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Sample Storage/Disposal Study

September 29, 1994

Prepared by
Blandina D. Valenzuela

MASTER

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1.0 INTRODUCTION

Radioactive waste from defense operations has accumulated at the Hanford Site's underground waste tanks since the late 1940's. Each tank must be analyzed to determine whether it presents any harm to the workers at the Hanford Site, the public or the environment. Analyses of the waste aids in the decision making process in preparation of future tank waste stabilization procedures. Characterization of the 177 waste tanks on the Hanford Site will produce a large amount of archived material. This also brings up concerns as to how the excess waste tank sample material from 325 and 222-S Analytical Laboratories will be handled. Methods to archive and/or dispose of the waste have been implemented into the 222-S and 325 Laboratory procedures. As the amount of waste characterized from laboratory analysis grows, an examination of whether the waste disposal system will be able to compensate for this increase in the amount of waste needs to be examined. Therefore, the need to find the safest, most economically sound method of waste storage/disposal is important.

1.1 SCOPE

The scope of this report will include examination of storage containers, archiving requirements, costs for various scenarios, criteria for transportation including shipping containers, storage locations and implementation schedules. Considerations also include the examination of the waste disposal/storage system currently in use, define problems which arise, and recommendation on changes to improve the system. The scope of this report will not include purchase of materials to implement the recommendation.

1.2 SUMMARY

This document reviews the storage containers, storage facilities, and disposal of excess tank sample waste. The storage containers used presently are borosilicate glass vials that allow gas venting as well as some which are gas tight. This document offers some recommendations to vials made of different types material. The storage facilities for archiving are presently the hot cells within the respective laboratories. This document summarizes the archiving requirement for the various programs and compares this to the present laboratory capabilities. Building new facilities for archiving appear to be an expensive venture and would not be available when the need is strongest. The disposal of excess tank sample material is written into 222-S and 325 Laboratory approved procedures. The approach to disposing of sample material is suitable both economically and spatially for the next couple of years, however, further into the future this storage/disposal study must be reviewed again to determine whether disposal is adequate.

2.0 ARCHIVING CONTAINERS

As the characterization of tank waste has developed, attention has been given to sample archiving. A great expense is taken to retrieve samples from each tank for characterization. Retaining a fraction of the waste may negate the need for additional core sampling in the future. To properly preserve the archived sample, certain concerns must first be investigated. A primary concern is the type of storage container to use. Presently, a borosilicate glass container was used to archive tank waste samples. Internal groups, however, expressed reservations about the composition of this container because it is believed sample contamination could result. In addition, external oversight committees expressed their apprehension with using borosilicate glass containers for the same reasons. Therefore, a decision was made to investigate which materials would be appropriate for fabrication of tank waste sample containers. This section has been developed from Strong (1993).

During the development of the archiving requirements (found in Section 3.0) a concern was raised about the material composition of an archiving container. The concern was the sample integrity could possibly be compromised, depending on the construction material of the container. Listed below are the fabrication material requirements for an acceptable archiving container.

- Non-leachability. Neither shall the archived sample be contaminated by the leaching of container fabrication materials nor shall the container absorb archived tank waste material.
- Container venting capability. Some of the tank waste is known to produce gases. The ability to vent containers of possible gas buildup is desired.
- Easily accessible archived sample. The container must allow rapid and easy access to archived samples.
- Compatible Geometry. The container geometry shall be compatible with existing practices at the 325 Analytical Chemistry and 222-S Laboratories. At the 222-S Laboratory, a double-stacked carousel was designed to maximize archiving storage space. At the 325 Analytical Chemistry Laboratory, archive shelving was designed to be compatible with its hot cells. Without satisfying this requirement, potentially high archiving costs could result.
- Cost. The container shall be fabricated at a reasonable cost. If at all possible, costly expenditures should be avoided.

2.1 CURRENT ARCHIVING VIALS

Previously, the archiving vials were plastic. This type of archiving vial was not suitable for storing the radioactive/hazardous tank waste, since it was found to degrade over time. When exposed to a radiation field for a long length of time the plastic containers were easily crushed or decayed upon touching.

Presently, borosilicate glass vials both with a rubber septum between the screw cap and the vial and without the rubber septum are used at the 222-S and 325 Laboratories. The rubber septum can be penetrated with a needle to vent the build-up of gas in the vial. This type of container is relatively inexpensive (\$1.75/container) and readily available from supply houses. However, concerns have been raised that boron and/or silica in borosilicate glass may contaminate the archived tank waste samples that are caustic in nature. It should also be noted that for trace analysis it is possible for the sample to leach (or lose) compounds and elements to the container. Additionally, the structural soundness of borosilicate glass in the presence of tank waste material is questionable. This material is not considered acceptable to scientist and engineers at Hanford and has been questioned by external oversight committees.

- Leaching will take place in both directions, depending on the sample makeup. Both boron and silica have the capability to leach into the sample while some metals in the sample will enter the glass of the vial.
- Used borosilicate glass containers with bakelite lids and polyethylene liners.
- The borosilicate containers are extremely hard to open if sample is left on the lip or threads of the vial.

