NOTICE

All drawings located at the end of the document.

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HALLIBURTON NUS
Environmental Corporation

PROCESS CONTROL PLAN

207C POND AND CLARIFIER

PONDSLUDGE WASTE PROCESSING

DELIVERABLE # WBS 253 & 254

for

EG&G ROCKY FLATS

prepared by

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

Rev. 0

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FOR REVIEW & COMMENT BY EG&G ROCKY FLATS

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PROCESS CONTROL PLAN

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1.0 GOAL

The purpose of this operation is to stabilize and solidify the contents of Solar Pond 207C and the Clarifier.

The final waste product is intended to be certifiable to all stowage, transportation and waste disposal requirements as established by Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements (NVO-325) Revision 1. Within this document, testing defined in NVO-325 will be referenced simply as product testing.

The certification program is an EG&G responsibility based upon the EG&G Waste Certification Program. Within the PCP, HNUS has identified those items which HNUS is responsible for providing to EG&G to support the Waste Certification Program. HNUS for purposes of this process defines "qualified" as the product that satisfies the requirements of this PCP.

The contents of a halfcrate is the smallest volume of stabilized waste that requires certification.

2.0 PROCESS SPECIFIC ORGANIZATION AND RESPONSIBILITIES

The following subsections present an outline of functional responsibilities unique to the Solar Pond 207C and Clarifier operations, as they relate to production of acceptable waste.

2.1 PROJECT ORGANIZATION

The Halliburton NUS team for the Pond 207C/Clarifier project consists of several units , the main responsibilities of whom are shown below:

HALLIBURTON NUS Denver

- Coordinate requirements with EG&G
- Erect equipment and process waste
- Train all on-site personnel
- Direct activities of subcontractors

HALLIBURTON NUS Pittsburgh (ESG)

- Provide waste characterization
- Provide treatability studies
- Provide process formulation report
- Conduct Off-site Lab tests

HALLIBURTON NUS Pittsburgh (LSG)

- Provide design criteria for on-site laboratory
- Provide laboratory equipment and personnel
- Conduct On-site Lab tests

BROWN & ROOT ENGINEERING

- Provide engineering design
- Provide procurement services

HALLIBURTON SERVICES

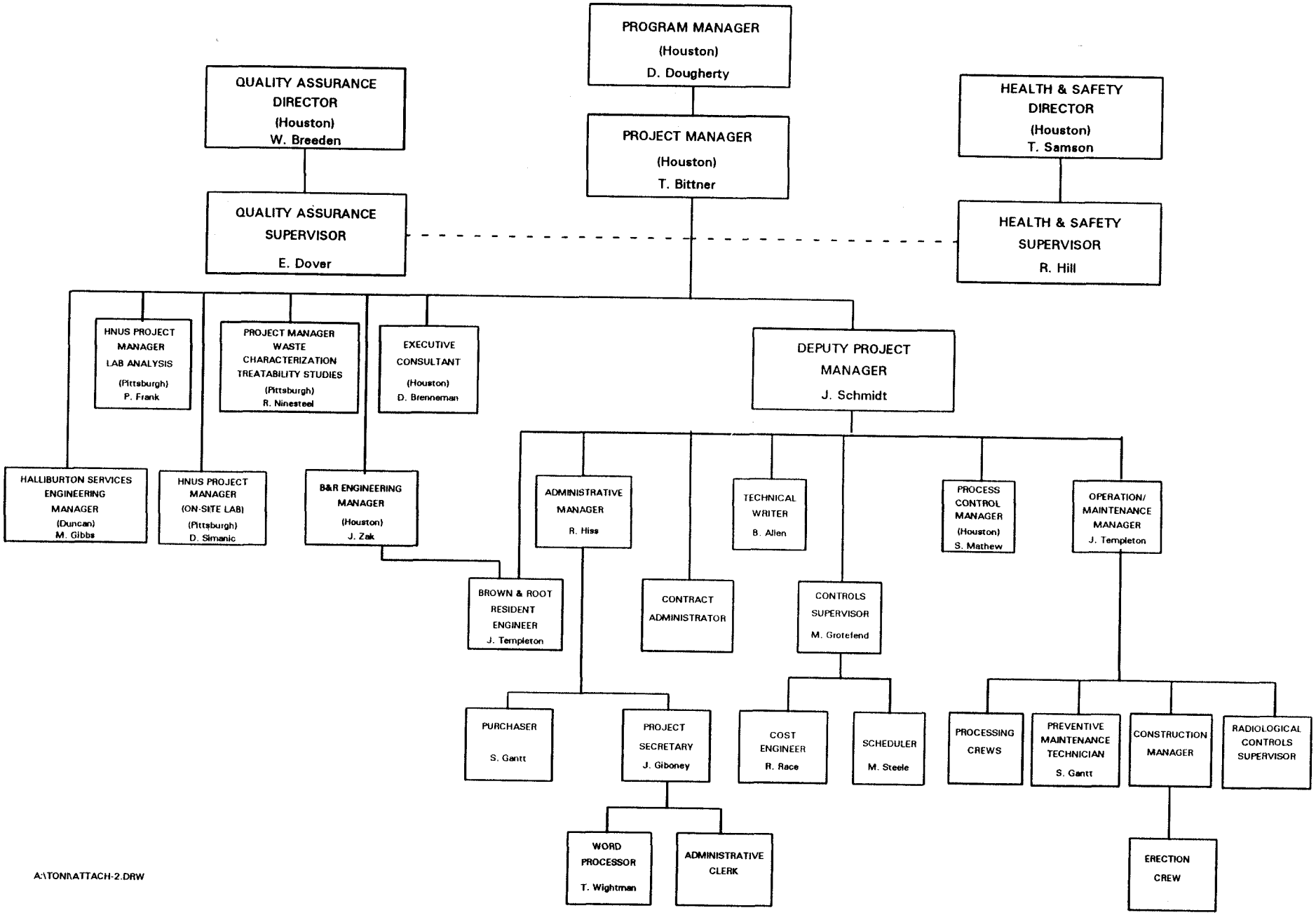
- Provide engineered mixer and tankage
- Provide erection assistance
- Provide start-up and operational labor
- Perform surrogate waste test programs
- Perform saltcrete studies in research facility

BROWN & ROOT CONSTRUCTION

- Erect equipment skids
- Erect pipelines, electrical and instrumentation

How these divisions interact to form a co-ordinated team to perform the 207C/Clarifier processing project is shown in Figure 2.1.1.

The organizational interfaces between EG&G Rocky Flats, Halliburton NUS, and its subcontractors are shown in Figure 2.1.2.



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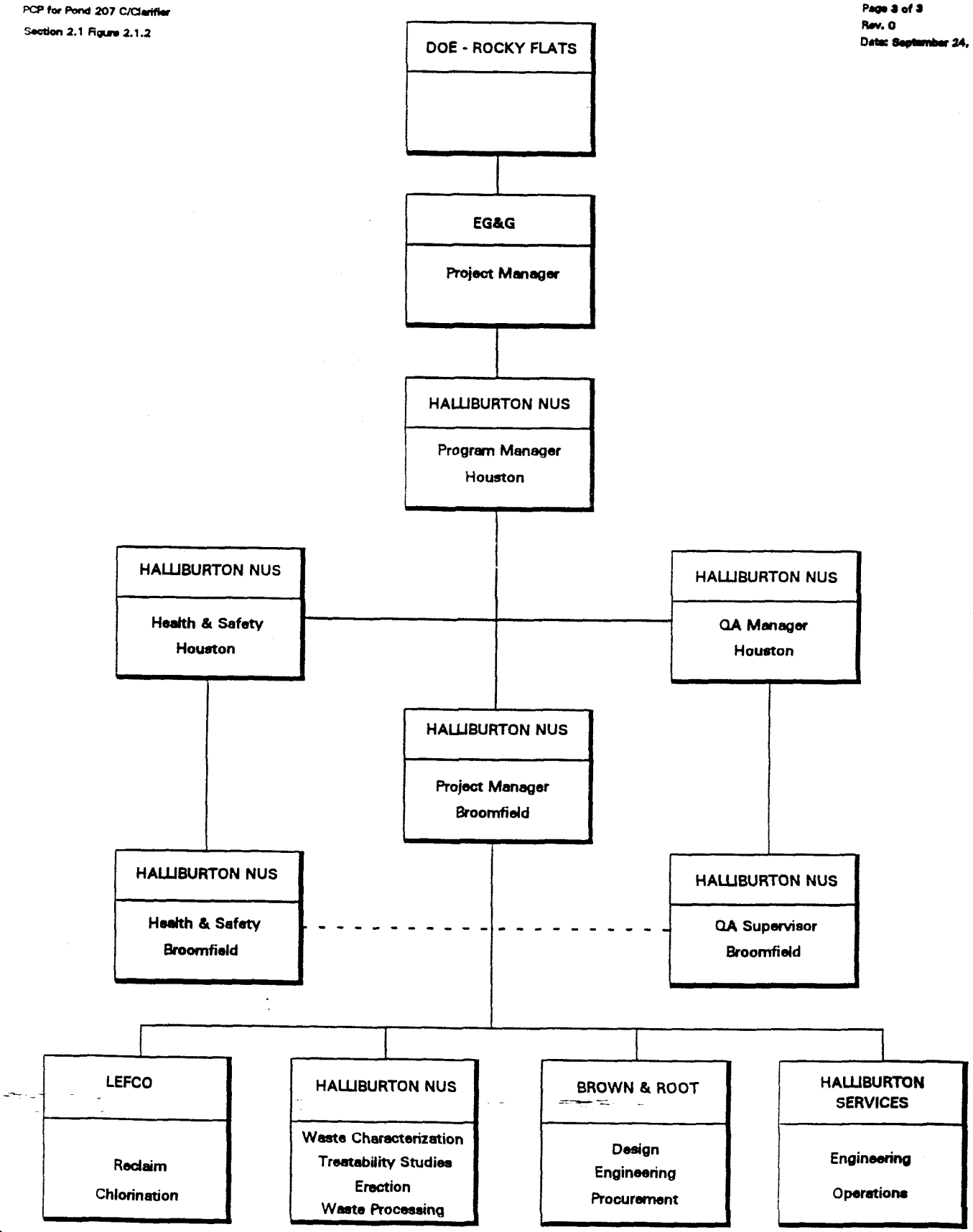

HNUS PROJECT ORGANIZATION INTERFACES
POND 207C/CLARIFIER
SOLAR EVAPORATION POND STABILIZATION PROJECT

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2.2 CERTIFICATION RELATIONSHIPS

"The certification of the final waste form(s) is the responsibility of Contractor (EG&G) and will be based in part on documentation provided by subcontractor (HNUS)."

Statement from the Special Conditions of 11/7/91, Rev. #3, page 31, Section 12.20.1:

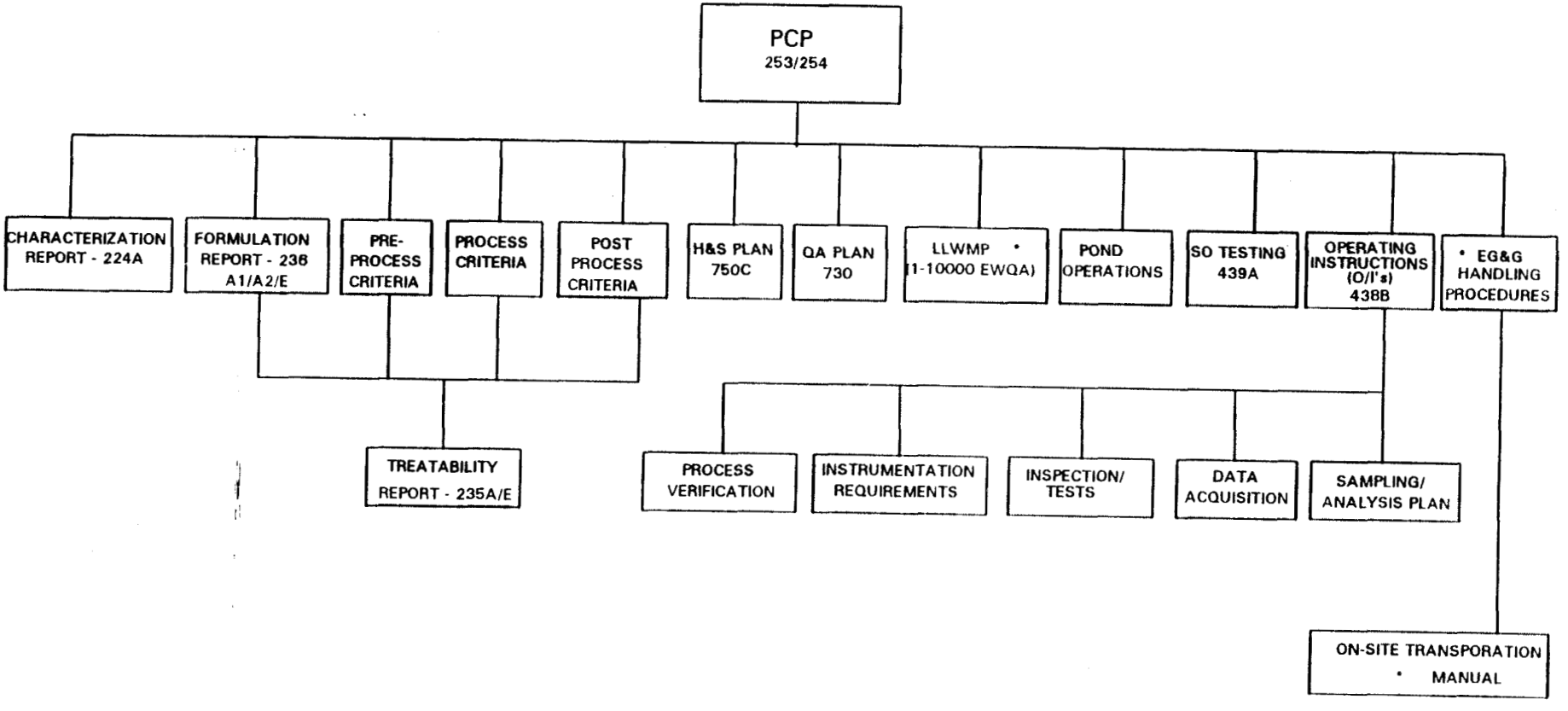
2.3 DOCUMENTATION RELATIONSHIPS

> "The Process Control Plan (PCP) is an integrating procedure to ensure that the output of each waste form processing unit meets all established requirements in documentable form."

Statement from the Special Conditions of 11/7/91, Rev. #3, page 31, Section 12.20.1:

Figure 2.3.1 indicates the documents that the PCP coordinates for purposes of providing an integrated approach to the processing of the waste stream.

PCP DOCUMENT TIERS



NOTE: NUMBERS REFER TO WBS's
* EG&G DOCUMENTS

2.4 CONTROL OF ACTIVITIES

Operational activities shall comply with:

- the Process Flow Diagrams (PFD) and Piping and Instrumentation Diagrams (P&ID) of Appendix C and description of the process in Section 3.1.
- the SO Test Procedure specific for this process, deliverable WBS-439A and
- the Operating Instructions for 207C Pond/Clarifier Waste, deliverable WBS-438B.

3.0 PROCESS DESCRIPTION

Waste (sludges, crystals and liquid) shall be treated to produce a cemented qualified waste form while minimizing final waste volume. This section describes the process that will accomplish the task.

3.1 OPERATIONS OVERVIEW

3.1.1 Remediation Plan

The plan for remediation and stabilization of the mixed waste brine solution and associated solids in the Pond 207C and Clarifier at the Rocky Flats Plant (RFP) consists of a number of sequenced preparation and processing steps. From pond homogenization to stabilized waste product casting and storage, the processing plant has been designed to permit stage-wise operation. This allows each unit to operate semi-independent of upstream or downstream operations and to maintain the stabilized waste production at a rate consistent with the requirements of all elements of the production train. The capacity of the reclaim and processing operations is designed to be able to accommodate the available waste within an acceptable time frame and to utilize available and reliable field service equipment wherever possible.

3.1.2 Processing Criteria

The processing criteria used as a basis for the stabilization process design are summarized below. The process is designed to:

- Produce a qualified waste form.

The stabilization process system design is required to achieve, maintain and control the stabilization process within the limits which have been defined for the qualified waste form. This primarily consists of controlling the free water to pozzolan ratio in the stabilization mixer, but also includes production rate control and feed material character control within acceptable limits.

- Minimize waste volume.

The major impact on the stabilized product waste volume results from the free water to pozzolan ratio requirements of the stabilization mix formulation. Free Water available for pozzolan hydration is the mass of the liquid phase which is not dissolved solids. Techniques have been developed to process at higher dissolved solids

which will greatly reduce the final waste volumes.

- Minimize Footprint of Equipment.

Suitable space available for locating processing equipment within the Rocky Flats Plant (RFP) boundaries is at a premium.

- Minimize On-site Erection Labor.

The Rocky Flats Plant, due to the high security, environmental sensitivity and radiation health and safety requirements, requires a number of extraordinary work rules, practices and procedures which are not typical for most industrial environments. For example the difficulty of clearing equipment/tools into and out of the Protected Area. Therefore, off-site fabrication, assembly and operational testing have been maximized for all equipment and systems utilized in the stabilization process.

