**FINAL REPORT
CPP-603 CHLORIDE REMOVAL SYSTEM
DECONTAMINATION AND DECOMMISSIONING**

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ABSTRACT

The CPP-603 (annex) Chloride Removal System (CRS) Decontamination and Decommissioning (D&D) Project is described in this report. The CRS was used for removing Chloride ions and other contaminants that were suspended in the waters of the underwater fuel storage basins in the CPP-603 Fuel Receiving and Storage Facility (FRSF) from 1975 to 1981. The Environmental Checklist and related documents, facility characterization, decision analysis¹, and D&D plans² were prepared in 1991. Physical D&D activities were begun in mid summer of 1992 and were completed by the end of November 1992. All process equipment and electrical equipment were removed from the annex following accepted asbestos and radiological contamination removal practices. The D&D activities were performed in a manner such that no radiological health or safety hazard to the public or to personnel at the Idaho National Engineering Laboratory (INEL) occurred.

SUMMARY

This final report is a description of the Chloride Removal System (CRS) decontamination and decommissioning (D&D) activities. The CRS was located in an annex to the north fuel basin of the CPP-603 Fuel Receiving and Storage Facility (FRSF) located in the southwestern portion of the Idaho Chemical Processing Plant (ICPP). The ICPP is located in the southern portion of the Idaho National Engineering Laboratory (INEL).

The CRS was installed in 1975 to reduce the chloride ion content of the water in the basins from 350 parts per million (ppm) to less than 50 ppm. The CRS was operated intermittently from 1975 to early 1981. The presence of chloride ions in the fuel storage basins was accelerating the corrosion of certain metals (including the cladding of some fuel elements). The CRS process which involved concentration by reverse osmosis and evaporation also removed fission products that were suspended in the basin waters. The equipment was flushed but the residue remaining contained low levels of radiological contaminants. The annex was unheated and had minimal maintenance from 1981 on. The gradual deterioration of the annex increased the possibility that radiological contaminants could be released to the surroundings.

In 1991 an environmental checklist, a radiological characterization, and a decision analysis were prepared. Analyses for the characterization verified the absence of hazardous chemical compounds which allowed compliance with low-level radioactive waste acceptance. Four logical alternatives were considered and compared based on estimated cost, material reuse, facility reuse, surveillance and maintenance costs, volume of waste generated, hazards to ICPP personnel, short and long term environmental impact to INEL personnel and to the public.

A D&D plan to carry out the chosen alternative was completed August 1991 and became the basis for Title I & II design and the construction package. Concepts that received special emphasis were waste minimization, safety, and containment of radiological contamination. The construction and work packages were completed by November of 1991, but were not released for bid until the National Environmental Policy Act (NEPA) documentation was approved by DOE-Id in March 1992. The bid was awarded June 10 and notification to proceed was given June 30. On-site work was initiated July 13 and completed mid November 1992.

The contracted work scope included erecting a temporary containment structure, isolating the annex from CPP-603 north storage basin, removing asbestos insulation, dismantling and removing all equipment, decontaminating and painting the interior, installing post D&D lighting and electrical service, and removing the temporary structure.

The total cost of decommissioning and decontaminating the CRS annex was approximately \$679K. The radiologically contaminated waste generated consisted of asbestos, asbestos covered piping, fiberglass, carbon steel, and stainless steel. Total boxed volume of the low level radiologically contaminated waste generated was approximately 1024 ft³. No hazardous waste was generated. Total measured radiation exposure to D&D personnel was less than 1 man-rem.

ACKNOWLEDGMENTS

The Decontamination and Decommissioning (D&D) of the Chloride Removal System (CRS) was the result of the efforts and cooperation of many individuals. The D&D programs group has members with experience in several departments at ICPP. A special thanks to those who used their expertise and contacts to help keep the project going with borrowed equipment when unexpected procurement delays or special needs would have delayed the project. Appreciation is extended to the efforts and the cooperation of those who had the responsibility to assure the safety of the workers on the project and expedite the work at the same time.