2.2 ALTERNATIVE CONTAINERS

Several engineers and scientists at the Hanford Site have offered suggestions to other types of storage containers to hold tank waste.

Hastelloy¹ alloy C-22 (59Ni-22Cr-13Mo-3W-3Fe), is a nickel-based alloy (here after referred to as Hastelloy), that is known for its resistance to corrosive environments. Hastelloy provides excellent performance in oxidizing and reducing environments. This alloy has undergone more than 10,000 laboratory corrosion tests producing favorable results. Hastelloy can be easily fabricated to be compatible with the archiving double-stacked carousel, and can be acquired at a cost of \$30/container.

¹Hastelloy is a trademark of Stellite Rod Division, Stoodly Deloro Stellite Incorporated.

Polypropylene, Kynar², Teflon³, and stainless steel are other materials that have been considered to fabricate the tank core archiving containers. However, these materials were bypassed for a variety of reasons. Polypropylene does not retain structural soundness in a radiation environment. Kynar has uncertain corrosion resistance properties and also has uncertain fabrication requirements. Teflon may cause fluoride contamination of the sample which is undesirable. Stainless steel is not as corrosion resistant as Hastelloy, however, there is very little difference in the cost.

2.3 TRACKING SYSTEM

The tracking system for the archived sample material is presently visible labels and ink markings. These type of markings tend to fade when the glass darkens due to radiation. A sample archive bar-coding system is recommended to maintain control of the sample as required by the chain-of-custody. This system will allow identification of the sample, location, radiation level, rotation schedule for the sample, location, radiation level, rotation schedule for the sample to be composited when the sample has ended its archival life span. It is important to keep track of the schedule for rotation of the samples due to the laboratory's limited space when a sample is due to be removed from sample archiving and identified as waste, this type of system will be able to notify the system operator that the time for removal has been reached, give location and type of sample. Samples are not considered waste until after the archive period recommended when it has been offered to other interested programs and has been declared a waste by the customer (McVey 1994).

²Kynar is a trademark of Atochem North America, Incorporated.

³Teflon is a trademark of E. I. du Pont de Nemours & Company.

3.0 SAMPLE ARCHIVING

A requirement of the closure process and retrieval operations is the sampling and analysis of the ground water, subsurface soils and waste material to be processed for treatment. The sampling and analysis will provide a basis for the effectiveness of the closure process, establishment of background concentrations, characterization of storage sites requiring treatment and supporting the treatment activities. These samples require a holding period until the results of the analysis have been verified and approved. A portion of these samples may require a longer archiving period for purposes of further testing or for use in future development testing. This section offers requirements of TWRS and the respective effects on laboratory capacity. This section has been taken from McVey (1994).

3.1 PERCEIVED PROGRAM REQUIREMENTS

Waste Tank Safety Program:

Tank waste core samples are removed from the storage tanks using push mode or rotary mode (in the future) retrieval systems. A core sample consists of a number of 19 inch segments which corresponds to the amount of waste in the tank. These segments are broken down into subsegments and homogenized. Analyses are performed on each segment, subsegment, facie, etc. to determine background safety parameters. The cost to perform such an operation is costly and time consuming. Archiving of these samples will allow future analyses to be performed without repeating the costly and labor intensive retrieval of additional core samples (Bratzel 1994).

Pretreatment Technology:

Pretreatment technology's interest in sample archiving is a need to save larger samples, 300 grams or larger. In the future pretreatment plans on taking several one (1) and two (2) liter samples from specific storage tanks. Pretreatment Technology requests all samples be saved until the report of the analyses has been distributed and interested parties have had time to review and question the results. This group is still under development and more information will be added as their needs develop (Bratzel 1994). If a need to archive additional tank waste samples arises it will be specified in the tank characterization plan.

Vitrification Technology:

Previously, the need for archiving samples was not understood and was to be revisited later. Presently, the need for sample archiving is to have a representative sample from the tank and not a segment specific sample on which to perform developmental analyses. However, the needs of the group has not evolved completely, more information will be available afterward.

Process Technology:

Process Technology is also not aware of the analyses nor the amount of sample they require therefore the samples need to be held for some time (tentatively 1998), at which time the programs will be further along. It was noted their archiving needs did not require a segment specific sample to perform developmental tests only a representative sample from each tank.

Environmental Division:

Environmental Division has stated their program will require 1250 samples for hot archiving. Short-term retention of samples (i.e., < 1 year will be handled in temporary facilities.

Solid Waste Program:

Solid Waste Program's requirement needs for sample archiving may be treated low-level mixed waste (LLMW from WRAP 2A), when is scheduled to begin operation in the year 1999. They are considering archiving samples from WRAP 2A (possibly at the site) and will provide details as the sampling and archiving plans are developed. Solid Waste Program has anticipated archiving no more that 40 or 50 samples per year through the end of the program in 2030.

On occasions, each program will want more waste from a specific tank archived for future analysis. These tanks should be specified in the data quality objectives (DQO) which will be stated in the tank characterization plans (TCP's) for the particular tank.

The people from the programs listed above were contacted to define their requirements for archiving. The summary of the archiving requirements for the Tank Waste Remediation System division are as follows:

- The segments, subsegments, facie, stratification layers, and core composite material will be stored segregated for a period of eighteen (18) months.

