY LIST		NEXT USED ON	REFERENCES

REVISIONS

CADFILE | CADCODE

BT BECKER

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
B&W HANFORD COMPANY

327 RLWS FILTRATION STATION

PARSONS I & T, INC

SHOWN

SHEET 1 OF 2

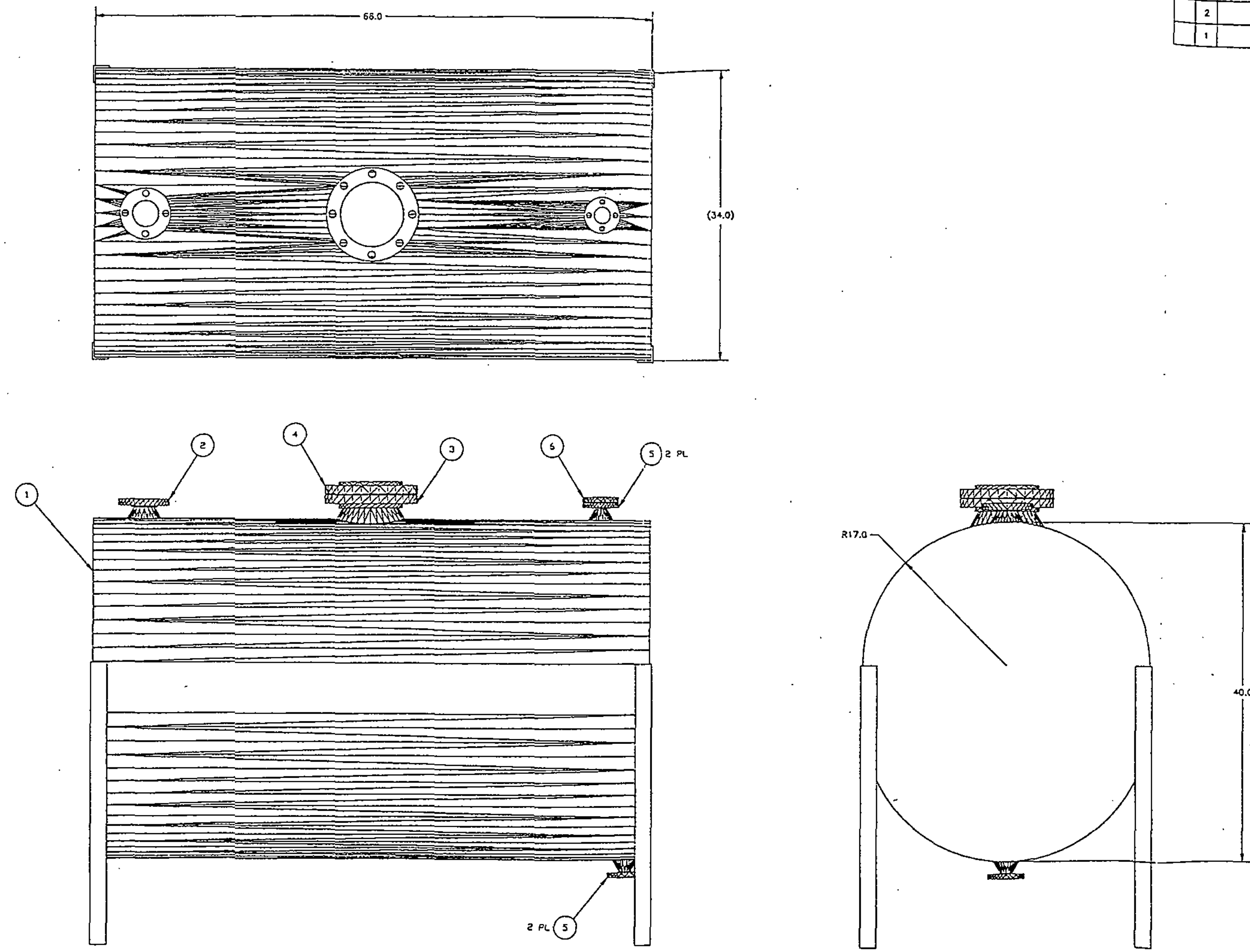
0

PLOT SCALE: 1=1

GTITLE.DWG (10/96)