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ACRONYMS

ALARA	As Low As Reasonable Achievable
CRS	Chloride Removal System
D&D	Decontamination and Decommissioning
DOE-ID	Department of Energy Idaho Field Office
FSRF	Fuel Storage and Receiving Facility (CPP-603)
HEPA	High Efficiency Particulate Air
HP	Health physics
ICPP	Idaho Chemical Processing Plant
INEL	Idaho National Engineering Laboratory
NEPA	National Environmental Policy Act
RCRA	Resource Conservation and Recovery Act
RWMC	Radioactive Waste Management Complex
WERF	Waste Experimental Reduction Facility

1. INTRODUCTION

The U. S. Department of Energy Idaho Field Office (DOE-ID), has assigned Westinghouse Idaho Nuclear Co. (WINCO) the responsibility for implementing the D&D program at the Idaho Chemical Processing Plant.

This report describes the tasks performed by the Westinghouse Idaho Nuclear Company, Inc. (WINCO) Decontamination and Decommissioning (D&D) Program to accomplish the D&D of the Chloride Removal System (CRS) annex (figure 1) of the Fuel Receiving and Storage Facility (FRSF). The report also summarizes the cost and duration of the project, radiation exposure to personnel, the waste volume generated, and final status of the annex. Figures 2 and 3 show where the CRS is located within the Idaho National Engineering Laboratory (INEL) and the Idaho Chemical Processing Plant (ICPP).

1.1. CHLORIDE REMOVAL SYSTEM HISTORY

Building CPP-603 contains the Fuel Receiving and Storage Facility (FRSF) and is located near the south perimeter of the ICPP (see Figure 1). Before fuel assemblies were reprocessed in the CPP-601 area, they were stored at the FRSF until a sufficient amount of fuel was accumulated for a reprocessing run. The fuel is stored in three deep basins in CPP-603. The basins are filled with water, allowing approximately 20 feet of water cover over the fuel assemblies to provide radiation shielding.

The FRSF was constructed in 1951. During early operations various water treatment systems were used to keep the basin water as free as possible of undesirable impurities that would interfere with the safe handling and storing of fuel elements in the storage basins. Impurities of concern were bacteria, undissolved solids, radioactive particles, and chloride ions.

Bacteria were present primarily as the result of using raw water as the storage medium. Undissolved solids (e.g., dirt and dust particles, corrosion products, etc.) entered the basins from the atmosphere and fuel handling tools and equipment. Both bacteria and undissolved solids affected the clarity of the water making underwater handling of the fuel very difficult because of reduced visibility.

The presence of chloride ions (Cl^-) in the water was the result of adding calcium hypochlorite to control the growth of bacteria. This added Cl^- became an undesirable impurity because it accelerated corrosion of certain metals (including the metal cladding of some fuel elements). Reducing the chloride ion content of the water became an extremely important requirement and led to the installation of the Chloride Removal System in 1975 to reduce the Cl^- level from 350 parts per million (ppm) to < 50 ppm. It was operated intermittently from 1975 to 1981. The process also removed other suspended solids and ions including some that were radioactive. The radiation level of the drummed concentrate ranged from 1 R/hr $\beta + \gamma$ at contact in early operations to < 200 mrem/hr $\beta + \gamma$ toward the end of operations.

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Figure 1. CPP-603 CRS Annex, East and North Sides.

IDAHO NATIONAL ENGINEERING LABORATORY

Figure 2. Location of ICPP at the National Engineering Laboratory

Chloride Removal System Annex

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Figure 3. Plot plan of Idaho Chemical Processing Plant

1.2 CRS DECOMMISSIONING PROJECT BACKGROUND

The CRS annex was radiologically characterized and a decision analysis¹ was prepared along with an environmental checklist by June of 1991. As part of the environmental checklist and decision analysis several D&D alternatives were considered. The recommended alternative was to remove all equipment and decontaminate the annex to an As Low As Reasonably Achievable (ALARA) level. The D&D Plan, issued August 1991, became the basis for the requirements of the D&D construction package.

Four alternatives for decommissioning the CRS annex were considered in this decision analysis. The "no action" alternative is not a decommissioning method and does not satisfy the project objectives. However, it was included as an alternative to show the risk of contamination spread by leaving the deteriorating annex in its pre D&D condition.