- This 18 month time period incorporates twelve (12) months for the analysis of the samples by the laboratories, and the writing of a tank characterization report, and a six (6) month waiting period which will begin when the tank characterization report has been approved by WHC.
- After the six (6) month waiting period, if there is a sufficient amount of core composite material, i.e. 40 mL (~60 g), the segments, subsegments, facie, and stratification layers will be offered to any interested programs/organizations. If no interest is expressed by either the customer or the programs the segments, subsegments, facie, and stratification layers will be considered waste and disposed of accordingly.

If there is less than 40 ml (~60 g), the stored segments will be used to prepare a core composite. Approximately 100 ml core composite material will be stored in an archiving container.

- In either case, the tank core composites will be archived for a period of five (5) years, this time period will begin after the six month waiting period. The five years will allow programs/organizations to accurately define their needs.
- Grab and auger samples will be stored segregated for a period of six (6) months after data approval by the laboratory. The amount archived will be approximately 40 ml (~60 g). After the six month time period, the samples will be offered to any interested program/organizations. If no interest is expressed by either the customer or the programs the grab or auger samples will be considered waste and disposed of accordingly.

Again, if a programs archiving requirements deviate from this it will be specified in the tank specific TCP.

Using these requirements placed on the laboratory and comparing this with the sampling schedule a theoretical an estimate of 4000 archived samples is calculated. The question is whether the laboratories could accommodate archiving such a large amount of samples.

3.2 ALTERNATIVES:

Several alternatives have been suggested as to what to do with the archived samples.

3.2.1 Alternative 1 - Do Nothing

The "do nothing" option does not require any capital or expense funding. This option also does not address the need or requirement for archiving of samples. If a decision was made to return all of the samples to the customer and not archive samples beyond the normal period for verification of analyses and data approvals, no further modifications or new facilities would be required at the laboratories. This decision would place the responsibility onto the customers to provide archiving space or re-sample if further information or characterization is required by other agencies. This option may require more capital and/or expense funding to provide multiple facilities if all customers decided to archive rather than re-sample when required.

This alternative also increases the possibility of exposure to core sampling personnel if re-sampling is required. During the core sampling process, the core sampling personnel are exposed to tank waste chemical vapors, radiation, and liquid residues.

3.2.2 Alternative 2 - New Facility

A "new facility" would require the expenditure of capital and expense funds. A new facility would provide relief of the space crunch at the laboratories. It would free hot cell space which could be put to better use and provide an organized sample archive inventory control system which would provide the "chain of custody" required.

A Fiscal Year 1998 Line Item would provide a new facility no earlier than 2001. This does not provide the space when it is needed in 1997-2000. A General Plant Project is not an acceptable solution since it would not provide sufficient space as required in the time frame needed. Therefore, the cost of this option was not estimated.

3.2.3 Alternative 3 - Use Existing Facilities

This option would require the expenditure of expense funds to provide modifications to existing rooms or areas in existing facilities. Options that can be implemented are storage of samples in a shielded casks in room 2E, vial racks in hot cells which allows stacking or storage in "box" type containers in 222-S Facility. These options will provide archive storage space for 1,800 samples of the 40 ml size or 540 samples of the 100 ml size in the new hot cell space. This is sufficient to meet the requirements for archiving for the minimum funded case.

Use of hot cells at 324 building were not considered since the 325 building has sufficient storage capacity. The use of the 324 building would have required packaging and transportation of samples. The 324 building does however, have the potential for further storage for an additional 800 samples. The 325 facility is capable of handling approximately 1800 samples of the 40 ml size or 450 samples of the 100 ml size, which is sufficient to meet to requirements of the Waste Tank Characterization and HWVP programs for the minimum funded case.

3.2.4 Alternative 4 - Use Closed Facilities

The 202-S (REDOX) facility is conveniently located adjacent to the 222-S Analytical Laboratory. It is currently classified and managed as a retired facility. Use of this facility would require RL Authorization, modification of existing or development of safety documentation, and facility modifications which will require expense and possibly capital funding. Storing archive samples in the new fabricated shielding casks being proposed is anticipated to cost an estimated \$5.7M to implement.

The WESF facility has seven hot cells, which are either being used or plans are in place for their future use. Five of the cells are heavily contaminated with one of them currently being used for waste packaging. The other cells are scheduled to house the Truex Pilot Plant and Waste Form Certification.

The FMEF facility has numerous hot cells and archival facilities that have not been completed. Several programs are proposing utilization of these facilities. Included in these programs is the Department of Energy's proposal for a national TRU alpha analysis laboratory which will utilize the majority of the facility. Utilization of these premium cells for archival storage versus these other vital programs would be impractical. The FMEF facility Fuel and Assembly Storage Area provides another possible archival area. This area has the capability to store 301 fuel assemblies in seismically qualified storage and would be an ideal archival storage facility with some modifications to storage canisters for retrieval. Modifications to equipment, hot cells and/or storage areas would require capital funding.

3.2.5 Alternative 5 - Add On to Existing Facilities

Add on to Existing Facilities - 222-S: This option would require the utilization of expense and capital funds to support a General Plant Project or a Line Item. As discussed in option 5.3.2, a GPP or LI does not sufficiently support the storage requirements in the years needed, therefore this option was not evaluated.