- Minimize Plant Interface.

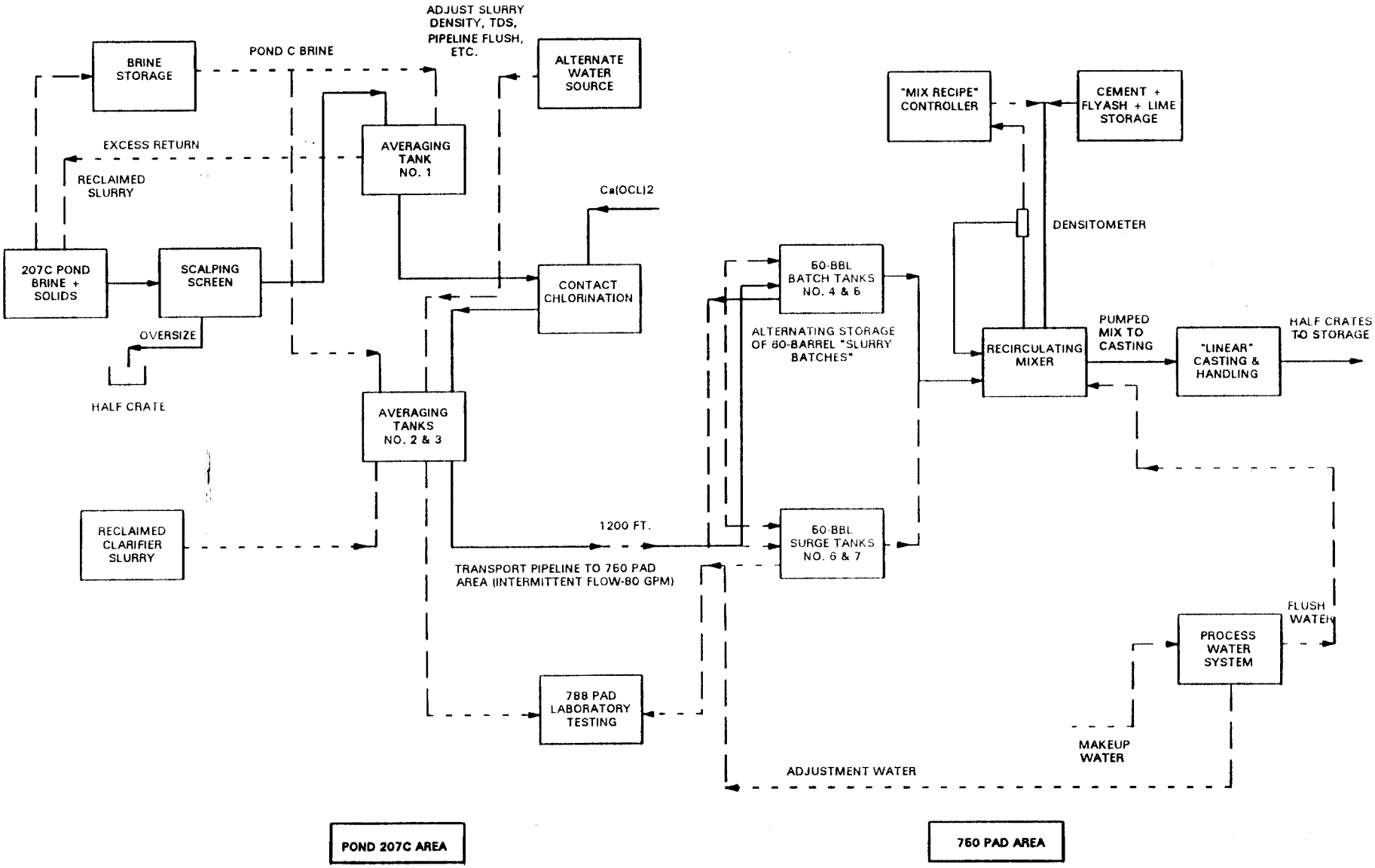
The process has been designed to be effectively self sufficient in order to minimize the impact on plant utilities. Almost all utilities including power, compressed air, fuel, and reagents have been provided independent of the existing systems at the Rocky Flats Plant.

3.1.3 Process Flowsheet

The process flowsheet for the Pond 207C/Clarifier process is schematically shown in Figure 3.1.1 (drawings are found in Appendix C). The main functional areas include: the brine slurry reclaim and handling systems, the waste batch preparation, transport and storage systems, the cement stabilization mixing and reagent systems, and the casting and waste form handling systems.

The process utilizes existing, proven field service equipment wherever feasible to provide

Figure 3.1.1
Processing Scenario for Pond 207C/Clarifier



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reliable operation and to reduce the time required for equipment design and construction. This type of equipment satisfies the requirements for modular components, secondary containment, minimization of field erection and interface requirements. The process equipment is also readily adaptable to the portable field services utilities and reagent storage and delivery systems which are being used.

The process is operated in a combination of batch and continuous operating modes. Reclaim from the pond can be a semi-batch operation up to the point at which the 50-bbl Averaging Tank #1 is overflowing back to the pond. Reclaim is halted and transfer of the waste brine slurry proceeds to the two 50-bbl Averaging Tanks #2 & 3. Alternatively, the reclaim system can continue to operate and overflow as necessary back to the pond, homogenizing pond materials, while the reclaimed slurry is being transferred. In transit from Averaging Tank #1 to Averaging Tanks #2 & 3, the waste brine slurry is chlorinated to insure that any pathogenic organisms are destroyed.

The contents of the Clarifier Tank, approximately 27,000 gallons of waste slurry, will be blended with Pond 207C waste slurry in Averaging Tanks 2 and 3. The waste will be combined in defined proportions on a batch-by-batch basis until the Clarifier is empty.

Any adjustments required in the reclaimed batch for TSS or TDS are made in the Averaging Tanks #2 & 3 prior to pumping to the pairs of Batch Holding Tanks #4 & 5 or 6 & 7. When the batch arrives into one of the Batch Holding Tank pairs, it is isolated as a discrete feed batch for stabilization processing. Instrumentation and lab results verify the parameters are met for stabilization mix formulation for that batch. As a result of the flexibility of the system arrangement, the slurry in the pair of tanks may be processed in parallel or series, to be determined by the Halliburton Services Site Foreman.

The approximately 4,000 gallon batch is processed as a discrete waste material through the Halliburton Recirculating Cement Mixer (RCM)

cement stabilization mixing system. While it is being processed, the next discrete batch is being reclaimed from Pond C and transported to the other set of Batch Holding Tanks. Thus, a new batch of waste brine slurry is being established while the former batch is being processed.

Feed to the RCM mixing system from the Batch Holding Tanks is continuous throughout a specific discrete batch. Pozzolan addition is controlled by measurement of the density of the circulating cementaceous slurry being mixed and compared with the target density of the stabilization mix.

Intermittent withdrawal of the cementaceous slurry from the pressurized circulating loop (grout loop) is accomplished by opening a discharge valve at the Casting Station. The fluid slurry is poured into a sealed bladder liner within the halfcrate box while displacing the air through a vent tube into a High Efficiency Particulate Air (HEPA) filtration system. Casting continues until the bladder is full or the weight limit of the halfcrate is achieved. The discharge valve is closed and the bladder evacuated to remove excess air and sealed.

The full halfcrate is moved from the Casting Station, which is a chain conveyor system, to the Waste Form Inspection and Box Closure stations further down the handling conveyor systems. Chain conveyer systems are also used to stage and feed the empty halfcrates waiting to be filled prior to the Casting Station. The casting and box handling operations are semi-automatic and require a minimum of personnel to operate. The inspection and box closure operations are manual and operated by EG&G personnel. Accumulating conveyor sections provide the surge and delay time required between these manual operations.

The sealed and inspected halfcrate waste form is moved by fork lift to other tent enclosures on the 750 Pad for curing and ~~interim~~ storage. The setting and solidification characteristics of the cementaceous stabilization mix formulation used for the Pond C brine waste slurry permit such transport and movement up to two hours after casting. Transportation and movement of the halfcrate is permissible only after 48 hours of

undisturbed cure time.

The following sections will elaborate on the various unit operations in greater detail.

3.1.4 Homogenization of Waste

The 207C Pond consists of a brine layer with layers of precipitated salt crystals and settled sludge at the bottom. Sampling studies have revealed the existence of layers or concentration gradients in the brine from the bottom of the pond to the top. The primary reasons to mix and homogenize the liquid brine layers in the pond are:

- To produce a relatively-homogeneous liquid phase with minimal density and concentration gradients and
- To re-dissolve the precipitated salt crystals. With the reduced overall dissolved salt concentration in the well-mixed liquid phase, it is possible that most, if not all, precipitated salts in the crystalline layer on the bottom of the pond will re-dissolve.

The additional reason to mix and homogenize the waste in Pond 207C prior to processing is to mix, disperse and redistribute the settled silt solids which are on the bottom of the pond under the salt crystal layer.

3.1.5 Reclamation and Averaging of Pond 207C

Even after pond homogenization,it is still expected that there will be slight differences in the physical character of each batch reclaimed and processed through the stabilization process. Therefore, the reclamation and averaging systems of the process have been designed to recover the desired quantity of waste brine slurry from the pond into discrete 4,000-gallon batches.

A determination is made of the slurry physical properties required by the stabilization mix formulation and for making any adjustments to the TSS and TDS in the slurry to insure that the batch properties fall within the acceptable target range for those variables.

The Averaging Tanks and the Batch Holding Tanks are all 50-bbl (nominally 2000-gallon), cone-bottomed tanks equipped with circulating and sampling pumps and a manifold of interconnecting piping and valves. With the exception of Averaging Tank #1 which receives the reclaimed slurry pumped from the pond, the other Averaging and Batch Tanks are configured as pairs which can operate in parallel or series as required. This field service equipment is commonly used by Halliburton as storage and mixing tanks for slurries in oil field applications.

The cone bottom of the tanks and their circulation pumps maintain the solids of the slurry in suspension. An air sparge into the cone throat provides a supplemental method of keeping the solids suspended. All of the tanks are enclosed and vented through passive HEPA filter systems for controlling airborne emissions. These skid-mounted tank systems with their pumped recirculating loops not only provide for surge and storage of the waste slurry, but produce a homogenous, well-mixed batch of waste slurry for feed to the cement stabilization mixer system.

The Reclamation System is discussed in more detail in Appendix F.

3.1.6 Chlorination

Chlorination is necessary in this CSS process (as discussed in Section 3.2 -- NVO-325 Requirements, under the heading of Etiologic Agents), in order to destroy any existing pathogens.

The overall process has three sources from which pathogens could access the final waste product:

- 207C supply from Averaging Tank #1,
- 207C supply to the Brine Dilution Tank, and
- the Clarifier.

Therefore for each of these sources, Chlorination (Calcium Hypochlorite) addition has been provided for in the process train and is detailed in Attachment III of Section 3.4.

For the three addition systems, two distinct methods have been utilized. The addition of Calcium Hypochlorite to the 207C supply from Averaging Tank #1, uses an in-process operation

(via an Injection Pump) as described in Section 3.4.1.

The Chlorination of the Dilution Brine Tank and the Clarifier is effected by a batch method. The quantity of material in the tank is determined, and utilizing On-site lab tests and the equations of Attachment III of Section 3.4, the amount of Calcium Hypochlorite to be mixed into the tank is determined.

3.1.7 Cement Addition and Mixing

The waste will be mixed with the pozzolans in a Halliburton Recirculating Cement Mixer (RCM), which is a high-intensity, circulating mixing system. This mixer is a high energy mixer capable of mixing high-viscosity, high-density, difficult-to-mix slurries over a wide range of densities and throughput rates. The RCM is a reliable, rugged and proven piece of operating equipment.

The RCM Mixer consists of two mixing and circulating chambers. The primary chamber has dual, two-impeller, axial-flow mixers which blend the dry pozzolan ingredients into the waste brine slurry. The dry pozzolan is fed to the chamber through a rotating orifice valve with pneumatic assist in transport. It is pre-wetted as it enters the mixing chamber with jets of the waste slurry being fed into the system. The balance of the waste slurry is fed to the first mixing chamber. The mixing is augmented by pumped circulating flow of the stabilized waste slurry in a loop leaving the bottom of the chamber and circulating back to the feed at the top of the chamber. In this loop a Densometer, part of the Halliburton Automatic Density Control (ADC) system, provides the measurement parameter which provides control of the rate of pozzolan addition to the mixing chamber.

Compared to other types of cement mixing equipment, air entrainment in the RCM product, is minimal. In addition, proprietary Halliburton plasticizers used to modify the rheological properties of the mix also reduce the entrained air in the mix. Not only does this produce relatively dense cast product but the small variation in product density due to small

variation in the entrained air content facilitates the use of density as the primary control parameter.

Feed to the mixing unit is capable of continuous operation throughout a given (4,000-gallon) discrete batch. Once the target product density has been achieved in the RCM mixing system, pozzolan addition continues at a rate proportional to the continuous feed rate. The cemented slurry overflows from the blending chamber when it is full into the second circulation/holding chamber. Another axial flow, dual impeller mixer keeps this product slurry well-mixed in the chamber. All agitators are hydraulically driven and are variable speed.

The mixed stabilized product in the holding chamber is circulated in a loop from the bottom of the chamber to the casting station and returned to the top of the holding chamber. A diversion valve on a "Teed" leg off of this loop is opened to discharge the mixed contents of the RCM. This permits a controlled portion of the circulating stabilized waste to flow through the casting nozzle into the sealed bladder within a wooden box called a halfcrate. It is also from this "Teed" leg that the sample station is supplied.

The volume can vary in the second RCM holding chamber. This permits the intermittent casting operation to continue in a semi-batch fashion as the individual empty halfcrate boxes are filled at the Casting Station and are moved by conveyor so that an empty halfcrate can be put into position at the Casting Station. Thus the inventory volume in the second chamber rises and falls during the casting and waste form handling operations.

Upon completion of the feed of a batch to the RCM mixing system, the pozzolan addition is stopped and the mixing and circulating systems allowed to empty. As the levels near empty in the mixing chambers, waste pond slurry from the next batch to be processed, being held in the other set of Batch Holding Tanks, is pumped into the mixer to dilute the cementaceous slurry. This diluted waste slurry is allowed to circulate through the RCM system to dissolve and remove product buildups.

The dilute wash slurry is emptied from the RCM system by pumping initially to the waste halfcrate (to remove the majority of the cemented slurry) and then to the empty pair of Batch Holding Tanks which were the feed tanks for the just completed batch. Any oversize solid material which would present pumping or handling problems is removed by in-line strainers in the return pipelines. Use of process water for equipment flush and cleanup is thus minimized by the use of the waste brine slurry, whenever possible. Similar cleanup procedures are followed at the end of daily operations or in the event of an unscheduled shut-down. The dilute stabilized waste and wash slurry which have been pumped to the Batch Holding Tanks is mixed with the incoming new batch of waste pond brine constituting the next batch to be processed.

During the course of operation, the key control and operating data are logged by a Halliburton Compupac data acquisition system. This enables records of the key operating variables associated with a batch being processed to be preserved and utilized for production of the Operational Traveler Reports (OTR).

The pozzolan reagent storage and delivery systems for the stabilization mix formulation are standard, mobile field-storage bulk tanks. These systems are supplied as three 440 cubic foot cone-bottomed bulk storage tanks on each trailer unit. A total of three storage trailers with nine hopper tanks are used to supply the approximately 100 tons of pozzolan mix per operating day required at full production. These tanks deliver the dry pozzolan to a scale tank by dense-phase pneumatic transport. The scale tank, in turn, delivers the pozzolan to the RCM mixer system. Densometer control is used to adjust the reagent addition rate from the scale tank to the RCM mixer.

The storage tanks are equipped with filtered venting system to eliminate dust emissions during filling or transport. Each tank has its own independent transport line and air controls to a central header feeding the overland supply line.

Samples of the stabilized product will be taken during processing for tests to confirm that the process is performing as designed.

3.1.8 Casting and Halfcrate Handling

The nominal design operating rate for the process is approximately 18 tons per hour of stabilized waste product. This translates into approximately 8 halfcrates per hour containing 4,350 pounds of stabilized waste per halfcrate. At this production rate, one halfcrate will be filled every 6-7 minutes. Each 4,000-gallon batch of waste slurry will take approximately four hours to process. This will result in approximately 30-32 halfcrates being produced from each feed batch.

The product is discharged from the RCM into halfcrates at the Casting Station. The Casting Station and halfcrate handling systems consist of twenty-eight, two-strand chain conveyor elements configured in a linear train. These systems, which consist of five operation centers or stations, transport the halfcrates from crate assembly, to casting, to inspection and closure, and smear testing prior to transport by fork lift to curing and interim storage. The halfcrate movement operations are semi-automatic with operator initiation and with sensors which detect position and control movement from one station to the next. A number of accumulating conveyors are provided prior to some of the stations to permit upstream operations to proceed and to form a queue of halfcrates awaiting servicing when necessary.

The casting and handling systems are located within an enclosed storage tent on the 750 Pad Area and are designed with their own secondary containment. The sealed and inspected stabilized waste forms in halfcrates are transported to storage tents for curing and interim storage.