PARTS/MATERIAL LIST

QTY REQD -020	QTY REQD -010	DASH NUMBER	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	SHEET	ITEM NO.
	X	-010	SST TANK		1	1
	1		FLANGE, 150# WELD NECK, 2" RAISED FACE		2	2
	1		FLANGE, 150# WELD NECK, 6" RAISED FACE		2	3
	1		FLANGE, 150# BLIND, 6" RAISED FACE		2	4
	2		FLANGE, 150# WELD NECK, 1-1/2" RAISED FACE		2	5
	1		FLANGE, 150# BLIND, 1-1/2" RAISED FACE		2	6



BT BECKER

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
B&W HANFORD COMPANY

327 RLWS FILTRATION STATION

PARSONS I & T, INC.

SCALE SHOWN

REV 0

SHEET 2 OF 2

DWG NO | TITLE | REF NUMBER | TITLE
DRAWING TRACEABILITY LIST | NEXT USED ON | REFERENCES | REVISIONS

CADFILE | CADCODE

PLOT SCALE: 1=1

GTITLE.DWG (10/96)

Supplemental Data B

Project Plan Conceptual Design and Construction Estimate

Conceptual Estimate 327 RLWS Drum Loadout Sysem

	Units	Material Unit Price	Material Total Price	Labor Unit Price	Labor Total Price [1]	
Design	25% of Construction estimate					84383.67
Piping						
SS piping						
2" SS Sched 40	10	1329.00	1329.00	172.26	516.78	
1 1/2" SS Sched 40	10	1037.00	1037.00	159.99	479.97	
1" SS Sched 40	20	700.00	700.00	130.50	391.50	
1" SS Flex	20	400.00	400.00	200.00	600.00	
SS fittings						
Flange 4"	1	431.00	431.00	73.08	219.24	
LR Elbow 4"	1	100.00	100.00	161.82	485.46	
Reduce 4"-3"	1	36.00	36.00	140.92	422.76	
LR Elbow 3"	1	56.00	56.00	120.06	360.18	
Reduce 3"-2"	1	33.00	33.00	104.40	313.20	
LR Elbow 2"	2	20.00	40.00	88.74	532.44	
Flange 2"	1	165.00	165.00	39.15	117.45	
Flange 1 1/2"	1	150.00	150.00	36.54	109.62	
LR Elbow 1 1/2"	1	15.00	15.00	78.30	234.90	
LR Elbow 1"	6	12.00	72.00	73.08	1315.44	
Tee 1"	1	35.00	35.00	109.62	328.86	
nipples	4	200.00	800.00	62.25	747.00	
sockolet	4	76.16	304.64	62.25	747.00	
Flange 1"	2	90.00	180.00	33.93	203.58	
Tank - 300 gal Stainless Steel w/ spray and level indication	1	8000.00	8000.00	10400.00	10400.00	
Vendor Supplied Treatment Skid						
1 gpm packaged skid 4man crew 1 week	1	192500.00	192500.00	10400.00	10400.00	
Drum Loadout						
Solenoid Valves	2	1640.00	3280.00	62.64	375.84	
Flow Element	1	295.00	295.00	78.30	234.90	
Flow Totalizer	1	215.00	215.00	113.50	340.50	
Ultra Spill Deck 2 drum w/ramp	1	640.00	640.00	1660.00	1660.00	
Drum Pump	1	946.60	946.60		0.00	
Electrical						
Cabling						
#3 4 wire 130ft	520	27.43	142.64	43.86	684.22	
#6 4 wire 50 ft	200	13.64	27.28	28.38	170.28	
#10 4 wire 100 ft	400	6.02	24.08	18.06	216.72	
Conduit & Fittings						
1 1/4" Rigid Conduit	130	151.32	196.72	110.94	432.67	
3/4" Rigid Conduit	150	82.35	123.53	110.94	499.23	
Elbow 1 1/4	5	7.18	35.90	5.16	77.40	
elbow 3/4	16	3.76	60.16	3.87	185.76	
Boxes	6	0.72	4.32	3.87	69.66	
Breakers						