1. "No action." The deterioration of the CRS equipment and annex, resulting from continued exposure to weather, temperature extremes, and minimal maintenance applied to the unoccupied surplus annex, would increase the potential for spread of the existing radiological contaminants to the environment.
2. "Decontamination of annex leaving equipment in place." Decontamination of the annex and the equipment interior and exterior, without removing the equipment, would generate radiological liquid wastes with no assurance that decontamination would be complete. The annex was not set up for liquid decontamination procedures. Temporary piping and equipment would have to be installed for the decontamination effort thus increasing the total amount of radiologically contaminated solid waste. The potential for the spread of radiological contamination to the environment resulting from the use of liquid decontamination agents and disposal of these contaminated liquids from the facility would be increased. The presence of contamination remaining in the annex would require upgrading the facility to minimize the release to the environment over the remaining life of the annex. Future disposal costs would not be diminished as equipment would still be considered low level waste and monitoring and maintenance requirements would be required for the remaining life of the annex.
3. "Partial removal and decontamination of annex." All CRS equipment and radiologically contaminated materials would be removed from the CRS annex. The passage between the fuel storage area and the CRS annex would be sealed off by performing repairs/modifications necessary to preserve the integrity of the structural components and security barrier shared by the CRS annex and the fuel storage basin. The remaining structure would be decontaminated to ALARA levels.
4. "Total removal including annex and foundation." This alternative would include and be in addition to alternative 3. Removal of the structural tie-ins to the CPP-603 Fuel Storage Facility would require extensive repairs and modifications to maintain the integrity of the east wall of the Fuel Storage Facility north fuel storage basin. Foundation removal activities would possibly weaken the underwater fuel storage basin which could result in radiologically contaminated basin water escaping to the environment. A planned decontamination and decommissioning of the entire CPP-603 complex, projected to be at least 10 years from now, would include removal of the annex structure and foundation.

2. FACILITY DESCRIPTION PRIOR TO DECOMMISSIONING

2.1 PHYSICAL CONDITION

The Chloride Removal System (CRS) annex adjoins the east side of the north fuel storage basin of the CPP-603 Fuel Receiving and Storage Facility (FRSF). A plan view showing the layout of major system components is shown in Figure 4. The annex walls are constructed of steel framework covered by 1/2 inch transite panels, a layer of rock wool insulation and an outer layer of corrugated transite siding. Transite is a trade name for a cement like material containing asbestos. The annex, constructed 35 years ago, originally housed an oil fired heating system. A water filtering system was installed and used for several years prior to the installation of the chloride removal system in 1975. The chloride removal system was operated for the last time in 1991. The walls were deteriorating (see figure 1) and maintenance was restricted because of asbestos content. The equipment inside which contained low level radiological contaminants was also deteriorating. Figures 6-9 are photographs of the primary CRS equipment.

2.2 RADIOLOGICAL CONDITIONS

The radiation fields prior to D&D ranged from 30 mrem/hr $\beta + \gamma$ to 5 mrem/hr $\beta + \gamma$ at contact. The 30 mrem/hr readings were from the east header pipe on the reverse osmosis setup and from the filter housing on the evaporator. Several smears were also taken and measured for radiological activity. Maximum $\beta + \gamma$ activity for a smear was 11,443 disintegrations per minute (dpm). There were no alpha radiation emissions detected.

2.3 HAZARDOUS MATERIALS PRESENT PRIOR TO D&D

Hazardous materials consisted of 1500 pounds of lead sheets used for shielding and 180 linear feet of asbestos piping insulation. Representative samples of residue were analyzed per RCRA guidelines for hazardous metals. Hazardous metals listed in 40CFR 261.24 were either not detectable or found in trace amounts far below regulatory limits. The lead was removed prior to initial D&D actions during an INEL site wide action to remove all lead which was not essential for shielding purposes.

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Figure 4. Plan view of the Chloride Removal annex

Figure 5. Reverse osmosis feed tank (SW corner of annex)

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Figure 6. Reverse Osmosis Unit (SE corner of annex)

Figure 7. Evaporator Feed Tank and pump (NE corner of annex)

Figure 8. Evaporator assembly (as viewed from NE corner of annex)

3. OBJECTIVES AND WORK SCOPE

3.1 OBJECTIVES

The specific D&D plan objectives were:

1. Reduce risk of spreading radioactive contamination to occupied areas or to the environment outside of the annex.
2. Perform the decommissioning in a safe and cost-effective manner and abiding by all governing rules and regulations.
3. Reduce the radiation field hazard caused by the contamination inside the annex.
4. Keep contaminated waste generation to a minimum during decommissioning. Methods used should include but will not be limited to: entry minimization, segregation of combustibles, and, as much as feasible decontaminating materials to levels below that requiring regulated storage and disposal.
5. Verification by sufficient sampling, analysis, and record keeping to assure that each waste container was properly handled and stored.