3.2.6 Alternative 6 - Re-sampling vs. Archiving

It is estimated that to re-sample and analyze a tank would require approximately \$150,000 to \$1,000,000 depending on type of sample (Grab vs. tank core samples). To date re-sampling has not been required. As Low As Reasonably Achievable (ALARA) is more of a concern than cost. The process required to re-sample a tank requires breaching containment of the tank for a period of time. This exposes the tank farm crew to tank waste penetrating radiation, chemical vapors, and liquid residues. The use of archive samples may eliminate the requirement of re-sampling if another analysis is required.

PREFERRED ALTERNATIVE/SOLUTION

The preferred alternative is Alternative 3 which recommends the use of existing facilities. This alternative not only provides the required storage space, but does so for a expenditure of funds. The existing and new hot cells at 222-S can be modified to accept 40 ml and 100 ml bottles, and room 2E can be modified to accept storage canisters which can be stored on hooks on the walls. The 325 facilities can be modified, if required, to accept 40 ml and 100 ml bottle storage racks and storage casks which can be stored on the walls of the hot cells. Space for the samples which do not require hot cell storage shall be identified at these facilities. Purchase of storage racks for the hot cells and shelving for the storage room will be required. Also purchase of new sample containers will be required if a decision is made to change from the present glass container. Procedures for compositing the 40 ml samples into 100 ml will be required prior to June 1995 to assure proper implementation of TWRS recommendations. TWRS will be required to identify which samples are to be composited to make up the 100 ml composite sample.

3.3 ANALYTICAL LABORATORIES

3.3.1 222-S Laboratory

The 222-S Laboratory provides analytical services to the operating plants and programs at the Hanford site. As required by analytical methods, a portion of the samples are saved until the analytical data is verified and approved as acceptable. This time frame aries from several weeks to several months depending on the type and number of analyses performed on the samples and the data package required for verification. The 222-S facility was not designed to perform the function of sample archiving, but due to the new environmental reporting requirements, it has become essential to provide this service to its customers on a limited basis. This is being accomplished by dedication of hot cell space for hot samples and room 2E for storage of low level samples and shielded casks containing high level samples. It is estimated that approximately 34 percent of waste tank characterization samples analyzed in the 222-S facility can be stored in room 2E as low level samples. The remaining 66 percent will require high level storage.

TWRS has provided criteria for storage requirements for sample archiving of the tank waste samples (Bratzel 1994). TWRS will require storage of these samples in 40 ml containers for a period of 18 months (or six months after TCR approval) for the majority of their samples and then they will be composited into 100 ml containers for a period of five years. An option of an additional 5 years may be requested for certain composites if the Pretreatment and Retrieval process is still undefined at the end of the storage period.

Room 2E is located on the main floor of the 222-S facility on the north side of the building. It is approximately 160 square feet in area and contains shelving. Fifty percent of the shelving has been identified for other programs and will not be available for sample archiving of Waste Tank Characterization samples or HWVP samples. Low level (less than 100 mR/L) samples will be stored in cans, with five 40 ml samples per can. Samples that are less than 200 mr/hr can also be stored in these containers since the majority of the samples have beta activity and the can offers sufficient shielding to reduce the levels to < 100 mr/hr. Nine of these storage cans can be stored on one square foot of shelf space and there are eight shelves in room 2E. This configuration will allow storage for 1,440 low level 40 ml samples or 360 samples of 100 ml size.

Existing hot cells are used to store high level (greater than 100 mR/L) samples. Currently there is space for 164 samples of 250 ml size in the existing hot cells in sample racks. This space is made up of a rack for fifty six (56) 250 ml bottles and eight feet of hot cell space with capacity for forty eight (48) 250 ml bottles, and 30 shielded casks which can store two 250 ml bottles each.

A 40 ml bottle holds approximately three times the material required for a complete laboratory re-analysis. These samples will be stored for approximately 18 months before being placed in a 100-125 ml bottle with other samples as determined by TWRS customer.

The 222-S Facility presently is using 120 storage containers with 60 dedicated for archiving needs. A container will hold approximately 30 samples of the 40 ml size and 9 samples of the 125 ml size. The total calculated capacity is 3,600 samples of the 40 ml size or a total of 1,080 of the 100 ml size.

For the minimum case in quarter 11 (Figure 3-1), 889 samples of the 40 ml size and 48 samples of the 100 ml size is required. These containers have the capacity to store all the samples with approximately 51% reserve space available for the 40 ml samples. In quarter 19 (Figure 3-1) when the 100 ml are at their maximum of 420 samples, there is approximately 22% reserve space. At quarter 19 there are no 40 ml samples being archive.

Under the maximum case (Figure 3-2), which is not funded, quarter 12 the 40 ml containers are at their maximum of 1314 samples and the 100 ml containers are only 53 samples. The capacity can still be met with the existing storage containers. A reserve

capacity of approximately 27% for the 40 ml samples would be available. During quarter 27 the 40 ml samples would be 24 and the 100 ml samples would be 751 and the reserve capacity would be exceeded. These reserve capacities are calculated using only 60 of the 120 available storage containers. If conditions existed that would require additional capacity, the 222-S facility would have the capacity to meet these needs up to an additional 50% reserve. This is not an ideal situation, but the containers could be made available as operational needs are justified. If the containers were not available other options could be quickly implemented, such as not compositing the 40 ml samples until space is available.