The operations at the various stations associated with the halfcrate handling system are discussed below:

Station No. 1: Halfcrate Storage and Assembly Area

At this station, the empty halfcrate is staged for the casting operation with the outer plastic liner, inner fiberboard liner, and pouring bladder inspected. In addition, a brace is installed around the box.

Station No. 2: The Casting or Pouring Station

The empty halfcrate moves into operating Station No. 2 which is the stabilized waste casting station. The casting nozzle from the RCM mixer product circulating loop is connected to one of the tubes on the bladder. The other discharge tube, located at the other end of the bladder, is connected to the venting and evacuation system. The bladder tubes are sealed around the pouring spout and the vent pipe to prevent any emissions during casting. At the completion of the casting operation a vacuum is pulled on the bladder to ensure intimate contact between the bladder and the waste form.

Station No. 3: Closure and Inspection of Inner Liners

The filled halfcrates are conveyed to this working station which consists of three accumulating conveyors. Here the outer bag liner is folded over the top of the stabilized waste in the filled bladder and sealed with tape.

Station No. 4: Sealing of Halfcrates, Brace Removal and Banding

This station consists of three distinct assembly-line operations: gluing and nailing of the halfcrate lid, removal of the peripheral pouring support brace and affixing steel bands around the box. The accumulation chain conveyors for each sub-work station in Station No. 4 are grouped in sets of three to normally accommodate a group of three halfcrates which are moved together as a unit. This facilitates the individual assembly-line operations being accomplished.

Station No. 5: Radiological Smear Testing and Inspection

The station provides for radiological smear testing and inspection.

Station No. 6: Halfcrate Removal Station

At the termination of the conveyor system the halfcrate will be removed from the conveyor by a forklift.

3.2 NVO-325 REQUIREMENTS

The following is an edited excerpt from Rocky Flats Plant Waste Sampling and Analysis Plan (WSAP) for Product Certification, Rev 0 of August 1992, written by HNUS for submission by EG&G to the Nevada Test Site (NTS). NVO-325, Rev 0, is the contractually responsible document for HNUS. However EG&G directed that the WSAP be written consistent with NVO-325 (Rev 1).

The primary objective of the WSAP is to determine if the treated waste from Pond 207C and the Clarifier complies with NVO-325 (Rev. 1) low-level mixed waste acceptance criteria. Specifically, the treated waste must be determined to be certifiable and acceptable for storage, transportation, and land disposal at the NTS, according to the summary of the criteria as follows:

- Radionuclides: Low Level Waste (LLW) must have a transuranic nuclide concentration less than 100 nCi/g.

  Radionuclide isotopic analysis of the solar pond sludge has verified that the transuranic concentration is less than 100 Nci/g.

  One sample for radionuclide isotopic analysis will be collected during the Production Demonstration Test Run (Hot Test). The sample will be analyzed for Pu-239/Pu-240, Am-241, U-233, U-235, and U-238. The results of this analysis will be used to determine packaging, labeling, and transportation of all subsequent samples.

  During remediation, two samples will be randomly collected to verify that the transuranic concentration of the final waste product is below the required 100 Nci/g. These samples will be analyzed for Pu-239/Pu-240, Am-241, U-233, U-235, and U-238.

- Hazardous Waste Components: LLW offered for disposal at NTS waste management sites shall not exhibit any characteristics of, nor be listed as, hazardous waste as identified in Title 40 CFR 261, "Identification and Listing of Hazardous Waste".

  Pond 207C and the Clarifier contents are low level radioactive, mixed wastes as defined in Title 40 CFR 261. The implication of the waste being a hazardous waste will be discussed under the "Treatment" criteria (See WSAP).

- Free Liquids: Free liquids mean liquids readily separate from the solid portion of a waste under ambient temperature and pressure conditions. Mixed waste disposed at the NTS shall contain no free liquids. To demonstrate compliance with the free liquids requirement, ASTM Method 9095 (Paint Filter Test) will be used.

  Low level, mixed wastes must not contain any free liquids. The 207C Pond contents and the Clarifier contents will be mixed with a pozzolan mixture to solidify and stabilize the waste. The mixture consists of cement, flyash, and lime. The liquid which is present in the raw waste will be chemically bound with the pozzolans after mixing. The CSS process provides multiple controls to ensure that the water and the pozzolanic material are stoichiometrically balanced, thereby eliminating the potential for free water after the solidified material has cured properly.

  Compliance with the free liquids criteria will be demonstrated by EPA Test Method 9095, "Paint Filter Liquids Test" as specified in Title 40 CFR 264.314(c). This test will be performed on samples which are cured using an accelerated process. The accelerated curing process follows a modified ASTM Method C684-89 (Procedure A, Warm Water Method). The procedure will be modified by allowing the cylinders to be cured for 48 hours rather than the 24 hours specified in the method. Testing in the Treatability Study indicated that if a sample passed the Paint Filter Liquids Test after an accelerated cure, then samples cured for a conventional 28 days (without an accelerated cure) also passed the free liquids criteria.

  Compliance testing will be performed on the final waste product after proper curing procedures are followed. Seventeen samples will be collected during remediation, which is the cube root of the expected number of half-crates that will be produced (4600 half-crates are expected to be produced).

- Particulates: Fine particulate wastes shall be immobilized so that the waste package contains no more than one weight percent of less-than-ten-micrometer-diameter particles, or 15 weight percent of less-than-200-micrometer-diameter particles.

  NVO-325 (REV. 1) has limits on the amount of fine particulates which may be present when the waste is

disposed of at NTS. If the amount of fine particulates exceeds the specified limits, then these particulates are to be immobilized.

Because of the nature of the CSS process, large quantities of fine particulates are not expected to be present. Provisions appear in NVO-325 (REV. 1) for other acceptable packaging if total immobilization is impractical, and in this application the solidified waste will be packaged in wooden boxes with a sealed plastic liner which is greater than 6-mils, as specified by NVO-325 (REV. 1). EG&G is also developing testing criteria to comply with this requirement.

- Gases: LLW gases shall be stabilized or absorbed so that pressure in the waste package does not exceed 1.5 atmospheres at 20 C.

  There are no radioactive gases or compressed gases, as defined by Title 49 CFR 173.300, involved with Pond 207C or the Clarifier. The radionuclides found are limited to Pu-239, Am-241, U-233, U-234, and U-238. Picocurie/liter quantities of tritium are present in the pond water as tritiated water.

- Stabilization: Waste shall be treated to provide a more structurally and chemically stable waste form.

  The treated waste must have structural stability and be chemically stable. Pond 207C and the Clarifier will be treated using a CSS process which will consist of mixing cement, flyash, and lime with the raw waste. The results of the Treatability Study indicate that the solidified waste product can be expected to have unconfined compressive strengths (UCS) greater than 200 psi and may likely exceed 600 psi. No harmful vapors, gases, or liquids were observed during the Treatability Study Test and are not expected to be present during the full-scale remediation. The final waste form will not react with the packaging during normal storage, shipping and handling.

- Etiologic Agents: The following LLW will not be accepted for disposal at NTS;

  - Wastes containing pathogenic organisms,
  - Infectious waste,
  - Medical waste as defined by EPA (see Federal

Register 122326 -12395, March 24, 1989).

- Etiologic agents (as defined in Title 49 CFR 173.386). Pond 207C and the Clarifier may contain pathogens from past disposal practices in which sewage was placed in the ponds. Analysis for typical indicator organisms (Total Coliform and Fecal Coliform) during the Treatability Study did not confirm the presence of these organisms. However, the required holding times for these analyses were exceeded because of the transportation time of the samples from the Rocky Flats Plant to the HALLIBURTON NUS Laboratory in Pittsburgh, Pennsylvania.

  To ensure that no pathogens are present in the final waste form, Pond 207C and Clarifier material will be chlorinated prior to mixing with pozzolans. The raw waste will be chlorinated with calcium hypochlorite at a dosage of 2000 ppm (100 percent pure product). This dosage of calcium hypochlorite will provide an excess of 1 ppm of residual chlorine after 30 minutes of contact time. This is a common wastewater treatment standard and will be achieved by providing an engineered structure capable of providing a 30 minute contact period. The treatment system will be designed and monitored to ensure that the entire waste inventory has been chlorinated prior to CSS processing. Additionally, the stabilized waste will have a pH of approximately 12 which will also provide additional disinfection capabilities.

- Chelating Agents: LLW containing chelating or complexing agents at concentrations greater than one percent by weight of the waste form will not be accepted.

  The wastes present in Pond 207C and the Clarifier do not contain chelating or complexing agents. Wastes generated at the Rocky Flats Plant do not contain chelating or complexing agents at concentrations greater than one percent by weight.

- Polychlorinated Biphenyls (PCBs): PCB-contaminated LLW waste will not be accepted for disposal at NTS unless

the PCB concentration meets the municipal solid waste disposal level of less than 50 ppm.

NVO-325 (Rev. 1) stipulates that wastes with a PCB concentration above 50 ppm cannot be accepted at NTS. Pond 207C and the Clarifier were not used to dispose of PCBs and testing of the water phase of Pond 207C indicated that no PCBs were present. As a verification, one sample will be collected and analyzed for PCBs during the Production Demonstration Test Run (Hot Test). This sample will be collected when both the Clarifier and Pond 207C are being processed and will be at a time when the solids loading are at the highest concentration.

- Explosives and Pyrophorics: LLW containing explosive and/or pyrophoric material in a form that may spontaneously explode or combust if the container is breached will not be accepted.

  There are no materials present in Pond 207C or the Clarifier that will spontaneously explode or combust.

- Treatment: All Mixed Waste (MW) accepted for disposal must comply with land disposal restrictions for the hazardous component(s) as specified under Title 40 CFR 268, "Land Disposal Restrictions" unless treated as specified under Title 40 CFR 268, Subpart D, "Treatment Standards.

  All mixed waste accepted at NTS must comply with the Land Disposal Restrictions as specified in Title 40 CFR 268. This implies that the treatment standards for F001, F002, F003, F005, F006, F007, F009, D004, D006, and D007 must be achieved prior to NTS acceptance of the waste (D004 and D007 are only applicable to Pond 207C). These standards are provided in Table 1-15 (WSAP).

  Review of the historic data from both Roy F. Weston Co. (who performed the initial pond characterization tests) and HALLIBURTON NUS indicates that no volatile organics, semi-volatile organics, or alcohols are present in the raw waste at concentrations that exceed the CCW (Contaminate Concentration in the Waste) for the listed wastes. Additionally, none of the contaminants are at concentrations that could potentially leach into solution to exceed the CCWEs (Contaminate Concentration in the Waste Extract) concentrations for the listed wastes. During the

Treatability Study, solidified samples were analyzed for volatiles associated with F001, F002, F003, and F005 wastes, using the TCLP zero-head space procedure. All of these results indicated that the volatile contaminants were non-detectable.

Because the organic contaminants associated with F001, F002, F003, and F005 are at concentrations below regulatory concern in the raw waste, there is no need to conduct further analysis of these compounds during remediation.

Total cyanide and amenable cyanide are regulated for F006, F007, and F009 wastes. The highest concentration of total cyanide detected in the Pond 207C water was 20 mg/l and the highest concentration detected in the Pond 207C sludge was 170 mg/kg (HALLIBURTON NUS, 1992). The highest concentration of total cyanide detected in the Clarifier water was 3 mg/l and the highest concentration detected in the Clarifier sludge was 190 mg/kg (HALLIBURTON NUS, 1992). For both the Clarifier and Pond 207C the analytical data indicates that the solidified waste product will be less than the non-wastewater CCW standard of 590 mg/kg, and therefore will require no further analysis during remediation.

The highest concentration of amenable cyanide detected in the Pond 207C water was -0.77 mg/l and the highest concentration detected in the Clarifier water was -3.3 mg/kg (HALLIBURTON NUS, 1992). Amenable cyanide was not analyzed in the sludge by either Weston or HALLIBURTON NUS for characterization of the waste. However, during the Treatability Study analysis, composite samples which simulated the actual solids content of Pond 207C and the Clarifier were analyzed for amenable cyanide. This data indicated that the concentration for both the 207C Pond slurry and the Clarifier slurry was below the non-wastewater CCW standard of 30 mg/L. A significant amount of the data for amenable cyanide has been reported as a negative number. This typically occurs if the cyanide is complexed with metals. Because the analytical data for amenable cyanide was not validated during the Treatability Study, two samples (cemented cylinders) will be collected during the Production Demonstration Test Run (Hot Test) to verify that amenable cyanide is below the LDR standard.

During remediation, metals associated with F006, F007, and F009 wastes will be analyzed for in the TCLP

leachate along with the metals associated with the characteristic of toxicity (Title 40 CFR 261). These metals include arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, and silver.

The solidified waste must not contain halogenated organic compounds (HOCs) at concentrations greater than 1000 mg/kg as specified in Title 40 CFR 268.32. HOCs are defined as those compounds listed in Appendix III of Title 40 CFR 268. Many of the compounds listed in Appendix III have been analyzed and the results indicate that these compounds are not present or are at very low concentrations and are significantly below 1000 mg/kg. However, all of these compounds have not been analyzed, although it is unlikely these compounds are present at high concentrations based on process knowledge. Therefore, one sample will be analyzed for the compounds listed in Appendix III of Title 40 CFR 268. The sample will be collected during the Production Demonstration Test Run (Hot Test).

Two other parameters which are specified in NVO-325 (REV. 1) include ignitability and corrosivity as defined in Title 40 CFR 261.21 and 261.22, respectively. No data exists for Pond 207C and the Clarifier for ignitability, however; because the final waste matrix will primarily be a pozzolanic based material, it will not spontaneously ignite under standard conditions. By definition, the solidified product is not considered corrosive and therefore will not require further testing.

- Reactive Wastes: All reactive wastes must be treated in accordance with Title 40 CFR 268, Subpart D, "Treatment Standards."

  The material in Pond 207C and the Clarifier is not considered reactive for any of the cases listed in Title 40 CFR 261.23 (i.e., reacts violently with water, capable of exploding, or classified as an explosive according to Title 49 CFR 173). Analytical results for cyanide are below the limits specified in Title 40 CFR 268. No analytical data exists for sulfide reactivity; therefore, one sample for reactivity for sulfide will be collected and analyzed during the Production Demonstration Test Run.

- Potentially Incompatible Wastes: Wastes must be identified by the most appropriate compatibility group

listed in Title 40 CFR 264, Appendix V, "Examples of Potentially Incompatible Waste".

The final stabilized waste will be a pozzolanic based matrix consisting of Type V Portland cement, Type C flyash, and hydrated lime. The material will be classified as a hazardous, mixed waste and will have a pH of approximately 12 to 12.5 S. U. However, the waste does not fall under any of the waste groups specified in Appendix V of Title 40 CFR 264.

Other Objectives

Other objectives which must be met for the treated waste form to be certifiable and acceptable for storage, transportation, and land disposal include requirements of the Colorado Department of Health and the U.S. Department of Transportation (DOT), as stated below:

- Must be transportable in interstate commerce as defined by DOT regulations in 49 CFR 173 and EPA regulations in 40 CFR 263.
- Must be within radioactive limits as defined by DOT regulations in 49 CFR 173, Subpart I (173.400).
- Must be certifiable as a waste as defined by the Rocky Flats Quality Assurance Manual, Low Level Waste Management Plan, 1-10000 EWQM, Section 1.1, and RFP Procedures.

Verification that the treated waste achieves all of the above criteria must be provided prior to acceptance of the waste by NTS. Demonstration that these criteria are achieved can be provided through:

- process knowledge,
- existing analytical data of the untreated waste,
- by sampling, testing and inspecting the after-treatment waste, and
- verifying process control.

3.3 PROCESS ENVELOPE DEFINED BY TREATABILITY STUDY

The stabilization operation will be conducted within a process operating envelope which has been proven in the laboratory. For purposes of this Process Control Plan the Operating Envelope can be defined as those criteria defined by the Treatability Study, operating within which a certifiable product can be produced.

Halliburton NUS has developed chemical stabilization/solidification (CSS) recipes (detailed in Section 3.4.7) in the laboratory that have passed all Land Disposal Restrictions (TCLP) and Department of Transportation requirements. In addition to meeting the regulatory requirements, the recipes have also performed satisfactorily in durability tests using ASTM wet/dry and freeze/thaw procedures.

The testing and formulation results are presented in the combined Treatability Study (TSR) and Formulation Report (Deliverable #'s 235A, 235E, 236A and 236E) of July 1992.

The recipes are based on a specified amount of pozzolans added to the waste stream such that the ratio of free water to pozzolans falls within a defined range. The pozzolans are to be pre-blended in a fixed weight ratio of cement to flyash to lime. Pozzolans are defined in the context of this process as mixtures of cement, flyash and lime which when combined with water in the correct ratio forms a solidified waste product.

The water to pozzolan ratio (w/p) for the process is the critical element required to produce a satisfactory product. A control strategy has been developed such that the w/p ratio can be maintained at a desired level by measuring the waste slurry density (input to the RCM) and controlling the output density of the cemented product (via the Automatic Density Control (ADC) of the RCM).