3.2 WORK SCOPE

The scope of the CRS D&D project consisted of the following basic tasks:

1. Engineering, planning, and procurement.
2. Site preparation including building a containment structure.
3. Sealing off the annex from the north fuel storage basin.
4. Removal of asbestos insulation.
5. Removal of CRS equipment
6. Decontamination of annex.
7. Demolition of containment structure and site restoration.
8. Preparation of final report.

4. WORK PERFORMED

4.1 ENGINEERING, PLANNING AND PROCUREMENT

WINCO Projects Department provided D&D project management. D&D Programs engineers were responsible for the Characterization and Decision analysis, the NEPA documents, and coordinating the planning, scheduling, and overall direction of the project. A project engineer was assigned to oversee the preparation and reviews of the construction specifications, work packages, bid and award functions, and to interface with the subcontractors. Frequent construction meetings were held to review current work status, discuss unforeseen problems with upcoming tasks and obtain the required approvals when changes to the original work packages were needed to accomplish the work in a safe and timely manner.

Major equipment items, such as the HEPA filtered exhaust blowers were identified early in the planning stages and ordered at the earliest possible date by the D&D programs engineers. Other supporting equipment such as waste boxes and personnel protective equipment were available in house.

WINCO Environmental, Safety, and Health Department personnel were assigned the responsibility to review each work package and construction activity and determine personal protective equipment and overall safety requirements. A health physics (HP) technician was assigned to the site to oversee each activity to assure the safety of the workers and see that radiation exposure was ALARA.

4.2 SITE PREPARATION

Site preparation included building a platform and containment structure (figure 9) to provide entrance and exits to meet the requirements for asbestos removal and radiation contamination control. The platform was built at the CRS floor level to enhance the safety and efficiency of the work. It also provided areas for donning and doffing personal protective gear and for bagging and placing contaminated wastes into the waste boxes. All utilities were tagged out and isolated and temporary sources of construction power and lighting installed.

Figure 9. Containment structure

4.3 ISOLATION OF THE CRS ANNEX

The CRS annex was connected to the north underwater fuel storage basin by an opening in their common wall. A permanent closure was installed to maintain security integrity of the Fuel receiving and storage facility. It was also a necessary function in fulfilling the ventilation control requirements for asbestos removal and the containment of radiological contamination during the demolition and removal of the CRS equipment. Figure 10 shows the HEPA equipped blowers that were installed to meet the ventilation control requirements.

Figure 10. HEPA filtered blowers

4.4 REMOVAL OF ASBESTOS INSULATION

Figure 11. Encapsulating asbestos

The removal of the asbestos piping insulation was performed in stages to minimize the disturbance of asbestos. First an asbestos abatement subcontractor using glove bags removed a short section of asbestos at each place the pipe could be conveniently cut into easily handled sections. The remaining asbestos was then encapsulated and samples of the air and smears from the floor and other locations were analyzed which verified the absence of free asbestos fibers. In the final stage the piping was carefully sectioned, double bagged, and placed in properly labeled waste boxes by the equipment removal contractor.

4.5 REMOVAL OF CRS ANNEX EQUIPMENT

Removal of all CRS annex equipment including utilities proceeded in an orderly and efficient manner. Figures 12 through 17 are photos of the work in progress. The work package stipulated not using plasma arc cutting to size the equipment into manageable sections because of the fumes and spreading of contamination. However the thickness and configuration of the stainless steel in the evaporator made alternative cutting methods extremely difficult and time consuming. In keeping with the ALARA principle, the decision was then made to allow plasma arc cutting to reduce the length of time the workers were exposed to the radiation emanating from the evaporator. However, the fumes and air born particles from the plasma arc caused the HEPA filters on the ventilation blowers to plug much quicker thus requiring more frequent replacement to maintain the required minimum air flow.

4.6 DECONTAMINATION OF THE ANNEX

The walls and ceiling were decontaminated by using wiping material dampened with window cleaner. Smears taken after the second decontamination effort found no smearable contamination above normal background levels, i.e. <200 disintegrations/minute (d/m) beta + gamma ($\beta + \gamma$) and <10 d/m alpha (α). The walls were then painted. The floor is in a deteriorating condition and the surface layer contains very low levels of radiological contamination. A smear consists of wiping 100 cm^2 with a cloth dampened with a cleaning solution. Average activity of 9 floor smears was $489\text{ d/m } \beta + \gamma$ with no alpha detectable. The process of finishing the floor requires the cement temperatures be above 70 degrees Fahrenheit. Conditionally scheduled for May 1993, WINCO personnel will decontaminate the floor to ALARA levels and seal with epoxy paint to retard cement deterioration and fix the imbedded contamination.