Table 3-1. 222-S Laboratory Archiving Capabilities

222-S LABORATORY				
	MINIMUM		MAXIMUM	
	40 ML	100 ML	40 ML	100 ML
Capacity	1800	540	1800	540
Demand	889	420	1314	751
% Remaining	51%	22%	27%	(28%)

Shielded casks are used for samples greater than 100 mR/L and can be stored in room 2E. A proposal to accommodate shielded casks in room 2E will provide space for 30 casks. Each cask can handle 10 containers of 40 ml samples, which will allow storage capability for 300 samples. This space of 300 samples is estimated as total contingency. It is estimated that the total available sample storage space for hot and cold samples, using the 40 ml samples, is 2640 total capacity. Buildings are being considered for additional storage space which may free up areas within the facility for storage of samples less than 100 mr/hr.

FIGURE 3-1. Sample Archiving at 222-S Laboratory (Minimum Case)

Calculations based on recommended archive schedule
for Tank Waste Characterization samples (Section 3.1).

Figure 3-2. Sample Archiving at 222-S Laboratory (Maximum Case)

Calculations based on recommended archive schedule
for Tank Waste Characterization samples (Section 3.1)

3.3.2 Pacific Northwest Laboratory - 325 Building

The Pacific Northwest Laboratory (PNL) provides laboratory services to a variety of customers at the Hanford site. Presently PNL is providing services to the Tank Waste Characterization Program (Memorandum of Understanding Between the Pacific Northwest Laboratory (PNL) and Westinghouse Hanford Company (WHC) on 325 Laboratory Operations in Support of Hanford Site Tank Waste Characterization Activities, March 10, 1992), Environmental Restoration and the Process Development Program. There are two independent hot cell facilities in the 325 Building. The High Level Radiation Facility (HLRF), or otherwise known as "A" hot cells, and the Shielded Analytical Laboratory (SAL) or "B" hot cells. The HLRF conducts both R&D and performs analytical services whereas the SAL conducts only analytical services for the Waste Tank Characterization Program.

Samples for the Tank Waste Characterization Program are currently being stored in 250 ml borosilicate containers. Four of these containers can be placed in a stainless steel canister which is then placed in the 325 Hot Cell facility. These hot cell facilities are capable of currently storing 45 canisters on the walls. There are six cells in the 325 Building that could potentially be used for tank sample archival. There are an additional four walls that rack systems could be installed which will increase the capacity to 180 additional canisters on the remaining walls. These additional walls could impact operations and will only be considered on an as needed basis due to the effective usage of the hot cells.

The 325 HLRF is simulating a laboratory scale Pretreatment Plant process and conducting process development work for the HWVP facility which is referred to as Radioactive Process and Products Laboratory Testing (RPPLT). This work requires the composition of tank waste segments. Core composite material is used for HWVP process development, which effectively reduces the number of tank waste samples required for storage by HWVP. HWVP Technology is requiring the storage of the initially processed tank waste materials for process development. These materials are referred to as wash water, washed solids and supernate. Due to the costs and time involved in developing these materials, it is vital to store these materials. The HLRF will continue to store the necessary archive materials for the RPPLT program.

Presently the 325 Laboratory is under a Part A permit as a Treatment, Storage and Disposal (TSD) unit for the SAL hot cells. Identification as a TSD facility removes most concerns about packaging and shipment of the samples after the archive life term has expired if samples are to be disposed of in other facilities. Presently space is available at the 325 SAL for 45 samples of 250 ml size in 45 storage canisters on the hot cell walls. By reducing the volume of the samples to 40 and 100 ml after analysis results are verified and approved the capacity of the 325 Shielded Analytical Laboratory is increased from 180 samples in 250 ml containers to approximately 1,800 samples in 40 ml containers and 450 samples in 100 ml containers. The samples can be stored in storage containers on the walls of the hot cells.

The minimum case in quarter 11 (Figure 3-3) requires space for 589 containers of the 40 ml size and 36 containers of the 100 ml size. This will leave a reserve capacity of approximately 67% for the 40 ml containers. During quarter 20 there is no requirement for storage of 40 ml samples, but the maximum requirement for 100 ml samples is 280 containers. This will leave a reserve capacity of approximately 38%.

The maximum case (Figure 3-4), which is unfunded, in quarter 11 requires space for 888 containers of the 40 ml size and 36 containers of the 100 ml size. Reserve capacity will be approximately 51%. During quarter 27 there is no requirement for 40 ml sample storage, but 100 ml samples are at their highest and requires 500 containers. This will exceed present capacity, but several options are available that can be quickly implemented.