The specific gravity of the waste slurry is a composite of the specific gravities of the water, and the suspended and dissolved solids. Equations developed in the TSR relate the required output product density to the input slurry density. The slurry specific gravity for each batch will be measured prior to processing. The equations in the TSR will provide the product density setpoint for the ADC of the RCM.

Since the desired w/p ratio is maintained by controlling the output product density, other parameters such as TDS and TSS are not required as controlling elements of the process control strategy. The levels of TSS and TDS in the waste stream need to be maintained less than the limits defined in the TSR since it was within these ranges that the formulation had been tested. An earlier processing concept emphasized measurement of TSS and TDS as the control strategy, which involved the calculation of the water content of the slurry and the proportional pozzolan addition. Since the methodology of control has changed to strictly a density control strategy, the TSS and TDS criteria need only satisfy the limitations noted below.

The operational envelope for stabilization of the contents of Pond 207C (only) are summarized in Table 1.

TABLE 1
OPERATING ENVELOPE FOR POND 207C PROCESSING

ITEM	PROCESS ENVELOPE
Water/Pozzolan Ratio	0.34 - 0.50 *
Limits for TDS	0 - 40.4%
Limits for TSS	0 - 17.2%
Pozzolan Composition: Cement:Flyash:Lime	1/1.2/0.05 - ** 1/3.34/0.09

The process envelope for recipe formulation for stabilization of the mixture of Pond 207C and Clarifier contents is shown in Table 2. The difference between Table 2 and the 207C recipe of Table 1 is that Table 2 includes the limits for Clarifier TSS.

TABLE 2
OPERATING ENVELOPE FOR 207C/CLARIFIER PROCESSING

ITEM	PROCESSING ENVELOPE
Water/Pozzolan Ratio	0.34 to 0.50 *
Limits for Total TSS in Input Slurry	0 - 11.6%
Limits for Clarifier TSS in Input Slurry	0 - 5.7%
Limits for TDS in Input Slurry	0 - 34.6%
Pozzolan Composition: Cement:Flyash:Lime	1/0/0.022 - 1/2/0.077 **

* The mid-point of 0.42 water/pozzolan ratio is the target for processing.

** The ratio of 1/2/0.075 is the selected ratio to be used during remediation in accordance with the Treatability Report. This specific ratio "is a goal and not an absolute criteria for certification of the final waste form". (Section 3.2.1.2 of the TSR). A super plasticizer (Modified Lignosulfonate, Halliburton Part # 516.006410) will be added to the pozzolan mixture at the bulk mixing plant by 0.1% by weight of the total weight of pozzolans.

3.4 INSTRUMENTATION AND CONTROLS

This section discusses each of the key process elements and describes how the process will be controlled, whereas the Operating Instruction (WBS 438B) will provide the specific operational steps.

The 207C/Clarifier slurry consists of silt and salts mixed in water. In order to achieve the goal of a stable waste form, the silt and dissolved salts in the feed slurry will be maintained below the levels specified in the Treatability Study, as discussed in Section 3.3.

All process control except for the final mixing (RCM) phase will be manual in nature. The final mixing phase will be automatically controlled by the RCM's Automatic Density Control (ADC) in order to maintain the desired output product density.

Attachment I to this section provides the decision flow diagrams to accomplish this. The reclaimed Pond and Clarifier material will be scalped to remove extraneous (coarse) trash prior to processing. The reclaim rate from the pond is sized to effectively remove the sludge from the pond. The actual flow rate advanced to the process will be substantially smaller, the difference being recirculated (from Averaging Tank #1) back to the pond.

Slurry in Averaging and Batch Tanks #'s 2 thru 7 will be limited to 80% of their capacity to enable adequate volume for trim dilution water.

3.4.1 Chlorination of Waste Slurry

Chlorine is introduced into the system as a 10% solution from Solution Tanks 1 & 2 (Z-09) by mixing Calcium Hypochlorite (CCH) with Process Water or Dilution Brine. Dilution Brine will be normally mixed with the Calcium Hypochlorite in the Solution Tanks in order to minimize waste output volume.

The Pond slurry will be pumped from Averaging Tank #1 through an installed Mass Flow Meter (FI-347), and an Adjustable Choke (AC-841) to the Chlorine Injection System. The 4-20 milli-ampere signal from the Mass Flow Meter will control the Injection Pump to proportion the quantity of Calcium Hypochlorite solution to the 207C Pond

slurry flow rate required for effective chlorination (in accordance with the Treatability Study Report). The Mass Flow Meter will also provide a local reading to the operator to ensure that the mass flow to the Injection System is maintained less than 1068 lbs/min (the limitation of the Injection System). The Adjustable Choke will be set to maintain the slurry flow within the operating range of the Chlorine Injection System (the Choke setting will be determined in Cold/Hot Testing).

The Calcium Hypochlorite solution will be injected into the piping manifold between Averaging Tank #1 and Averaging Tank #2. A Static Mixer downstream of the Injection Pump ensures effective mixing. The discharge from the Static Mixer enters the Chlorine Contact Chamber, which is sized (3600 Gal) and baffled to provide the minimum 30 minutes residence time required by the Treatability Study Report for effective chlorination. The Chlorinated slurry is then pumped to Averaging Tanks #2 and/or 3.

Attachment II addresses the specifics of Calcium Hypochlorite addition.

3.4.2 Ratio Control for Clarifier slurry addition in Tanks 2 & 3

When Clarifier material is to be added to the process stream, a suction device will collect the contents of the Clarifier, adding Dilution Brine as necessary to assist in transportation of the slurry. The slurry will be transferred to the Scalping Screen and collected in the 3600 gallon Holding Sump. Calcium Hypochlorite will be added to the Holding Sump in accordance with Attachment III. The Clarifier Holding Sump recirculation line will mix the Calcium Hypochlorite and slurry for a minimum of 30 minutes. A sample will be collected and analyzed for TSS. Once the sample has been collected, this volume will be processed as a batch without any additions.

The Clarifier slurry will be manually ratioed into Averaging Tank #2 or 3 such that the contribution of the Clarifier TSS will not exceed 5.7% by weight of the total TSS of tanks #2 and 3. An

overview of the procedure for mixing Clarifier slurry and C Pond slurry is presented in Attachment III (details of this procedure are found in Operating Instruction (O/I) # 438B).

3.4.3 TSS/TDS Control in Averaging Tanks #2/3

The TSS in averaging tanks #2 and 3 will be maintained below the acceptable upper limit by the addition of Dilution Brine (see Table 1). The TDS in the tank will also be kept below its acceptable upper limit by the addition of Process Water. These actions represent the initial "macro" adjustments to achieve TSS/TDS envelope requirements. Final trim, by the addition of process water to dilute a high TDS or TSS level (above the operating parameters), will be accomplished in the Batch Tanks located on 750 Pad.

Table 1 -- DILUTION WATER USAGE

TANKS	#1	#2 & 3	#4 & 5	#6 & 7
HIGH TDS	----	PROCESS WATER	PROCESS WATER	PROCESS WATER
HIGH TSS	----	DILUTION BRINE	PROCESS WATER	PROCESS WATER

Dilution Brine -- from surface water of Pond 207C.
Process Water -- from fire main at 750 Pad, hose bib at the 788 building

3.4.4 TSS/TDS Control in Batch Tanks #4/5 & 6/7

When the batch arrives from Averaging Tanks #2 and/or 3, into one of the Batch Holding Tank pairs, it is isolated as a discrete feed batch for stabilization processing. Each batch will be homogenized by recirculating pumps. The silt (TSS) and salt (TDS) loadings will be lowered, if necessary, to acceptable readings by the addition of process water. At this point no additional material will be allowed to enter the tankage system for the batch. The final measurements of TDS, TSS, and density are recorded. In the event the batch is not within the operating parameters, then additional dilution will be required as well

as homogenization and sampling, until the parameters are satisfied.

There is no requirement to totally empty a set of Batch Tanks in order to complete a batch. A batch will be considered complete once the discharge line is closed and the supply line is re-opened. Under normal circumstances a batch will be considered to be the contents of one pair of tanks.

3.4.5 Temperature Control

The temperature (TI-408) of the brine feed to the RCM is monitored and action shall be taken to terminate operations when the temperature of the slurry feed is below 50°F or above 100°F.

3.4.6 Control of RCM

The RCM mixes the feed slurry with the pozzolans using an Automatic Density Control (ADC) System which regulates the pozzolan feed via a throttling valve to achieve the desired product density. The RCM controller also maintains the slurry feed rate to the mixer to achieve the desired processing rate. The ADC requires input, via a manual dial, of the required output product density to maintain this control.

The feed slurry from the batch tanks is fed as a batch to the RCM. The throughput rate, output product density and the water to pozzolan ratio are not expected to change significantly from batch to batch. The Lab Supervisor will calculate the output product density, using a computer program that will be developed (and verified in accordance with HNUS's Site Specific QA Plan, Section 19 (Deliverable # 730)) from the equations in section 5.0 of the TSR. The input slurry density, the pozzolan density, the ratio of clarifier TSS to total TSS and the degree of air entrainment are the required inputs for the program. The output product density calculated by the program will be the set-point to which the ADC will control. The density of the output product slurry is controlled (by the ADC) using the feedback signal from the nuclear densometer in the recirculation line of the RCM.

Once the RCM output density is determined, the remaining variable that is required is the permissible operating range for the input slurry density. Even though the Batch Tanks will have been thoroughly homogenized, provisions need to be made for any abnormalities in the flow density readings from the Batch Tanks to the RCM, as measured by the incoming slurry densometer. For each batch an operating range for input slurry density will be provided which enables the output product to remain within the required w/p ratio. Appendix D describes the procedure to provide these ranges.

The Compupac operator will be monitoring both input and output densities during operations. Operations will be ceased if either reading is outside of the established operating parameters.

In the event the input density is outside of the range, he will inform the RCM Operator, who will immediately shut the valve for the incoming slurry. The material in the RCM will continue to be processed, since the amount of any slurry outside the operating window compared to the quantity in the RCM and grout loop will be minimal. Homogenization by circulation of the material in the RCM and grout loop will eliminate single point spikes at or below the operating parameter window established for incoming slurry density. The source of the slurry (set of Batch Tanks) will be isolated, and the alternate set of Batch Tanks will be brought on line in accordance with the O/I. The isolated set of tanks will be refilled and treated as a new batch; recirculated and sampled in accordance with the O/I.

If the Compupac operator observes deviation outside of the density range for the RCM output densometer, as compared to the ADC setting, the Casting Station and the RCM operators will be immediately notified. The Casting Station operator will cease filling the halfcrate until the RCM operator has made the necessary adjustments at the RCM and the output density densometer reads within the range associated with the value of the ADC density setting.

The cemented waste output of the RCM will be cast into a bladder placed in the half-crate. The bladder facilitates effective curing as well as minimizing Health and Safety concerns.

3.4.7 Density Control For Processing

The entire process will be controlled to an output product density, the calculation of which has been detailed in Appendix G of the Treatability Study Report. Some of the relevant details will be summarized here in this section. Three equations have been developed to calculate the output specific gravity. The cumulative error in the operation, including that inherent in the equation and those in the control instrumentation have also been quantified.

Pond 207C Processing
To cover all possible variations of pozzolan specific gravity, input slurry density and water to pozzolan ratios, the following equation (Equation 1) was developed for the output slurry specific gravity.

$$SG_{out} = 0.10743982ABC - 0.084269BC + 0.35896237AC + 0.31719081C - 0.65494AB + 0.594529B + 0.169365 + 2.23888A - 4.03501A^2 + 2.2348958A^3 \quad (1)$$

where A = Water to Pozzolan Ratio
B = Specific Gravity of Pozzolans and
C = Specific Gravity of Input Slurry,

The highest possible cumulative error in the control of the output specific gravity would be ±0.028 SG units if Equation 1 is used in its computation.

Since the process will be conducted at a water to pozzolan ratio of 0.42, output specific gravity can be expressed using the following simpler equation (Equation 2).

$$SG_{out}=0.4291364C-0.0123718BC-0.004024B^2C +0.147656+0.6015B-0.0474934B^2 \quad (2)$$

where B = Specific Gravity of Pozzolans and
C = Specific Gravity of Input Slurry,

The highest possible cumulative error in the control of the output specific gravity would be ±0.022 SG units if Equation 2 is used in its computation.

Pond 207C and Clarifier
An equation was also developed for the 207C/Clarifier mix. It covers all possible variations of pozzolan specific gravity, input slurry densities, and the percentage of Clarifier TSS that is part of the total TSS of the input slurry. This equation was developed using the same approach used to develop Equation 1 and 2. To simplify the equation, it was developed at a fixed water to pozzolan ratio of 0.42.

$$SG_{out}=5.9422E-5BCD-0.0388898BC-6E-5CD+0.46859C -4.484E-5BD+0.31666994B+4.55E-5D+0.571779 \quad (3)$$

where B = Specific Gravity of Pozzolans,
C = Specific Gravity of Input Slurry and
D = Clarifier TSS as a percentage of total TSS,

The highest possible cumulative error in the control of the output specific gravity would be ±0.022 SG units if Equation 3 is used in its computation.

Adjustment for Entrapped air
Mixing in the RCM introduces air into the cement slurry. This entrapped air can be measured using a pressurized mud balance, which effectively measures the specific gravity of the slurry after squeezing out all the entrapped air. The air introduced into the slurry by the RCM will be

measured at intervals to set the correction factor to compute the actual output specific gravity set-point.

For instance for a product with 5% entrapped air,

Actual Sp. Gr. Set-point =	Calculated Specific Gravity Set-point ÷ 1.05

The amount of entrapped air in the product is not expected to vary significantly during the process. Initially the test to measure entrapped air will be measured once every batch. If there is no significant variation in this value from batch to batch, the measurement can be reduced to once every operating day.

3.4.8 Critical Process Control Instrumentation

The Treatability Study Report determined the following parameters are critical to the process. These instruments which monitor these parameters shall be maintained and calibrated in accordance with HNUS site specific QAI-12, Control of Measuring and Test Equipment.

PARAMETER	LOCATION	DEVICE	BACK-UP	RECORDED BY
DENSITY	RCM INCOMING SLURRY #	DENSOMETER	ON-SITE LAB	COMPUPAC
DENSITY	RCM OUTPUT	DENSOMETER	ON-SITE LAB	COMPUPAC
TSS	BATCH TANKS	TEST SVI *	ON-SITE LAB	OPERATOR **
TDS	BATCH TANKS	CONDUCTIVITY METER	ON-SITE LAB	OPERATOR **

* SVI is the Sludge Volume Index Test, discussed in Section 7.1.

\# Densometer reading at the Batch Tank is the density of the slurry entering the RCM.

** Manual entry into Compupac.

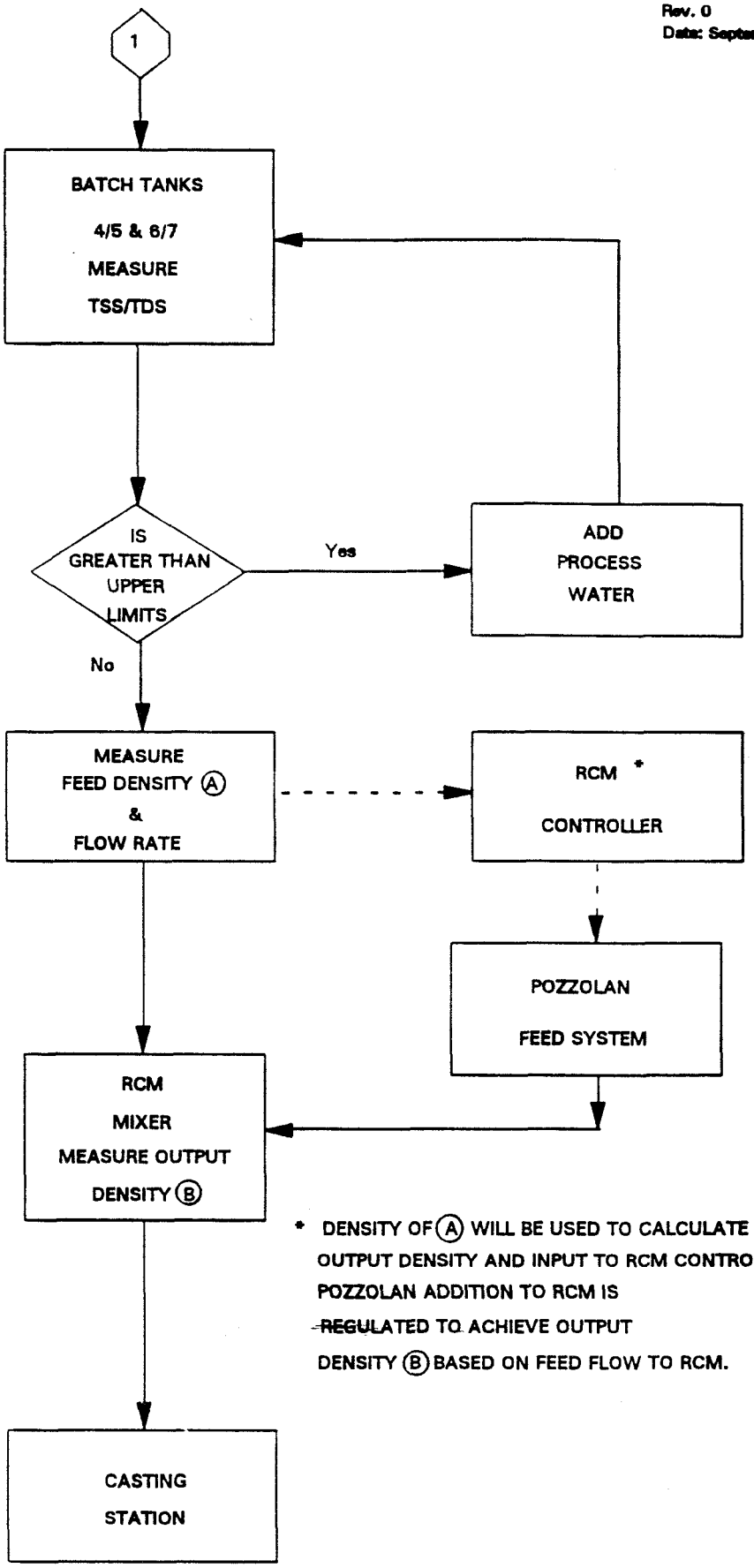
ATTACHMENTS:

Attachment # I - Pond 207C/Clarifier Process Control Flow Diagram

Attachment # II - Chlorine Addition Methodology

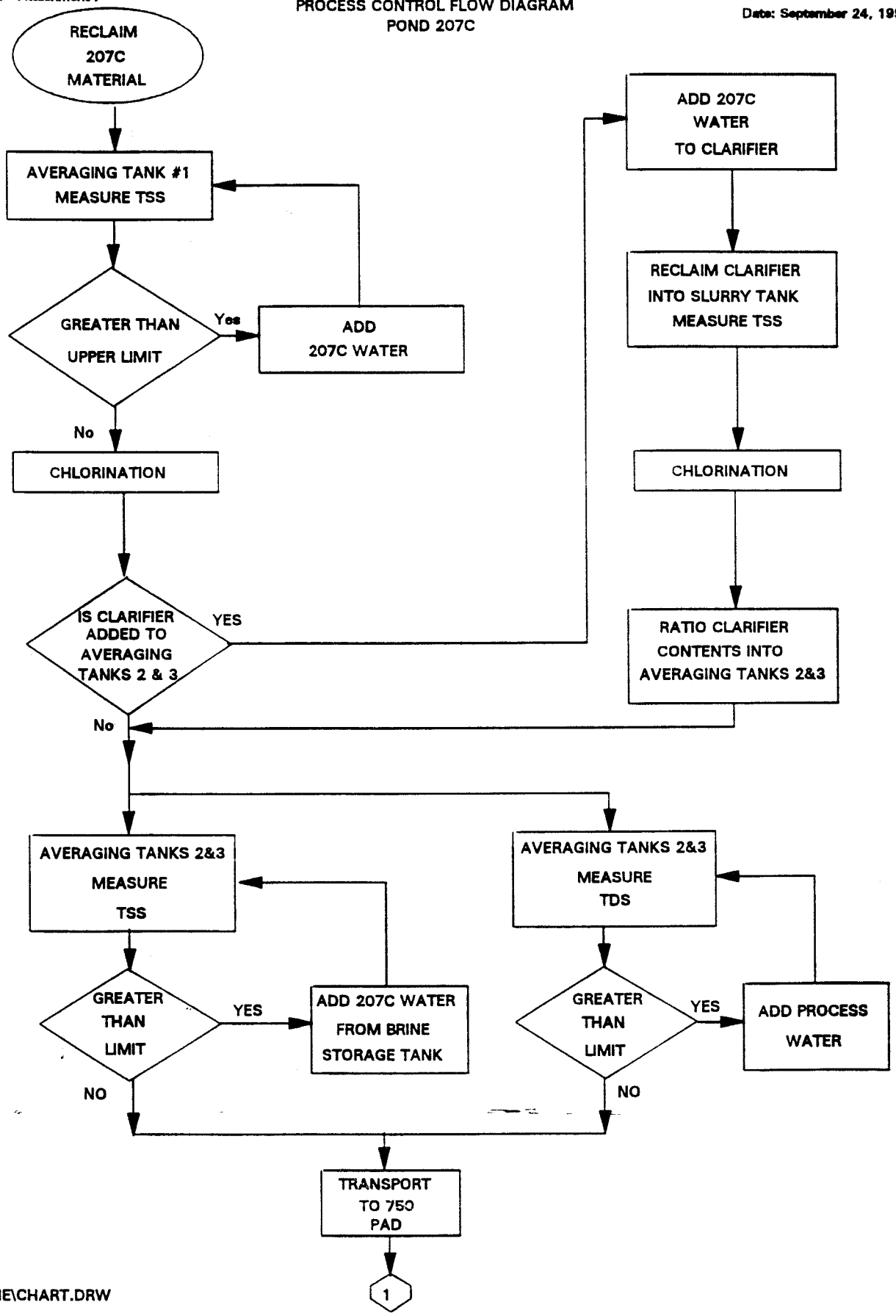
Attachment # III - Clarifier Slurry Mixing Procedures

PROCESS CONTROL FLOW DIAGRAM



* DENSITY OF Ⓐ WILL BE USED TO CALCULATE OUTPUT DENSITY AND INPUT TO RCM CONTROLLLER. POZZOLAN ADDITION TO RCM IS REGULATED TO ACHIEVE OUTPUT DENSITY Ⓑ BASED ON FEED FLOW TO RCM.

PROCESS CONTROL FLOW DIAGRAM
POND 207C



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SHEET 1 OF 2

ATTACHMENT II

CHLORINATION OF WASTE

Chlorination using Calcium Hypochlorite will be performed on:

- 207C supply from Averaging Tank #1,
- 207C supply to the Brine Dilution Tank, and
- the Clarifier.

For the three addition systems, two distinct methods have been utilized. The addition of Calcium Hypochlorite to the 207C supply from Averaging Tank #1, uses an in-process operation (via an Injection Pump) as described in Section 3.4.1.

The Chlorination of the Dilution Brine Tank and the Clarifier is effected by a batch method. The quantity of material is measured, and On-site lab tests and the equations of Sections B and C are utilized to determine the quantity of Calcium Hypochlorite to be mixed into the tank.

A. CALCIUM HYPOCHLORITE (CCH) ADDITION for POND 207C

The Calcium Hypochlorite will be added to the 207C Waste in the form of a 10% Calcium Hypochlorite solution. The following is a sample of the calculations that are involved in the calibration of the Calcium Hypochlorite solution addition pump and the controls.

KNOWN FACTORS/RATIOS:

Density of water (lbs/gal)	=	8.345
Pounds per ton (conversion factor)	=	2000 lbs/ton
Maximum flow rate	=	80 gpm
Max Sp. Gravity of slurry in 207C pond	=	1.6
Calcium Hypochlorite (CCH) requirement (determined in HNUS's Pitt. Lab *) Equates to CCH requirements of **	=	2000 ppm 6.15 lbs CCH per ton of slurry

CCH Manufacturer (OLIN) recommends:

Maximum solution concentration	=	10 %
Density of 10% CCH Solution	=	9.25 lbs/gal

* HNUS's Pitt. Lab has proven that 2000 ppm of 100% equivalent Calcium Hypochlorite results in at least a 1 ppm concentration of free chlorine after 30 minutes in solution.

** CCH solution contains 65% Calcium Hypochlorite

CALCULATIONS:

Upper Extreme Example:

Max Mass Flow of slurry = 80 gpm x 8.345 lbs/gal x 1.6
= 1068 lbs/min
or,
1068#/min ÷ 2000 #/ton = 0.534 ton/min

In order for a 10% by weight (10lbs Calcium Hypochlorite/100lbs solution) solution of Calcium Hypochlorite to form a 6.15 lbs/ton of slurry solution then:

$C_1M_1 = C_2M_2$

C_1 = Concentration of Calcium Hypochlorite in 10% solution by weight
C_2 = Concentration of Calcium Hypochlorite in final solution by weight
M_1 = Mass of 10% solution by weight
M_2 = Mass of final solution by weight

C_1 = 10 lbs/100lbs of solut'n = 10lbs x 1/100lbs x 2000lbs/1 ton
= 200 lbs/ton of solution
C_2 = 6.15lbs/1 ton of solution

M_1 = unknown mass

M_2 = 0.534 tons/min + M_1

Therefore the rate of addition of 10% Calcium Hypochlorite solution is:

$M_1 = C_2M_2 / C_1$ = 6.15 lbs/ton x (0.534 tons/min + M_1) ÷ 200 lbs/tons = .0164 tons/min + .0308M_1;

$0.969M_1$ = .0164 tons/min

M_1 = .0169 tons/min x 2000 lbs/ton

= 33.9 lbs/min

To determine the volume for addition:

At a Calcium Hypochlorite solution density of 9.25 lbs/gal:

33.9 lbs/min ÷ 9.25 lbs/gal = 3.66 gpm

Expected Specific Gravity Example:

The expected Specific Gravity of the 207C slurry is expected to be around 1.3. Performing the same calculations as before:

Flow rate of slurry = 80 x 8.345 x 1.3 = 868 lbs per minute

Therefore the mass rate of 10% Calcium Hypochlorite addition = 27.5 lbs/minute

Volumetric rate of Calcium Hypochlorite addition 27.5 ÷ 9.25 = 2.98 gpm

Chlorination System Calibration Considerations:

1. The injection pump is sized to cover the range of flow rates from 0 to a max of 3.87 gpm (nominal 4.0 gpm).

2. The density of the Calcium Hypochlorite solution will be verified for each batch that is mixed.

3. The addition of Calcium Hypochlorite crystals needs to be controlled in order to maintain the 10% solution by weight.

4. The injection pump will require volumetric calibration in accordance with the manufacturer's instructions.

5. The controller will have to be programmed for a fixed concentration of Calcium Hypochlorite in water. This requires a strict adherence to the 10% by weight concentration of Calcium Hypochlorite in water.

B. CLARIFIER CHLORINATION OPERATIONS -- OVERVIEW

1. Fill the Clarifier Holding Sump to 80% full. This will be 2880 gallons (tank is 3600 gallons; measure the volume using the tank level indicator).

2. Recirculate the tank for one hour.

   This is predicated on a flow rate of about 100 gpm (not specifically known since pump not selected and the density of the material is unknown). The pump that is

targeted should pump water about 200 gpm. Using a conservative flow rate of 100 gpm and a 2880 gallon tank, the turnover will be 29 minutes, therefore for 2 turnovers -- an hour will suffice; additionally the tank is agitated, so the turnover rate should be even higher.

3. Take physical samples for Density and TSS. The TSS Lab Analysis will be used to determine the amount of Clarifier slurry to be mixed with pond slurry.

4. Based on the density of the sample, calculate the amount of Calcium Hypochlorite that is required to achieve a concentration of 6.15 lbs of Calcium Hypochlorite per ton of Clarifier Slurry.

5. Add the solid Calcium Hypochlorite.

6. Recirc/agitate the holding sump for one hour.

SAMPLE CALCULATIONS:

Density of Clarifier Slurry = 10 lbs/gal (estimate)
Volume of Clarifier Slurry = 2800 gals.
Amount of Calcium Hypochlorite required to create 2000 ppm available Chlorine in solution = 6.15 lbs/ton of slurry

Therefore:
the Mass of Clarifier slurry = 2800 x 10 = 28,000 lbs
= 14 tons

Mass of Calcium Hypochlorite to be added = 6.15 x 14 = 86.1 lbs. of Calcium Hypochlorite

C. DILUTION BRINE TANK CHLORINATION OPERATIONS -- OVERVIEW

1. Fill the Dilution Brine Tank to 80% full. This will be 2400 gallons (tank is 3000 gallons, measure the volume using the tank level indicator).

2. Recirculate the tank for one hour.

This is predicated on a conservative estimate flow rate of about 100 gpm. At a flow rate of 100 gpm and a 2400

gallon tank, the turnover will be 24 minutes, therefore for 2 turnovers -- an hour will suffice.

3. Take samples for Density.

4. Based on the density of the sample, calculate the amount of Calcium Hypochlorite that is required to achieve a 6.15 lbs of Calcium Hypochlorite per ton of Clarifier Slurry.

5. Add the Calcium Hypochlorite.

6. Recirc the tank for one hour before using.

SAMPLE CALCULATIONS:

Density of Dilution Brine = 9 lbs/gal
Volume of Dilution Brine = 2400 gals.
Amount of Calcium Hypochlorite required to create 2000 ppm available Chlorine in solution = 6.15 lbs/ton of slurry

Therefore:
the Mass of Dilution Brine = 2400 x 9 = 21600 lbs
= 10.8 tons

Mass of Calcium Hypochlorite to be added = 6.15 x 10.8 = 66.4 lbs. of Calcium Hypochlorite

ATTACHMENT III

CLARIFIER SLURRY MIXING PROCEDURES

The Treatability Study Report establishes specific process criteria for the slurry solids contents. This criteria becomes somewhat complex when determining the amount of Clarifier slurry to blend with the C Pond slurry, as each one has a different limit for TSS as well as the combination. In order to satisfy these requirements, a computer program will be used, which compensates for the TSS and TDS of the Clarifier Slurry and 207C Slurry and calculates the optimum amounts to be mixed together so that the mix will be within the confines of the operating envelope. This program also estimates the amounts of dilution brine and/or process water to be added.

The detailed steps to conduct the following operations are found in Operating Instruction 438B.

The steps to prepare a satisfactory mixture of 207C Pond and Clarifier are:

1. Is Clarifier Slurry to be added?

   If no, proceed to step #2. If yes, proceed to step #5.

For 207C Pond only:

2. Fill the Tank (Averaging #2 or 3), with Pond 207C slurry from the Chlorination Injection system, to approximately 80% capacity (2000 gallons each). From the mass flow meter, determine the slurry mass transferred to the tank. Recirculate (for homogeneity) the tank to determine TSS and TDS.

3. Input TSS, TDS and Mass values into the program to determine the amount of Dilution Brine/Process Water (if any) to be added.

4. Add the requisite quantity of Dilution Brine/Process Water to Averaging Tank # 2 or 3.

For 207C Pond and Clarifier:

5. Fill Averaging Tank #2 or 3 with ~~207C~~ Pond slurry to approximately 60 to 70% of tank capacity. Determine the slurry mass transferred to the Tank. Recirc the Tank to determine TSS and TDS.

6. After the Clarifier Holding Sump has been Chlorinated, recirculate it and measure TSS and TDS.

7. Input Pond 207C's: TSS, TDS and Mass values and the Clarifier's TSS and TDS values into the computer program, to determine the amount of Clarifier slurry and Dilution Brine/Process Water (if any) to be added.

8. Add the requisite quantity of Clarifier slurry and Dilution Brine/Process Water (if required) to Averaging Tank # 2 or 3.

The following page provides the format for a computer form which shall be utilized in the determination of the mixing ratios. The substantiation for the formulation is found in Appendix G of the Treatability Study Report.

POND 207C/CLARIFIER RATIO MIXING CALCULATION FORM

INPUT REQUIRED:

FROM POND 207C:

MASS PUMPED TO AVERAGING TANK # 2/3 (lbs): _____

TSS: _____

TDS: _____

CLARIFIER:

TSS: _____

TDS: _____

[Enter the above factors into the computer program at the On-site Lab to determine the quantity of Clarifier slurry and dilution brine/process water (if any) to be added to Averaging Tank #2/3.]

COMPUTER PROGRAM OUTPUT:

The following amounts will have to be added to the averaging tanks 2/3:

Clarifier slurry (lbs) _____

Dilution Brine (lbs) _____

Process Water (lbs) _____

Date

Time

****

Values Input by:

_____ _____
Lab Technician Date

Values checked by:

_____ _____
Lab Supervisor Date

Noted by HNUS Processing Supervisor: _____ _____
Date

ATTACHMENT IV
OUTPUT DENSITY CALCULATION FORM - POND 207C (Equation 2)

DATE: _____ BATCH #: _____ SAMPLE LOCATION: _____

$$SG_{out} = 0.4291364C - 0.0123718BC - 0.004024B^2C + 0.147656 + 0.6015B - 0.0474934B^2 \quad \textbf{(2)}$$

where B = Specific Gravity of Pozzolans and
C = Specific Gravity of Input Slurry,

(1)	SPECIFIC GRAVITY OF POZZOLANS { from test of date: _____ } (B)	
(2)	LINE (1)X 0.6015	
(3)	DENSITY OF INPUT SLURRY, lb/gal {densometer measurement of date/time: _____/_____ }	
(4)	SPECIFIC GRAVITY OF INPUT SLURRY = LINE (3) ÷ 8.345 (See Note) (C)	
(5)	LINE (4) x 0.4291364	
(6)	LINE (2) + LINE (5) + 0.147656	
(7)	LINE (1) X LINE (4) (BC)	
(8)	LINE (7) X (-0.0123718)	
(9)	LINE (1) X LINE (1) (B^2)	
(10)	LINE (9) X (-0.0474934)	
(11)	LINE (9) X LINE (4) (B^2C)	
(12)	LINE (11) X (-0.004024)	
(13)	OUTPUT SPECIFIC GRAVITY = LINE (6) + LINE (8) + LINE (9) + LINE (12)	
(10)	OUTPUT DENSITY, lb/gal LINE (9) X 8.345 (See Note)	

Calculations: Performed by Lab Tech: _____ Date: _____
Checked by Lab Supervisor: _____ Date: _____

INSTRUCTIONS: This form has a dual function. It can be used as a manual calculation form to determine the output density. Alternatively, the data can be input directly into the computer program, resulting in automatic calculation of the output density.