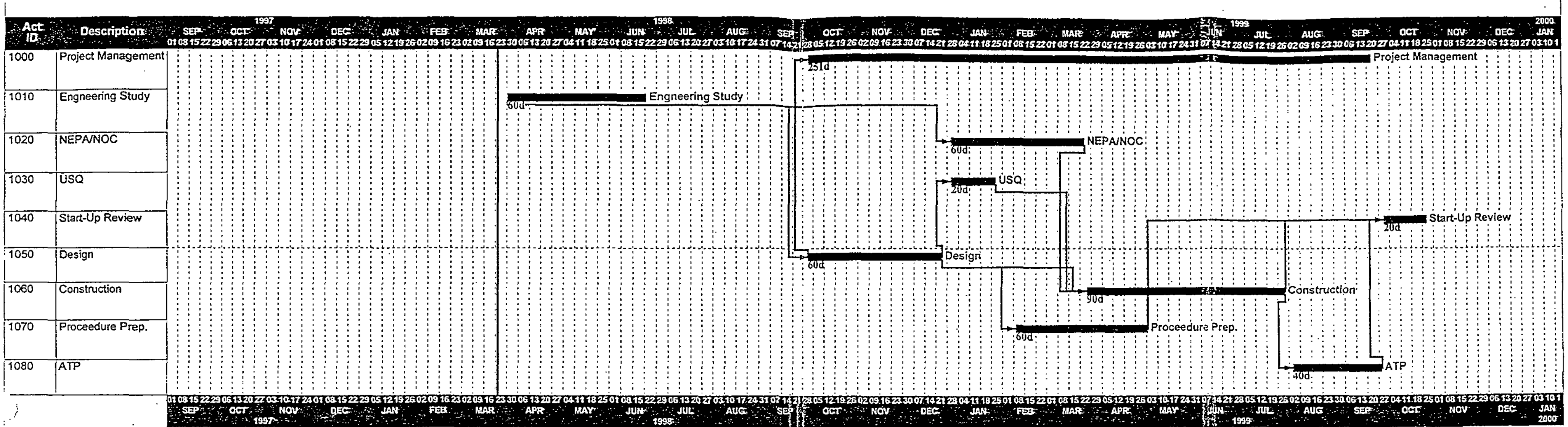
Diconnect	1	98.12	98.12	51.60	154.80	
Distribuition Panel	1	431.03	431.03	234.78	704.34	
Waste Disposal						
7 ft^3 (9.2 ft^3 x $11.51/ft^3) Waste Disposal		106.00	160.00		480.00	
Drum	1	150.00	150.00			
			209748.01		35211.69	
MPR 7.0%			14682.36			
Contigency 30%			67329.11		10563.51	
Total			291759.48		45775.20	421918.35

1 Estimated labor unit rate has been multiplied by three to account radiation work and building operation interface
2 Hourly rate for facility personnel is $50/hr Bargaining unit, $60/hr Exempt, $35/hr non-exempt
3 Crew size consists of 4 bargaining units and 1 exempt
4 Treatment skid is assumed to require 110v 60amp service and 110v 15 amp control power.

Supplemental Data C

Project Plan Schedule

327 RLWS MODS



DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	324 Subproject Projects	Date 7/28/98
Project Title/Work Order		EDT No. 623064
327 Building Liquid Waste Handling Options Modification Project Plan		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
EJ Bitten	L1-02	X			
TL Erickson	L1-03	X			
JE Ham	L1-06	X			
RL Hobart	L5-65	X			
DL Johnson	L1-05	X			
RM Millikin	L5-65	X			
SA Norling	L6-57	X			
DE Rasmussen	L1-04	X			
DH Sandoz	L1-06	X			
RW Stevens	L1-03	X			
Central Files	B1-07	X			