Table 3-2. 325 Analytical Laboratory Archiving Capabilities

325 BUILDING				
	MINIMUM		MAXIMUM	
	40 ML	100 ML	40 ML	100 ML
Capacity	1800	450	1800	450
Demand	589	280	888	500
% Remaining	67%	38%	51%	(-10%)

At PNL all samples, whether they are < 100 mr/hr or > 100 mr/hr are stored in the hot cells. Taking the < 100 mr/hr samples into consideration, sample storage space availability are exceeded for the maximum case, using the existing availability of storage containers. If the maximum case becomes a reality, PNL could meet this need with the fabrication of additional storage canisters and use of available wall space. This would only be done as the need becomes a reality.

Figure 3-3. Sample Archiving at 325 Laboratory (Minimum Case)

SAMPLE ARCHIVING - 325 MINIMUM CASE

Calculations based on recommended archive schedule
for Tank Waste Characterization samples (Section 3.1)

Figure 3-4. Sample Archiving at 325 Laboratory (Maximum Case)

Calculations based on recommended archive schedule
for Tank Waste Characterization samples (Section 3.1)

3.4 CONCLUSIONS

Section 3.2 discusses alternatives that were considered for this study. Alternatives covered such items as "do-nothing", new facility, use of closed facilities, additions and re-sampling vs. archiving. These alternatives were not considered viable for various reasons ranging from As Low As Reasonably Achievable (ALARA) to insufficient timing support for sample archiving loads. The best option selected was to use existing facilities (222-S and 325) with the implementation of TWRS archive requirements and the change from 250-500 ml samples to 40 ml and 100 ml composited samples.

4.0 DISPOSAL OF TANK WASTE

4.1 222-S LABORATORY/COMPLEX

This section provides information on the disposal of tank waste samples at the 222-S Laboratory/Complex. Once the tank samples are considered waste within the 222-S Complex they are disposed/stored in the 219-S Waste Handling Facility.

4.1.1 219-S Waste Handling Facility

The description of the 219-S Waste Handling Facility taken from DOE/RL (1991). The 219-S Waste Handling Facility consists of tanks 101, 102, and 103; it receives low level aqueous mixed waste that is generated by the laboratory. The waste can either be categorized at intermediate- or high-activity waste (defined respectively as exhibiting a radiation level less than 10 millirems per hour, or between 10 and 100 millirems per hour). The 219-S Waste Handling Facility treats and stores aqueous mixed waste before transfer of the waste to the Double-Shell Tank System. The waste is designated as dangerous primarily due to the waste characteristics of corrosivity. The following paragraphs describe the source of the waste treated and stored in tanks 101, 102, and 103.

Waste treated and stored at the 219-S Waste Handling Facility is generated from activities within the 222-S Laboratory. Currently the 222-S Analytical Laboratory conducts process support analyses environmental analyses, and research and development activities. Typical waste includes unused portions of nitric acid, and aqueous mixed waste generated inside laboratory hoods during sample analysis. Any liquid organic waste generated by the 222-S Analytical Laboratory is not accepted in the 219-S Waste Handling Facility, it is stored at the 222-S Dangerous and Mixed Waste Storage Area. For more information on the 222-S Dangerous and Mixed Waste Storage Area refer to DOE/RL (1991).

The intermediate-activity aqueous mixed waste received at tank 101 is generated from laboratory operations that discharge to hot (i.e. radioactive) cell drains, laboratory sinks, and the inductively coupled plasma analyzer drains. The high-activity aqueous mixed waste received at tank 103 is generated from laboratory operations that discharge into the hot cell drains, from the manipulator repair hood, from the atomic absorption spectrophotometer from the aspirators of the decontamination hood, and from the tunnel sumps. Waste from tanks 101 and 103 are transferred on a batch basis to tank 102 for treatment before being discharged to the Double-Shell Tank System. Because the aqueous mixed waste from the two tanks (tanks 101 and 103) is acidic (pH of less than 2), the acidic mixed waste is treated in tank 102 to raise the pH to greater than 12 and the nitrite content to greater than 600 parts per million (ppm) to protect the Double-Shell Tank System and to ensure compatibility of the waste that is already in storage.

Waste identification occurs in the generating laboratory where specific analytical methods are conducted in assigned hoods. Waste is collected in the laboratory hoods in approved accumulation bottles. Some bottles are maintained on vacuum during waste collection. Each hood is subject to a specific standard analytical method that requires use of the same chemicals. The chemicals transferred to collection bottles are characterized through (1) knowledge of the standard analytical methods and the chemicals known to be used in the methods or (2) information recorded on an inventory sheet during waste collection from multiple methods or activities. When the bottles are full, collection bottles approved for discharge to 219-S Waste Handling Facility are taken to a hood drain that discharges into the storage tanks (tanks 101 and 103). Waste that has less than 10 millirems per hour of activity (intermediate-activity waste) is decanted to tank 101, and waste that has higher than 10 millirems per hour is jetted to tank 103 by way of hood drain lines. The waste is transferred to the storage tanks by way of 4-inch (10.2-centimeter) stainless steel pipelines running underground from the 222-S Laboratory to the 219-S Waste Handling Facility. All drain lines and underground transfer pipelines are flushed with water following transfer to tanks 101 or 103.