NOTE:
To convert between density in pounds per gallon and specific gravity, the conversion factors 8.345 pounds/gallon.

3.5 EQUIPMENT AND PROCESS VERIFICATION AND VALIDATION

The Site Specific QA Plan (SSQAP) will be followed to document the operational controls and the quality of the process. Each of the following phases will have incorporated into the Operating Instructions specific check sheets to meet the requirements of the SSQAP; Section 9 (Implementation Plan) of this PCP, designates responsible parties.

3.5.1 Installation Phase

The equipment arrives on site subject to receipt inspections for overage, shortage and shipping damage. After inspection the equipment is installed by either: the equipment supplier, a sub-contractor or HNUS.

3.5.2 Inspection Phase

The installation of each piece of equipment is validated to be in accordance with the manufacturer's requirements, the construction drawings. B&R/HNUS equipment Check-out Procedures are signed off by the HNUS designated representative as part of the equipment Check-Out. Any deficiencies require correction prior to advancing to the SO Test.

3.5.3 System Operational Test (SO Test)

This System Operational Test (SO Test) defines the pre-operational test requirements for Pond 207C/Clarifier operations utilizing process water.

Operating Instructions (O/I), Deliverable # 438B for C Pond/Clarifier waste processing and # 316 for the On-site Lab O/I, will be used as the operating basis for conducting the SO Test. Specific requirements (outside the scope of normal operations) will be detailed in the procedure; eg, deviations, modifications, or supplementary requirements. All O/I required documentation and records shall be maintained.

This test will contain the following elements:

- system operations for final check out of the operating instructions, including manual data gathering per operating log sheet,

- personnel training final qualification,

- data acquisition/instrumentation functional check-out, in accordance with the PCP,

- communication control functional check-out, and

- integration of sampling and the tests of the On-site lab O/I's.

Appendix A to the SO Test, supplied by EG&G, will specify the necessary data requirements for purposes of system qualification.

3.5.4 Equipment Check-out Phase

Check out is a prerequisite to the Systems Operational Test (S.O. Test -- Deliverable #439A). The check out phase is for the purpose of validating individual equipment operation, for example: the jogging of a pump/motor to ensure proper rotation, and the testing of the integrity of the systems with a pressure test.

When all equipment is determined to be ready for operation (by completion of Appendix C of the SO Test, titled: Master Listing of Equipment Check-out Sign-off Sheets) and the Pond 207C Process Train Operating Instructions (O/I's) are approved, the system is ready for the S.O. Test.

3.5.5 Systems Operations (SO) and Hot Test phases

The SO Test (439A) is the first time the process train is operated as a system. The test is conducted with process water, not waste. Testing also demonstrates that the controls, instrumentation and O/I's support maintaining all process parameters within defined acceptable limits. During operation of the SO Test, the O/I is demonstrated to be effective/correct, or shall be officially changed. The SO Test shall contain all test requirements for this phase. Data obtained during this phase will contribute to interim qualification as specified in Appendix A of the SO Test.

Any problems identified (either equipment or procedures) will be corrected and the S.O. Tests

successfully re-done before moving to the next level of testing. However, discrepancies identified in either the operations or instructions associated with the SO Test, which have no impact on process qualification will not require repeating a portion of these tests. Agreement to this exception must be made in writing by HNUS and EG&G.

Upon satisfying all the objectives of S.O. Testing, HNUS shall request written permission from EG&G to conduct actual waste operations with the process train. Upon receiving a written notice to proceed, HNUS will commence waste processing.

Hot Testing will be the initial phase of actual waste operations for this process and the objectives are defined in Appendix A of SO Test #439B. These operations will commence under interim qualification status awaiting long time duration test results from the SO Test (Cold) 439A and the tests associated with SO Test (Hot) #439B.

3.5.6 Operations Phase

The equipment must be operated strictly in accordance with the approved O/I.

In order to ensure timely and accurate logging of pertinent data, a data acquisition system (Compupac) that is a normal operating partner to the RCM system will be utilized. This device will record the pertinent automated data points at fifteen second intervals. The information to be recorded and printed out on the Operational Traveler Record (OTR - Attachment II) and the Batch Summary Report (Attachment IV) will consist of:

1. Incoming temperature of slurry to the RCM.
2. Incoming density of slurry to the RCM.
3.* Batch tank readings (4/5 or 6/7) of Total Dissolved Solids (TDS), Total Suspended Solids (TSS).
4. Output density of the product to the casting station.
5. Time (hours, minutes, seconds) and date of the readings.
6.* Sequential Batch number (unique) for the 3-4 hours of casting.

7. Cumulative flow rate of slurry to the RCM for each distinct batch.
8.* Data field in which waste source of the slurry will be annotated (C Pond material or C Pond Clarifier blend).
9.* Data field to input the output density operating window.
10.* RCM manual density setting.
11.* Event marker for manually keying data; e.g., start/stop of filling halfcrate.

NOTE:
* ==> Manually input information to the Compupac at the time of the event.

At the end of each day, the Compupac operator will provide two electronic discs (floppies -- 3.5", high density) with the total day's operational information. EG&G-QA will be provided one copy. In order to effectively present the data for each halfcrate, the second copy will be transferred to the HNUS off-site office for input into reports called an Operational Traveler Record (OTR) and a Batch Summary Report. These two documents will be transferred to EG&G within 36 hours of casting the respective halfcrate, to demonstrate the halfcrate's production basis relative to the operating parameters.

The OTR for each halfcrate will present the process operating parameter requirements, as well as each recorded parameter for that halfcrate/batch.

For documentation purposes, master files will be established in the HNUS off-site office. Each halfcrate will be filed by its batch number, which will be the controlling element for maintaining an auditable record. Attachment III illustrates the make-up of the Batch File, consisting of:

- the OTR for each halfcrate in the batch,
- the complete Data Tables from the batch ,
- the laboratory sample reports from both the On-site and Off-site (the results of the Off-site lab tests will take several weeks) labs,
- chain of custody logs for samples sent to the Off-site Lab, and
- a control sheet that will acknowledge receipt of the various documents and that the file is

satisfactorily completed.

These files will be turned over to EG&G upon completion of the project, or as requested by EG&G.

The on-site Operations Center will also maintain, as necessary, a copy file of the OTR's and associated documents for purposes of process monitoring.

3.5.7 Inspection Phase

The waste product is tested by sampling of the product at the casting station. Samples are taken and tested in accordance with Section 7.

Any halfcrate rejects are segregated from the normal process at Station Six according to Waste Inspection procedures. Those that are later determined to meet the applicable standards by Waste Inspection are returned to the normal process. Those halfcrates that cannot be certified will be labeled in accordance with the SSQAP and segregated for later re-processing. In the event that Phase 3 of the HNUS/EG&G contract is not executed, HNUS is relieved of the responsibility to reprocess the rejects.

3.5.8 Verification

Instrumentation, periodic sampling and lab analysis are the means of verifying that the process is operated within the defined parameters.

TABLE 3.5.1 VERIFICATION PROGRAM

Parameter	Instrument or Sample	Point of Measurement or Sample	Instrument Type or Responsible Party
• **Pozzolan Mixture** -- Mixture will be pre-blended off site in accordance with the procedures of Appendix E.			
- Specific Gravity	Mill Cert's	Batch Plant Delivery	Material Supplier
- Blend Composition	Instrument	Blending	Weigh Scale
	Sample	RFP Delivery	Independent Lab
- Blend Sp. Gravity **	Sample	RFP Delivery	On-site Lab Analysis
• **Slurry Feed to RCM**			
- Flow Rate	Instrument (FI-409)	RCM Mixing Pump Disch.	Mass Flow Meter
- Total Dissolved Solids (TDS)	Instrument (AI-333)	Batch Tanks	Conductivity Meter
- Density of Incoming Slurry	Instrument (AI-490)	RCM Mixing Pump Suction	Nuclear Densometer
- Temperature	Instrument (TI-408)	RCM Mixing Pump Disch.	Thermocouple
- Total Suspended Solids (TSS)	Sample	Batch Tanks	On-site Lab
• **RCM Output Density**			
- Density	Instrument (AI-413)	RCM Output	Nuclear Densometer

** The pozzolan specific gravity will be a factor in the formula to determine the RCM output product density, and is not a verification test

The process is impacted by the Water to Pozzolan (W/P) Ratio through the formula that determines the output density set point for the ADC of the RCM. Even though the W/P Ratio cannot be directly measured, the output density which is measured by a nuclear densometer (recorded by the Compupac) in the grout loop as well as by physical samples, will provide the necessary verification that the correct W/P Ratio is maintained.

Product samples will be collected at the discharge of the RCM and handled in accordance with Section 7.0. Test results of samples that fail the defined operating parameters will trigger an immediate evaluation by the HNUS Processing Supervisor to verify that the process is operating within the specified envelopes. Corrections will be made when necessary.

Appendix C (2) contains the relevant instrumentation and sampling points required for verifying process operations.

3.5.9 Product Qualification

Product certification is an EG&G responsibility based upon the EG&G Waste Certification Program. This PCP identifies those items which HNUS is responsible for providing to EG&G to support the Waste Certification Program. **The contents of a halfcrate is the smallest volume of stabilized waste that requires certification.**

In order to meet the project's goal of providing EG&G the ability to certify each halfcrate, a data acquisition system has been employed, capable of measuring various elements in the process. However, the final qualification is whether the overall density of the processed waste in the halfcrate falls within the necessary envelope (provided the input slurry and pozzolans are documented to have remained within the specified operating envelope(s)). Determining the overall density of a halfcrate necessitates measuring the halfcrate's input feed density in discrete

be made when necessary.

Appendix C (2) contains the relevant instrumentation and sampling points required for verifying process operations.

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Chlorination effectiveness is established in accordance with the Treatability Study Report, such that:

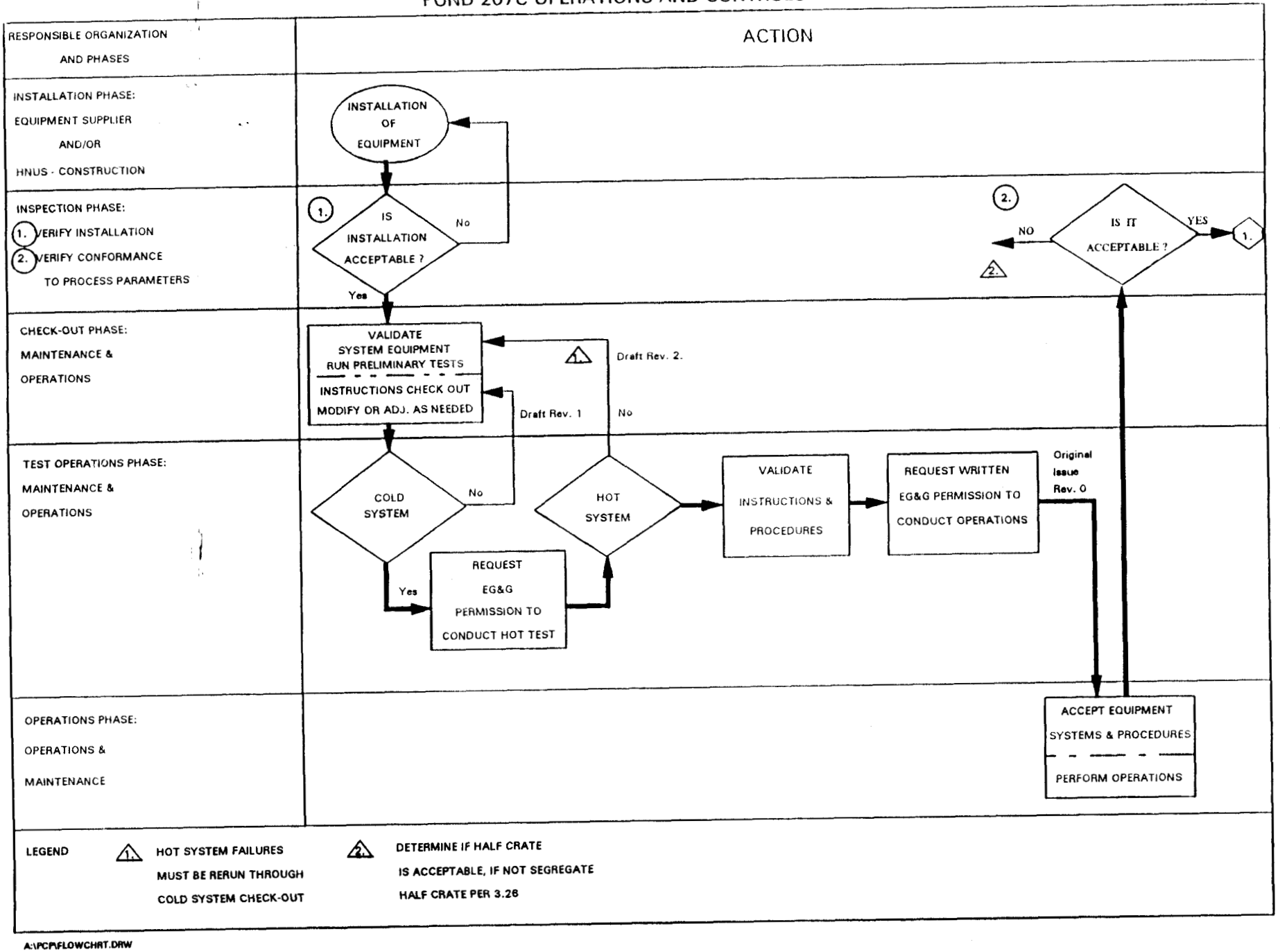
- the prescribed quantity of Calcium Hypochlorite will be added to a given quantity of solution/slurry, and
- a 30 minute residence time provided to allow for effective contact.

ATTACHMENTS:

I. OPERATIONS AND CONTROLS -- FLOW CHARTS
II. SAMPLE OTR
III. DOCUMENT CONTROL FILE ILLUSTRATION
IV. SAMPLE BATCH SUMMARY REPORT

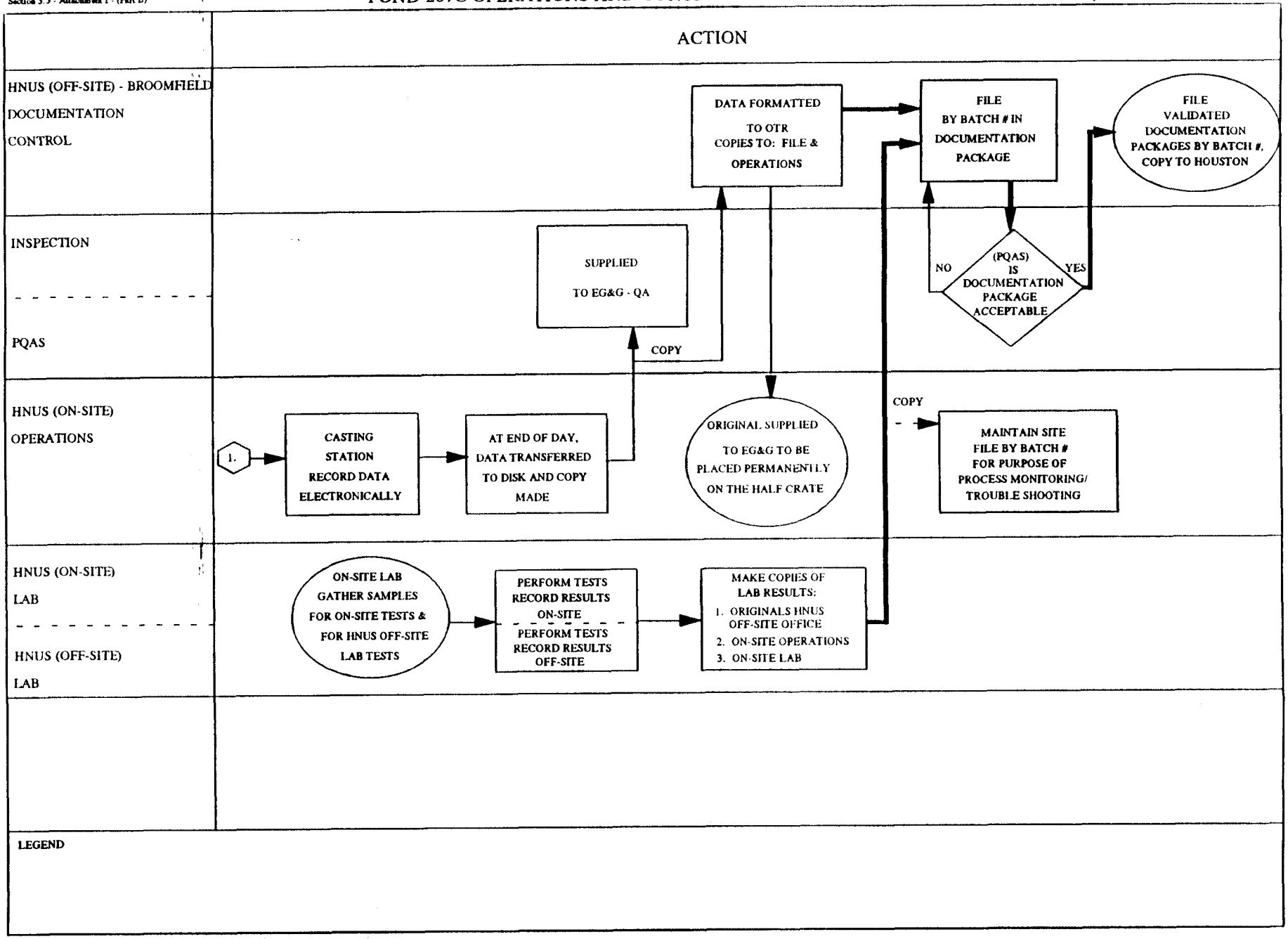
FLOW [redacted] RT

POND 207C OPERATIONS AND CONTROLS



A:\PCP\FLOWCHRT.DRW

FLOW CHART
POND 207C OPERATIONS AND CONTROLS



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ATTACHMENT II -- SAMPLE OTR

SOLAR PONDS SOLIDIFICATION PROJECT
ROCKY FLATS PLANT
OPERATIONAL TRAVELER RECORD

_____ Processing

date _____

Batch # _____ Sequence # __

Halfcrate # _____

Casting Time: Start __:__:__ Finish __:__:__

Reference Procedure: _____

Data Directory: _____

PARAMETER	ENVELOPE	ACTUAL
Input Slurry to RCM:		
TDS	0.00 - _____ (%)	__.__ (%)
TSS	0.00 - _____ (%)	__.__ (%)
Temperature	50.0 - 100.0 (Deg F)	AV _____ HI _____ LO _____
Density	____ - _____ (lb/gal)	AV _____ HI _____ LO _____
RCM Output Product:		
Temperature	_____ - _____ (Deg F)	AV _____ HI _____ LO _____
ADC Density Set Point	N/A	_____ (lb/gal)
Actual Density	___ - ___ (lb/gal)	AV _____ HI _____ LO _____