4.7 CONTAINMENT STRUCTURE DEMOLITION AND SITE RESTORATION

In keeping with the goal of minimum radiological waste generation the temporary containment structure was lined with two layers of herculite such that it could be carefully removed without spreading contamination to the structure itself. The lining material was successfully removed and disposed of as compactible low level radioactive waste (note the bags in foreground in figure 17). The remainder of the structure was dismantled, surveyed for verification of no radiological contamination and transported to a landfill. The soil around the annex was undisturbed by the D&D activities thus no further site restoration action was implemented.

Figure 12. Feed tank and evaporator internals

Figure 11. Checking radiation fields prior to days work

Figure 13. Partially dismantled evaporator feed tank

Figure 14. Hole cut in evaporator feed tank

Figure 15. Partially dismantled reverse osmosis unit

Figure 16. Bagged containment structure lining

5. COST AND SCHEDULE

The major D&D activities for the CRS project were started in January 1991 and were completed in November 1992. The scheduled completion date for the project in the D&D plan was February 1992. The \$570K cost estimated in the D&D plan had been revised to \$699K to cover NEPA documentation, additional personnel time, and environmental compliance costs unanticipated at the time the D&D plan was drafted. Due to delays in approval of NEPA documentation the contract was not allowed to be put out for bids until April 1992. Notification of bid award was mailed 10 June 1992 and work began in mid July with a completion date of October 1992. Restricted stay time, to avoid heat stress, and unanticipated difficulty in dismantling the evaporator delayed project completion to mid November. A detailed cost breakdown is given in table 1.

Table 1.

Detailed cost breakdown

Major components of effort and time frame	Estimated cost (\$K)	Actual cost (\$K)
Pre-D&D Characterization, Decision Analysis, NEPA documents, D&D plan, final report and project engineering-management Jan 1991 - Feb 1993	\$297	\$313
Support services including: purchasing, security, quality engineering and inspections, graphic, photographers, and docu- ment control. March 1991 - February 1993	\$10	\$14
Materials and supplies (includes replacements for borrowed filters and waste boxes not delivered as of Jan 1993) June 1991 - February 1993	\$10	\$25
Subcontractors, plant maintenance services, plant craftsmen, operational health phys- ics personnel May 1992 - November 1992	\$382	\$327
Total	\$699.00	\$679.00

6. VOLUME OF WASTE GENERATED

Eight standard sized, 8 x 4 x 4-ft, waste boxes were filled with low level radioactive waste and sent to the INEL Radioactive Waste Management Complex (RWMC) for disposal. The compactible and combustible low level wastes, which are temporarily stored at ICPP pending shipment to the INEL Waste Experimental Reduction Facility (WERF), consist of 52 compactible and 48 combustible waste bags which average 2 ft³ each. Without practicing waste reduction at least two more waste boxes (128 ft³ each) would have been used. However at compaction the reduction factor is 6 to 1 and at combustion the reduction factor is 300 to 1. The end volume of the bagged radiological waste is expected to be approximately 9 ft³. The total boxed volume, including the boxes, of low level radiological waste sent to the RWMC is 1024 ft³ and is summarized in table 2 below.

One of the project goals was to minimize the number of radiological waste boxes sent to the RWMC. Every effort was made by D&D personnel to utilize the space efficiently and at the same time remove and size the equipment in such a manner that would minimize the radiological exposure to the workers. Waste boxes were filled to capacity with the last box also containing the electrical powered tools and other equipment that was either not possible or not cost effective to decontaminate. The total radioactive waste generated was 33% (512 ft³) less than the amount estimated in the D&D plan. Cooperation between the subcontractor and WINCO personnel was the prime factor in keeping waste generation to a minimum and to faithfully keep the combustible and compactible wastes separate. No attempt was made to segregate the wastes by material so the following table contains estimates based on contents of the annex and order of removal.

Table 2
CRS D&D Radiological Waste Estimates

Items and or material	Boxed Volume (estimated)
Evaporator, pumps, piping, and miscellaneous stainless steel	600 ft ³
Steam piping, conduit, switch boxes, vessel framework, chain hoist and other carbon steel items	250 ft ³
Vessels, reverse osmosis canisters, electrical wire and switches. fiberglass, plastic, and copper	100 ft ³
Miscellaneous debris, contaminated tools, and 35 ft ³ of asbestos insulation.	74 ft ³
Total (actual, including waste boxes)	1024 ft ³

7. PERSONNEL EXPOSURE

The following guidelines were used to limit and prevent undue radiation exposure to workers during the CRS annex D&D activities.