The estimated quantity of mixed waste treated at the 219-Waste Handling Facility is 49,000 gallons (185,484 liters) per year. This quantity is expected to increase over the next 25 years, reaching a maximum waste volume of 75,000 gallons (283,905 liters) in the year 2015 (WHC 1990b). This increase in waste volume will result in more frequent batch transfers of treated waste to the Double-Shell Tank System. Normal working volumes for tanks 101, 102, and 103 are 3,600 gallons (13,630 liters), 3,600 gallons (13,630 liters), and 1,250 gallons (4,700 liters), respectively. This type of waste disposal system is expected to contend with the growing amount of tank waste samples.

4.2 PNL - 325 LABORATORIES AND HOT CELLS

These types of waste are broken down into two large sections (SOLIDS/LIQUIDS), then into several different subsections. This information was taken from Laboratory (MA-8).

SOLIDS

(1) Low Level Radioactive Waste

Low-Level Waste (LLW) is defined as waste which contains radioactivity which is not classified as High-Level Waste, Transuranic, spent nuclear fuel or byproduct. LLW consist mainly of labware and room generated waste such as gloves, paper, wipes, ducting, piping, and construction debris. This type of waste can be broken down into several different categories:

- Category 1 - Low activity waste with very low concentrations of long-lived radionuclides that are less than or equal to the limits given in Table 4-1 Column 1. Low-Level Waste Category 1 will be buried and may be packaged in carbon steel/galvanized 55 or 30 gallon drums, 4x4x8 plywood boxes, or self-contained, strong-tight steel containers.
- Category 3 - Moderate to high activity waste with low to moderate concentrations of long-lived radionuclides that are greater than the limit given in Table 4-1 Column 1 but less than or equal to the limit in Column 2. Category 3 it will be stored or buried and must be packaged in carbon steel/galvanized 55 or 30 gallon drum, Transuranic Metal Boxes (TMB) or other metal boxes. The packages which will hold the Category 3 waste will be placed in a High Integrity Container, with a 300 year life, for burial.
- > Category 3 - Waste which has radionuclide concentrations Greater Than Category 3 Waste. This type of waste is not generally accepted for near-surface disposal. Greater Than Waste Category 3 is not being accepted for storage or disposal at WHC. This waste is being stored in PNL hot cells. Prior approval is required before generating.

Once this waste has been packaged it is either sent to a satellite area for short term storage then shipped offsite. The waste can also be sent to 305-B TSD for treatment, recycling, reuse, or storage. Tank waste samples are packaged and sent to the Central Waste Complex in the 200 West Area (discussed in 4.3) for storage until a treatment facility can be built.

(2) Transuranic waste

Transuranic (TRU) contains alpha-emitting radionuclides with the following characteristics:

- atomic number greater than 92
- half-life greater than 20 years
- concentrations greater than 100 nCi/g

Transuranic waste is broken down into two separate categories. *Contact-handled TRU waste* has a surface dose of 100 mrem/h at any point. This limit may be extended to 200 mrem/h on a case-by-case basis. Most of the *Contact-handled TRU waste* at PNL consists of glovebox waste (such as surgical gloves, paper wipes, plastic bags, vials, bottles, and metal cans) and ducting, piping and construction debris. This type of waste is placed into 55 gallon galvanized metal drums with a 4-mm liner (minimum), compacted and transported to the Waste Isolation Pilot Plant. This drum is limited to 100-g total mass of TRU and/or fissile material. The problem with such disposal is the tremendous amount of paperwork needed and the regulations and transportation is tightly controlled. Making it difficult to remove and transport from the Hanford Site. Therefore the waste is shipped to the Hanford Site 200 Area CWC for storage (discussed in 4.3).

The second type of transuranic waste is *Remote-handled TRU waste*, which has a surface dose rate of greater than 100 mrem/h. The *remote-handled TRU waste* consists of mainly of irradiated fuel or samples from the Hanford tank wastes. This type of waste is disposed of on a case-by-case basis.

Transuranic waste can be stored temporarily on the Hanford Site provided the TRU is segregated to avoid the commingling of with high-level or low-level waste. The TRU storage has to be monitored periodically to ensure that the wastes are not releasing their radioactive and/or hazardous constituents. Storage facilities are designed, constructed, maintained, and operated to minimize the possibility of fire, explosion, or accidental release of radioactive and/or hazardous components of the waste to the environment. The storage facilities have contingency plans designed to minimize the adverse impacts of the before mentioned possibilities.

(3) Hazardous/radioactive waste

The hazardous radioactive waste is stored in standard 208-L (55-gal) galvanized drum. For liquids, a 90-mil high density polyethylene (HDPE) inner liner is required. For solids a 10-mil nylon reinforced plastic liner is required. Other suitable "metal" containers may be used as the storage container. This type of waste is stored onsite at CWC (discussed in 4.3).

(4) High-Level Radioactive Waste

This type of waste can further be broken down in a few separate categories:

High Level Waste - This waste results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains a combination of TRU waste and fission products in concentrations requiring permanent isolation from the biosphere. At present, no disposal pathway exists for HLW at PNL. Disposal pathways must be developed for each identified HLW waste stream on a case-by-case basis. This type of waste is a large part of what 325 Hot Cells has and will be dealing with. Theoretically, the waste is to be packaged and sent to the central waste complex (CWC) in the 200 West area. However, the problem is because 325 Hot Cell facility deals with very "hot" waste, there is trouble meeting CWC's acceptance criteria. The acceptance criteria is no waste will be accepted unless the concentration is less than 100 mR/hr. With this type of waste found on the Hanford Site the criteria is difficult to meet. Therefore, the samples remain within the hot cells.