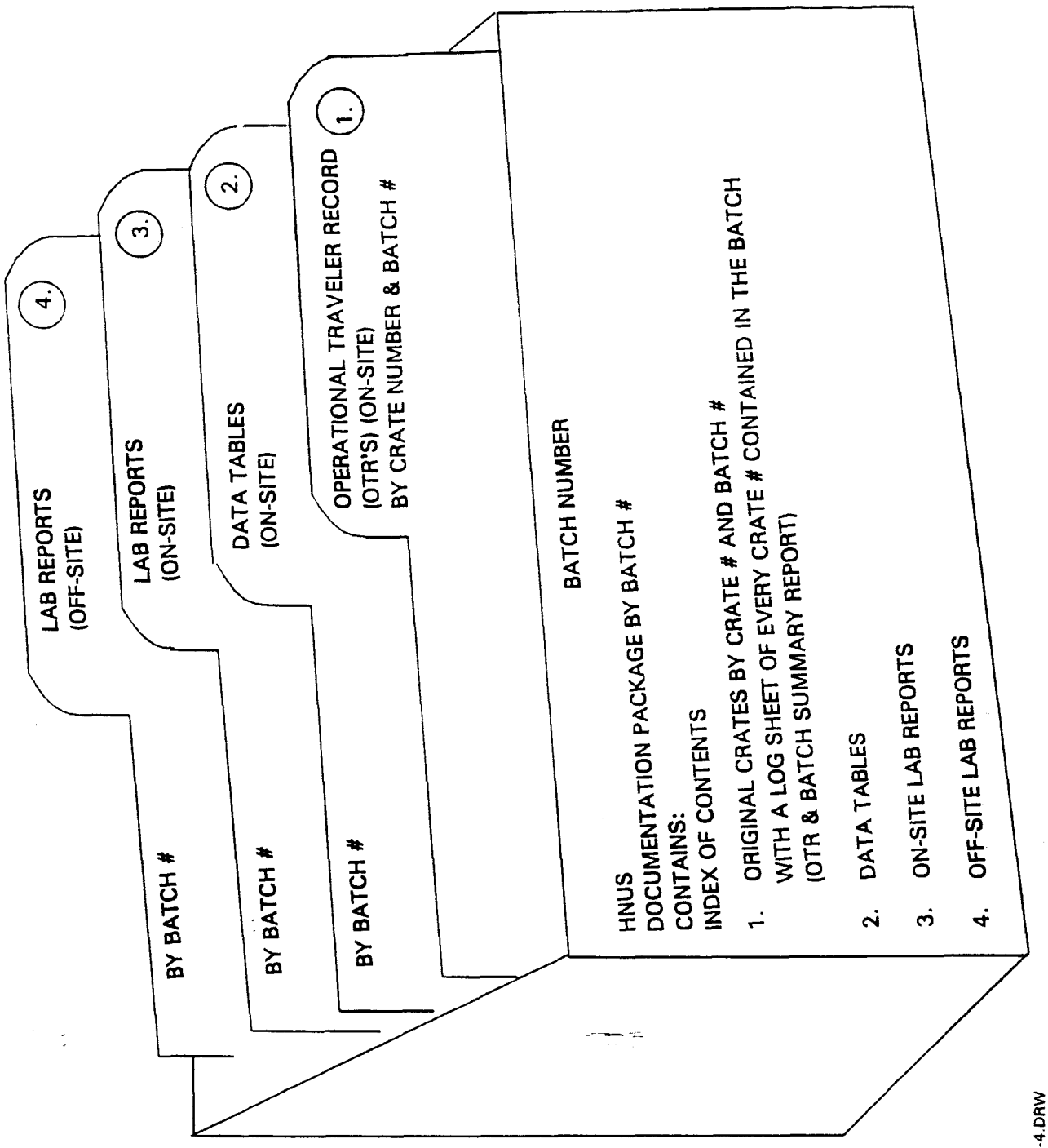
Distribution: Original - HNUS File, Copy to: On-site Lab File and HNUS PQAS

(FORM 253.001)

Controlled Program # ____

Version # _____

DOCUMENT CONTROL FILE ILLUSTRATION



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ATTACHMENT IV -- BATCH SUMMARY REPORT SAMPLE

SOLAR PONDS SOLIDIFICATION PROJECT
ROCKY FLATS PLANT
BATCH SUMMARY REPORT

_____ Processing

19-Aug-1992

Batch # _____

Start Time 16:04:01 End Time 16:04:56

Total Waste Slurry Treated 165 (gal)

Halfcrate #	Start Time	Stop Time	Elapsed Time
207C-6-12-001-1	16:04:14	16:04:29	00:00:15
207C-6-12-001-2	16:04:39	16:04:47	00:00:08
207C-6-12-001-3	16:04:47	16:04:56	00:00:09

REMARKS ABOUT JOB:

_____

_____

_____

_____

3.6 SUMMATION OF OPERATING PARAMETERS

The 207C/Clarifier Process will be operated within the operating parameter ranges indicated below: For purposes of this Process Control Plan the following definitions apply:

- Envelope parameters -- those parameters defined in the Treatability Study Report to establish a product is qualified.
- Operating parameters -- those envelope parameters which have been reduced by anticipated accuracy errors of instruments (or lab tests) which control the process.

Parameters	Envelope Parameters	Instrument Accuracies	Operating Parameters	Remarks
• Slurry Temperature:	50°F to 100°F	0.1% Full Scale	51.5 to 98.5°F	Section 3.4.5 refers.
• Water to Pozzolan Ratio:	.34 to .50	(NA)	.34 to .50	Section 3.3 refers.
• Limits for TDS:				
Pond 207C:	0 to 40.4%	(TBD)	(TBD)	Section 3.3 refers.
Pond 207C/Clarifier:	0 to 34.6%			
• Limits for TSS:				Section 3.3 refers.
Pond 207C only:	0 to 17.2%	On-site	0 to 17.2%	
Clarifier:	0 to 5.7%	Lab	0 to 5.7%	
Total TSS 207C/Clar.:	0 to 11.6%		0 to 11.6%	
• Maximum half crate weight:	4350 lbs	(NA)	4350 lbs	Contents only - EG&G Responsibility
• Pozzolan composition (#) (cement-type V:flyash-type C:lime):				Blending will be conducted in accordance with Appendix E; and validated by an independent testing lab. Ratios from Table 3-24 (page 3-62) of Treatability Study Report
Pond 207C:	1/1.2/0.05 to 1/3.34/0.09	Scale accuracy	(TBD)	
Pond 207C/Clarifier:	1/0/0.022 to 1/2/0.077			

Parameters	Envelope Parameters	Instrument Accuracies	Operating Parameters	Remarks
• RCM Incoming Slurry Density: Specific Gravity of Waste Slurry:	8.345 to 12.518 lbs/gal 1 to 1.5	± 0.15 lbs/gal	8.495 to 12.36 lbs/gal	Refer to Section 5.0 of the Treatability Study Section Report.
• RCM Output Density: Specific Gravity of Waste:	14.0 to 22.0 1.68 to 2.64 lbs/gal	(NA)	(NA)	Source: Halliburton Services "RCM Mixing System" G-9102(Revised).
• EPA/DOT test frequencies:	(NA)	(NA)	(NA)	See Section 7.1
• Halfcrate Handling Time:	0 to 2 hours	(NA)	0 to 2 Hours	EG&G has the responsibility to handle the halfcrate in accordance with the cure time constraints. The 2 to 48 hours is the time the halfcrate must remain stationary.
• Halfcrate Immobilization Time:	2 to 48 hours	(NA)	2 to 48 hours	
• RCM Mixing Time:	(NA)	(NA)	(NA)	RCM mixing/residual time within the operating frame work will have no adverse impact on the final product.However from operational considerations HNUS will not operate the RCM with a given load for greater than 90 minutes.

All other operating parameters established within EG&G's Certification Program will be the responsibility of EG&G.

(#) A super plasticizer (Modified Lignosulfonate, Halliburton Part # 516.006410) will be added to the pozzolan mixture at the bulk mixing plant by 0.1% by weight of the total weight of pozzolans.

NA Not Applicable

TBD To Be Determined

3.7 EMERGENCY SHUTDOWNS

There are a number of scenarios for which operations will have to be terminated. The time available to effect shutdown (immediately to 15 minutes) may vary, depending on the reason for the shutdown. Two different options are available to the operators dependant upon the type and the expected duration of the shutdown. These options are:

- Evacuate (dump) the pipelines (containing wetted cement) and the RCM into halfcrates.

- Flush (using the Batch Tank(s) or Process Water as a source of flushing material) the pipelines and RCM into the Batch Tanks.

Operating Instruction 438B includes provisions for these options.

The types of emergency shut downs that can be anticipated are:

- High winds.
- Weather alert.
- Security alert.
- Electrical failure.
- Mechanical failure.
- Personnel hazard/injury.
- Data logging system failure.

Emergency shutdowns will not be considered as non-conformances to the Operating Parameters. Any out-of-spec materials resulting from an emergency shutdown will either be incorporated back into the processing train or segregated for later reprocessing. These will be considered as operational requirements in lieu of violations to the Operating Parameters as established within the Statement of Work.

4.0 PROCESS AND EQUIPMENT QUALIFICATION

The SO Test and Hot Test will (as discussed in Section 3.2.5) provide the basis for formal qualification of both the process (as specified in the Treatability Study Report), personnel and equipment qualifications. The process will ultimately be qualified per EG&G WQE (Waste Quality Engineering) in accordance with a EG&G Waste Operations (WO) procedure for inspection/test verification for compliance with the critical parameters.

SLUDGE RECLAMATION

Pond sampling programs have been performed to determine the character and distribution of the sludge, crystals and brine in Pond 207C. This data was used to qualify the type of equipment and the system configuration required to reclaim (discussed in detail in Appendix F) and process the waste.

Equipment criteria for acceptable qualifications for reclaiming the sludge material include:

1. Adequate system safeguards to protect the environment, the general public and the workers.

2. Containment structures of adequate size and design that are integral to each unit or can be designed as a component of unit.

3. Piping systems complying with piping system requirements as established by 6CCR 1007-3 Part Y.

Pond contents are reclaimed at a sufficiently high rate to suspend solid particles as large as 1" in the fast moving slurry. This reduces the chance that solids will settle and plug the reclamation pipeline or be incapable of being collected and transported in the process train.

Stabilization criteria require that the size of the solid waste particles in the stabilized sludge does not exceed 10 mesh. Dilution equipment to dissolve any salt particles in the pond as well as screen separation equipment are incorporated in the reclamation system to comply with this requirement.

CHLORINATION AND CONDITIONING

The sludge is Chlorinated in order to destroy any biological agents (pathogens) and thus provide personnel protection. NVO 325 stipulates that no pathogens are allowed in the final waste form. Proven technology commonly used in the

waste-water treatment industry is used in the chlorination of the Pond 207C and Clarifier contents. The Chlorination system consists of a contact chamber and Calcium Hypochlorite delivery equipment. Chlorine concentration is maintained in the sludge greater than 1 ppm for thirty minutes. Chlorination is addressed in detail in Section 3.4.

DILUTION AND AVERAGING

The stabilization formulations impose limits on the amount of dissolved and suspended solids present in the sludge. Averaging and Batch Tanks are used to blend feed streams and adjust the TSS and TDS levels as necessary. Pond 207 C Brine or process water is used to dilute 207C/Clarifier sludge containing high dissolved solids or high suspended solids to within defined acceptable limits.

SLUDGE STABILIZATION

Pond 207C and Clarifier contents are stabilized as durable cement mixtures prepared according to approved formulas/recipes which were the result of considerable laboratory experimentation. The Treatability Study Report documents this laboratory work. Mixing of the sludge with stabilization reagents (pre-blended pozzolanic materials) occurs in a Recirculating Cement Mixer (RCM). The RCM system has demonstrated the ability to handle difficult-to-mix thixotropic slurries at varying densities.

SPECIFICATIONS FOR HOT & COLD WASTE STABILIZATION OPERATIONS

Temperature considerations for hot and cold extremes shall be observed during operations, from pre-operations to post operations. Brown and Root Project Specifications 000-062-00-001 (incorporates ACI Standard 306R-90) and 000-062-00-002 (incorporates ACI Standard 305R-89) for cold and hot weather (respectively) apply.

5.0 PERSONNEL QUALIFICATIONS

The training requirements for the personnel on this project are summarized in the following table:

Category I Administration (Red Badge Personnel)	Category II Erection	Category III Operators/Maintenance/Lab	Category IV Field Surveillance (No "hands-on" work)
Access to RFP	Access to Protected Area during Construction Phase (Non-RCA)	Access to Protected Area during Operations Phase (RCA)	Access to Protected Area during Operations Phase (RCA) (4)
Subcontractor GET (6)	Subcontractor GET (6)	Subcontractor GET (6)	Subcontractor GET (6)
RCRA Hazardous Waste Training Checklist	RCRA Hazardous Waste Training Checklist	RCRA Hazardous Waste Training Checklist	RCRA Hazardous Waste Training Checklist
RCRA Hazardous Waste Training CBT	RCRA Hazardous Waste Training CBT	RCRA Hazardous Waste Training CBT	RCRA Hazardous Waste Training CBT
Computer Security For Users (7)		Computer Security For Users (7)	Computer Security For Users (7)
	Nuclear Materials Safeguards CBT (1)	Nuclear Materials Safeguards CBT (1)	Nuclear Materials Safeguards CBT (1)
	Building Indoctrinations	Building Indoctrinations	Building Indoctrinations
	Hazard Communications CBT (3,5)	Hazard Communications CBT (3,5)	Hazard Communications CBT (3,5)
		Respirator Indoctrination (CBT/Fit) (2,5)	
		Radiation Worker Level II	Radiation Worker Level I
		Radioactive Waste Generator Training and Qualification	
	Hearing Conservation (3,5)	Hearing Conservation (3,5)	Hearing Conservation (3,5)

(1) Per 1-1000-TUM 02.03 NMS is required for personnel needing regular, unescorted access to the PA. Therefore, this course is not required for personnel who are escorted by a L or Q cleared escort having the NMS training.

(2) Respirator Indoctrination (CBT/Fit) is required before one uses a respirator. Equivalent respirator training and fit can be used to substitute for "Respirator Indoctrination (CBT/FIT)" with approval of the H&S Liaison Officer. Respirator Indoctrination training typically will not be needed until after initiation of "hot" systems operations tests, and then only for workers who must actually use a respirator to perform a job task.

(3) Required per OSHA regulations.

(4) Required training must be met by the escort, escortee, or combination thereof.

These requirements may be met by providing documentation of applicable training courses meeting OSHA requirements.

NOTICE:

The following page has been misnumbered when originally printed. No pages are missing from this document.

The Administrative Record Staff

(6) The Fire Extinguisher portion of GET Training must be updated on an annual basis.

(7) Required for anyone using a DOE-owned computer.

Note: All subcontractor personnel in Categories II, III, and IV will receive training (to be provided by their respective employer) to meet the requirements of OSHA 1910.120 for Hazardous Waste Operations. Special courses may be required based on job description (e.g. Electrical Safety, CPR, LO/TO, Computer Security).