- All D&D personnel that entered the annex were trained in radiation work and in the use of respirators.
- All D&D work was performed under HP technician surveillance.
- The philosophy of keeping personnel radiation exposure as low as reasonably achievable was factored into work packages and daily construction work permits.

All ICPP personnel are required to wear film badges. Periodically the film badges of D&D workers were collected to determine and record the amount of exposure each individual received from working in radiation areas. In addition, personal dosimeters were worn in the radiation zones and read frequently during the day to ensure no individual would exceed the maximum daily dose allowed under company guidelines which are less than the DOE limits. Recorded exposures were far below the company allowable daily and quarterly maximums and within the 1.0 man-rem predicted in the D&D plan. The measured exposure is summarized below in Table 3.

Table 3
Personnel Radiation Exposure During D&D

	<u>Non-penetrating</u>	<u>Penetrating</u>	<u>Total Exposure</u>
Highest individual exposure (rem)	0.0	0.175	0.175
Total exposure (man-rem)	0.0	0.563	0.563

8. POST-DECOMMISSIONING CONDITION

After the second decontamination effort the annex was surveyed for radiological contamination. No smearable contamination was found on the walls or ceiling. The walls and ceiling were then painted. It cannot be assumed that the ceiling and walls are entirely free of imbedded or fixed contamination only that direct reading instruments did not detect any evidence of radiological contamination above the background. Figures 18 and 19 are photographs of the northwest corner of the annex taken during D&D and after the walls were decontaminated and painted. The cover for the drum pits was put in place after photograph 18 was taken.

The deteriorating floor still has small amounts of smearable contamination, with activity readings ranging from 263-663 d/m $\beta + \gamma$, and < 10 d/m α . Materials which smear < 200 d/m $\beta + \gamma$, and < 10 d/m α are considered free of loose radiological contamination. WINCO maintenance personnel will decontaminate the floor again and apply an epoxy coating to retard further floor deterioration and to seal possible subsurface radiological contamination. The work is conditionally scheduled for May, 1993 because application of the epoxy floor coating requires that the temperature of both the cement and air to be $> 70^{\circ}$ F.

Figure 18. NW corner after decontamination and painting

Figure 17. NW corner of annex during D&D activities

9. LESSONS LEARNED

Experience that may be applicable to similar D&D projects in the future came from controlling contamination and waste and obtaining the required NEPA documentation and clearances. Portable exhaust fans equipped with HEPA filters located outside the annex cause air to flow from the containment structure through the annex and out through the filters. This, in effect, kept the contamination from escaping to the environment. It also assured that airborne contamination generated during the cutting operations was exhausted out through the fans and HEPA filters.

Applicable lessons learned were:

- Waste volume can be minimized. The subcontracts and work packages must state the requirement and suggest ways to accomplish waste reduction. Specifications must provide for the necessary sorting, arranging, and packaging the wastes in an optimum space-conserving manner. The subcontractors foreman and the HP technician in charge are the key people in meeting the goals. However, workers can make a big difference in little things like choices in sizing and the order in which materials are boxed.
- In older facilities, undocumented changes may cause available drawings to be misleading and vendor data may be unavailable for old equipment. Characterization studies must include additional first hand examination when as-built drawings and vendor data are inadequate or unavailable.
- Process records and information can reveal the best locations for obtaining representative and worst case samples of materials to be cleaned up. Accurate sampling reduces the chances of running into unknown substances that may impact the projects cost and schedule.
- Investigation into improved methods of using plasma arc cutting could reduce or eliminate two areas of concern. Nearly one-half of the radiological exposure was to the workers cutting up and removing the evaporator. The thick stainless steel required too much time to be sized by conventional other methods. In addition to increased exposure to the workers, electrical tools which could not be successfully decontaminated increased the waste volume of the project. Plasma arc cutting fumes carried particles that spread contamination and plugged the HEPA filters quadrupling the expected HEPA filter costs.

10. REFERENCES

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2. C. L. Moser, Decontamination and Decommissioning Plan for the CPP-603 Chloride Removal System at the Idaho Chemical Processing Plant, WINCO-332, August 1991.

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