Spent Nuclear Fuel - This is fuel that has been withdrawn from a nuclear reactor following irradiation, but that has not been reprocessed to remove its constituent elements. Spent nuclear fuel is accepted for storage at the Hanford Site TSD facilities on a case-by-case basis. Because of the presence of TRU radionuclides in concentrations greater than 100 nCi/g of the waste matrix, spent nuclear fuel is stored in a retrievable manner similar to TRU waste. This allows eventual recovery and disposal in a geologic repository.

> Category 3 - Greater-Than-Waste-Category-3 is waste that has radionuclide concentrations greater than Category 3 (Table 4-1 Column 2). Again, PNL has no disposal pathways for this type of waste, therefore the waste is stored at the 325 Hot Cell facility.

Problems with disposing of laboratory waste

The major problem of disposing of waste is the hazardous/radioactive solid waste (tank waste material). The waste is placed into a 4 to 5 quart "paint" cans, these cans are placed into shielded 55 gallon drums considered acceptable shipping containers for radioactive waste. Solid waste from 325 Laboratories is too "hot" to meet the 100 mR/hr dose rate. Even after the packaging in the "paint" cans and shielded drums the dose rate is found to be 2 R/hr. This dose rate is too high for both the acceptance criteria and transportation regulations. Therefore, the tank waste samples are stored in 325 hot cells.

By not taking into account being cost effective the solid radioactive/hazardous waste can be transported in a TMB5, a large shipping container approved for the kind of materials dealt within 325 labs. By using these containers it would be possible to meet CWC acceptance criteria, although the idea of spending \$70,000 per container to ship 6 gallons of waste.

LIQUIDS

(1) Radioactive/hazardous waste

In the 300 Area buildings and laboratories there is an intricate piping system called the radioactive liquid waste system (RLWS). The pipes all lead to the 340 Facility holding tanks where it is collected and stored for a short period of time. The waste is then collected in 15,000 gallon basins. From these basins the waste is loaded onto a railroad tank/car where it is then shipped to the 200 Area double-shell tanks. The problem with this is they also have acceptance waste criteria that must be met such as pH, corrosivity, organics, fissionable products. Not a lot of waste has been transported through the RLWS.

4.3 CENTRAL WASTE COMPLEX

The Hanford Site Central Waste Complex (CWC) will operate in a portion of the 200 West Area. The complex provides storage space for mixed waste (MW) in accordance with requirements of the Resource Conservation and Recovery Act (RCRA) of 1976 (EPA 1981) as well as contact-handled (CH) radioactive waste. The descriptions of the consequences will remain valid as long as the operation of this complex is conducted in compliance with the operating safety requirements (OSR). The following information is found in WHC (1991).

The CWC is a multifacility complex, located in the 200 West Area of the federally owned Hanford Site, that will receive and store most of the solid MWs that are generated, received, and stored at the Hanford Site. The solid wastes that will be handled at the CWC will include both currently stored and newly generated contact-handled transuranic (CH-TRU), LLW, MW, and transuranic (TRU)/PCB wastes.

The following facilities compose the CWC:

- Plutonium/polychlorinated biphenyl (Pu/PCB) Storage Facility (2401-W)
- LFMW Storage Modules (1 through 8)
- MW Storage Facility 2402-W (2402-W and 2402-WB through 2402-WL)
- MW Storage Facility (Project W-016 Buildings 2403-WA through 2403-WD)
- Receiving and Staging Pad
- MW storage pad.

The CWC, located within the 200 West Area, comprises of 17 storage buildings, 8 low-flashpoint modules, 2 pads, and support facilities. The 200 West Area provides controlled access to the CWC. Security is maintained by guards staffing both the entrances to the Hanford Site and to the 200 West Area. All facilities within the CWC are locked when not in use. The CWC provides storage space for approximately 55,400 208-L (55-gal) or equivalent waste containers. It was noted space to store tank waste sample material would not be a problem, because magazines will be built to accommodate the needs of the Hanford Site.

4.4 FUTURE TREATMENT OF LABORATORY WASTE

Los Alamos National Laboratory (LANL) is being supported by Westinghouse Hanford Company (WHC) in fiscal year 1994 to develop proposals for reducing the volume of laboratory generated wastes. LANL is surveying regulatory criteria for consent to treat laboratory wastes without the requirements of a treatment, storage, and disposal facility (TSD). The proposal include laboratory demonstration to reduce waste volume using:

- chemical precipitation techniques
- organic destruction by ultra-violet
- chemical and/or electrochemical oxidation

4.5 CONCLUSIONS

Presently, the methods to dispose of excess waste is the most economically sound, logical procedure. This includes the procedures for both 325 and 222-S Laboratories. However, as the more tank samples taken the space in the 325 Hot Cells will be compromised. For the next few years the space in the Hot Cells should accomodate the demand. However, the author suggests revisiting this study every couple of years.

5.0 REFERENCES

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