The document "Qualification of Processing Crews" Rev 0 of August 21, 1992, addresses the specific operator training requirements. This is attached as Appendix D.

6.0 INSPECTION, TESTING AND EXAMINERS

All inspections and tests will be conducted in strict compliance with the site specific QA manual (WBS #730).

All personnel qualified to conduct inspections or tests will have completed the HNUS Quality Training Course and any Quality Training necessary to perform the assigned task. This may consist of on-the-job training (OJT).

Personnel performing inspections and testing activities shall not review their own work or areas that they are responsible for.

7.0 SAMPLING and ANALYSIS PLAN

This section outlines the sampling methodology and provides details on the on-site laboratory.

7.1 SAMPLING PROGRAM FOR POND 207C/CLARIFIER PROCESSING

During the processing of Pond 207C/Clarifier, sampling and analysis of feed and product will be conducted for:

- Instrument Verification
- Product Testing
- Process Monitoring
- Response to Problem Analysis Efforts
- Density measurements for chlorination addition determinations
- Clarifier mixing ratio

SUMMARY TABLES OF SAMPLING REQUIREMENTS

TABLE 7-1

Product Sampling (for testing)

1. Sample taken for **Process Certification** - 17 samples (each for 7 cylinders) randomly taken (no more than 1 sample/batch).
   - TCLP Metals (analyzed off-site)
   - TCLP Organics (analyzed off-site)
   - Paint filter (on-site)
   - Paint Can (on-site)
   - UCS test for correlation purposes only (on site)
   - 2 cylinders shall be maintained on site as future TCLP back-up for tests.

2. Every batch:
   Sample taken for **Process Monitoring** - 1 cylinder
   - UCS tests (see Sect 7.2.3); this cylinder will also be utilized for density verification check on the output densometer.

   Entrapped Air (see section 7.1.2)

Feed Sampling (for instrument verification)

1. One sample per day from the Batch Tanks for TDS instrumentation performance verification. - 500 ml sample

TABLE 7-2

Chlorination Addition Determination Sampling for the Clarifier & Dilution Brine Tank

Clarifier

After the Clarifier Holding Sump has been homogenized, collect 800 ml of sample in a one liter plastic container and test in the On-site Lab for Density. (Same Sample will be utilized for TSS and TDS determination.)

Dilution Brine Tank

After the Dilution Brine Tank has been homogenized, collect 500 ml of sample in a one liter plastic container and test in the On-site Lab for Density.

Clarifier Ratio Determination Sampling

Same as Clarifier above.

After Averaging Tank #1 (or 2 or 3) has been homogenized with Pond 207C slurry, collect 500 ml of sample in a one liter plastic container and test in the On-site Lab for TSS.

7.1.1 Sampling for Product Certification

To ascertain that the final stabilized waste form conforms to the standards demonstrated by the Treatability Studies, samples will be taken at a frequency determined by the cube root of the total number of halfcrates produced (estimated to be 4600) by this process. Therefore 17 random samples will be taken (no two from the same batch).

TCLP samples will be subjected to accelerated 48-hour cures and sent to the HNUS Off-site laboratory for TCLP tests for compliance with Land Disposal Requirements. It has been demonstrated at the Halliburton NUS labs in Pittsburgh that for TCLP considerations, the 48-hour accelerated cure and 28-day ~~extended~~ cure tests produced similar pass/fail results. This methodology will provide the fastest and most efficient confirmation that the waste form passes the applicable tests.

Cured samples will also be subjected to Paint Filter and Liquid/Solids (Paint Can) tests on-site to ascertain conformance with Department of Transportation

requirements.

7.1.2 Sampling for Process Monitoring

Processing will be conducted in a semi-batch mode consisting of quantities sufficient for 2-4 hour batches. At some time during the 2-4 hour period, in conjunction with any regularly scheduled sampling for product testing, samples will also be obtained for Process Monitoring. Samples will be subjected to the 48-hour accelerated cure followed by UCS testing in the On-site Lab. This test will provide information required to identify any potential problems with process control.

7.1.3 Sampling for Instrument Verification

Two critical analytical instruments are the slurry density and TDS measuring instruments. Samples will be collected once a day from the batch tanks to verify instrument performance and will be analyzed at the On-site Lab. The densometer in the grout loop will also be checked each batch when an output product sample is taken to validate the nuclear densometer's calibration.

Mixing in the RCM introduces air into the cement slurry. This entrapped air can be determined using a pressurized mud balance, which measures the specific gravity of the slurry after squeezing out the entrapped air. The quantity of entrapped air in the product is not expected to vary significantly during the process. Initially the entrapped air will be measured once every batch. If there is no significant variation in this value from batch to batch, the measurement may be reduced to once per day.

7.1.4 Chlorine Addition

Attachment III of Section 3.4 details the calculations to determine the chlorination requirements. The sampling required to perform these calculations is summarized in Table 7-2.

7.1.5 Clarifier Ratio Determination

The contents of the Clarifier will be mixed with the Pond 207C slurry using a ratio scheme, the details of which are discussed in Attachment IV of Section 3.4.

Analyses will be conducted in the On-site Laboratory to determine the values to be used in the above referenced computer program for determination of the correct mix ratio of Clarifier slurry with Pond 207C slurry.

7.1.6 Sampling for Process Evaluation

In addition to the regularly scheduled sampling program, the HNUS Processing Supervisor may, at his discretion, require additional sampling if it is deemed necessary in order to improve the performance of the process.

7.1.7 TSS Measurements

Total Suspended Solids (TSS) determination of the waste slurries is required at various points in the process. The conventional oven-dried TSS laboratory method requires considerably more time to run than what is desirable, in order to avoid lengthy processing delays.

The alternative methodology that will be utilized is a variation of a method that is commonly used in the biological waste-water treatment field to measure the characteristics of activated sludge mixture. This method (Sludge Volume Index[1]) measures the degree of settling of the sludge particles within a 30 minute period.

In order to expedite the process the waste slurries will be spun in a lab centrifuge for a specified number of minutes. The volume of the solids phase measured in the centrifuge tube, is directly proportional to the % TSS in the slurry.

The specific relationship between TSS and the sludge volume will be determined for the specific slurry in the On-site Lab in accordance with an approved On-site Lab Operating Instruction.

7.1.8 Documentation Record Requirements

Logs and records of all tests shall be maintained in accordance with Operating Instruction #316 (On-site Lab O/I).

The following documents shall be used to record inspection activities (examples provided in Attachments I & II):

- Surveillance Report
- Instrumentation Verification Report

7.1.9 Sampling and Testing Methodology

Sampling and testing will occur per the methods and protocols contained in the On-site Lab Operating

Instructions (Deliverable # 316).

ATTACHMENTS:

I. Surveillance Report
II. Instrumentation Verification Report
III. Sampling Summary Tables

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[1] Dick, R.I. and Vesilind, P.A., J. Water Pollution Control Fed 41, 1285 (1969)

ATTACHMENT I
SURVEILLANCE REPORT

Page 1 of _____

Report No: _____ Date of Activity: _____ Surveyor: _____

Area of Facility: _____

Responsible Organization: _____ Supervisor: _____

Requirement(s): _____

_____

_____

Classification/Inspection Level: A. ☐ B. ☐ C. ☐ D. ☐ N/A ☐

Narrative Detail:

Condition Classification: Finding ☐ Concern ☐ Observation ☐ Satisfactory ☐

Recommended Corrective Action:

Action Due Date:

Action Taken to Preclude Recurrence: Implementation Date: _____

Responsible Area Supervisor: _____ Date: _____

Corrective Action Verification/Follow-up: By: _____ Date: _____

Required Action Completed by Due Date: Yes ☐ No ☐

Action Taken Corrected Problem: Yes ☐ No ☐

Is Additional Action Required: Yes ☐ No ☐ Due Date: _____

Date Closed:

Review/Approvals

PQAS: _____ Date: _____

Deputy Project Manager: _____ Date: _____

ATTACHMENT II

DAILY INSTRUMENTATION VERIFICATION REPORT

Date: _____ Shift: _____ Time: _____

Instrument to be checked:

SERIAL NR: _____ [Within calibration due date: yes__ no__]

TYPE: _____

LOCATION: _____

INSTRUMENT READING AT TIME OF SAMPLE: _____

Sample:

LOCATION: _____

SAMPLE NR: _____

LAB TEST: _____

LAB TEST RESULTS: _____

Verification:

TEST RANGE SPECIFICATIONS: _____

ACTUAL RANGE: _____

SATISFACTORILY VERIFIED YES --- NO

Comments:

****

_____ _____
Lab Tech Date

_____ _____
Lab Supervisor Date

Distribution: Original - HNUS File, Copy to: On-site Lab File and HNUS PQAS

(Form 207.004)

ATTACHMENT III

NVO-325 SAMPLING REQUIREMENTS

TEST	COLD OPS	SURROGATE OPS	HOT OPS	NORMAL OPS
# of Halfcrates to be Generated	1 + 9	10	23	4600
TCLP	□	---	□	(17)* -P
Paint Filter	(2) + □	(2)	□	(17)*
Paint Can	(2) + □	(2)	□	(17)*
Radionuclide Spec	---	---	(1) -P	(2) -P
Amenable Cyanide	---	---	(2) -P	---
Sulfide Reactivity	---	---	(1) -P	---
HOC - Halogenated Organic Compounds	---	---	(1) -P	---
PCB	---	---	(1) -P	---

NON NVO-325 HALFCRATE SAMPLING REQUIREMENTS

TEST	COLD OPS	SURROGATE OPS	HOT OPS	NORMAL OPS
# of Halfcrates to be Generated	1 + 9	10	23	4600
Density	(4) + □	(4)	□	▲
UCS	(8) + □	(8)	□	(17 +▲)
Freeze/Thaw	□	---	□	---

( ) = # of cylinders required for test
P = At Pittsburgh Lab, all others at On-Site Lab at Rocky Flats Plant
* = 17 Actual samples based on cube root function of # of halfcrates
▲ = Sample taken for process monitoring for each batch.
□ = Per EG&G QUL requirements

SLURRY SAMPLING MATRIX

	BRINE DILUTION TANK CHL	CLARIFIER HOLDING TANK	AVERAGING TANK		BATCH TANKS
			1	2/3	
Density	Each Chl.	Each Chl.	---	---	---
TSS	---	1/Batch	---	---	1/Batch
TDS	---	1/Batch	---	1/Day	1/Day(*)

Chl = Chlorination

(*) = Instrument verification

7.2 ON-SITE LABORATORY

The On-site laboratory, located within the permacon of tent #5 on 750 Pad, will perform limited testing, in accordance with Section 7.1.

The packaging for off-site sample transportation will be performed by HNUS in the On-site Lab, in accordance with the EG&G transportation and packaging procedures.

7.2.1 Product Testing

For product regulatory testing, the On-site Laboratory will perform only the following tests:

- EPA Paint Filter Liquids Test -- EPA 9095-SW846
- Liquid/solids test (Paint Can Test) -- ASTM 4359-84

The Toxic Characteristic Leach Procedures (TCLP), for both inorganic and organic components, will be performed (extractions and analyses) at the HALLIBURTON NUS Lab in Pittsburgh.

7.2.2 Instrumentation Verification Testing

The four key variables which will be monitored during the process include the Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) of the feed slurry and the densities of the feed slurries and final product. These variables (TDS and densities) will be monitored daily by on-line instrumentation, the performance of which must be confirmed, and if necessary adjusted.

TDS is measured using a conductivity meter, and the densities will be monitored using Halliburton Services Densometers. These instruments require performance verification checks with physical measurements as delineated in the On-site Laboratory Standard Operating Instructions (#316) for the Rocky Flats Solar Pond Project.

TSS will be measured utilizing a test in the On-site Lab.

7.2.3 Testing For Process Monitoring

Testing for process monitoring may include, but is not limited to, any of the tests discussed above in

sections 7.1.

pH will be measured, if required, for the purpose of process monitoring.

The Unconfined Compressive Strength Test (UCS), (ASTM D4219-83) of a cylindrical product sample, will be sufficient to be used as an indicator of overall process performance based on data obtained during the Treatability Study Testing.

7.2.4 Schedule and Personnel Requirements

Laboratory personnel will attend the daily operations meeting in order to determine if additional testing or schedule modifications will be required. The laboratory personnel will include a laboratory manager and up to five technicians (to be determined by the number of operating shifts) to perform the above tests.

7.2.5 Quality Assurance

Quality Assurance for the On-site Laboratory will be maintained through the appropriate sections of the HNUS Pittsburgh Laboratory QA Plan and the procedures of Operating Instruction 438B and 316.

7.2.6 Non-Conformance

The HNUS SSQAP, Section 15, addresses non-conformance. If sampling and analysis reveals non-conformance, the non-conformance will be identified as an administrative or a physical non-compliance and appropriate root cause analysis and corrective action will be completed (sample form included as Attachment I to this section) in accordance with the SSQAP.

ATTACHMENT

Attachment I -- NON-CONFORMANCE REPORT

ATTACHMENT I.

NON-CONFORMANCE REPORT

NCR NO	PROJECT NUMBER	DATE

NON-CONFORMANCE DESCRIPTION (attach additional pages as required)
STATE REQUIREMENT:

STATE NON-CONFORMANCE:

REPORTED BY: TITLE: DATE:

CONCURRENCE (COGNIZANT MANAGER) DATE:

RECOMMENDED DISPOSITION: ____REPAIR___REWORK___REJECT___USE-AS-IS

DESCRIPTION OF CORRECTIVE ACTION TO BE TAKEN:

JUSTIFICATION FOR REPAIR AND/OR USE-AS-IS

PROVIDED BY: TITLE: DATE:

RECOMMENDED BY: TITLE: DATE:

ASSIGNED TO: SCHEDULED FINISH DATE:

ACTION TAKEN:

ACTUAL FINISH DATE:

REEXAMINATION (REPAIR AND REWORK) BY: DATE:

NOTIFY QA OF ACTION COMPLETION BY: DATE:

QA VERIFICATION OF CORRECTIVE ACTION: DATE:

QUALITY ASSURANCE CLOSEOUT BY: DATE:

8.0 RECORDS

The Site Specific Quality Assurance Plan (#730), Section 17 notes: "The quality records shall be safely stored and maintained to ensure availability and retrievability for the duration of the Project and subsequent turnover to the customer as required." The project's Quality Assurance Instruction (QAI) #17 provides the specifics associated with record keeping.

The following records shall be maintained in accordance with the above.

Instrument Verification Testing:

- TDS
- Verifications of Density of Incoming Slurry and Final waste Product (Densometers)
- Instrument Calibration Records

Waste Product Testing:

- Toxic Characteristic Leach Procedures (TCLP)
- Paint Filter Liquids Test
- Paint Can Test

General QA Records:

- Audit Reports
- Operators Training Records
- Surveillance Reports
- Non-Conformance Reports (as applicable)
- Corrective Action Reports (as applicable)
- Supplier Surveys
- Mill Certification Reports for Raw Material
- Test Reports (SO Test and Hot Test)
- Instructions and Procedures
- Operational Traveler Record (OTR)
- On-site Lab Test Records
- Batch Calculation Output Density Form
- Operating Logs
- Batch Files

207C/Clarifier Specific Operating Instructions:

- SO Test Tests) - O/I # 439A
- Hot Test - O/I # 439B
- Waste Processing - O/I # 438B

9.0 IMPLEMENTATION PLAN

Task 1: Approval of Pond 207C/Clarifier SO (Systems Operational) Test Procedure, WBS-439A.

Responsible Manager: A. C. Allen

Signature of Responsible Manager:

_____

Completion Date: _____

*****

Task 2: Approval of Pond 207C/Clarifier Operating Instruction (OI), WBS-438B.

Responsible Manager: T. Bittner

Signature of Responsible Manager:

_____

Completion Date: _____

*****

Task 3: Approval of Site Specific QA Plan, WBS-730.

Responsible Manager: E. Dover

Signature of Responsible Manager:

COMPLETED

Completion Date: _____

*****

Task 4: Approval of Solar Ponds Waste Processing Areas Health and Safety Plan, WBS-750C.

Responsible Manager: R. Hill

Signature of Responsible Manager:

COMPLETED

Completion Date: _____

*****

Task 5: All necessary operational and maintenance personnel have satisfactorily completed training.

Responsible Manager: J. DePriest

Signature of Responsible Manager:

_____

Completion Date: _____

*****

Task 6: Approval of On-Site Lab Design Criteria, WBS-311.

Responsible Manager: D. Simanic

Signature of Responsible Manager:

COMPLETED

Completion Date:

*****

Task 7: Approval of ON-Site Lab Laboratory Operating Instructions, WBS-316

Responsible Manager: D. Simanic

Signature of Responsible Manager:

_____

Completion Date: _____

*****

Task 8: Approval of 207C/Clar. Design Criteria, WBS-431.

Responsible Manager: D. Brenneman

Signature of Responsible Manager:

COMPLETED

Completion Date:

*****

Task 9: Approval of 207C/Clarifier System Final Waste Form

Sampling and Analysis Plan.

Responsible Manager: EG&G

Signature of Responsible Manager:

_____

Completion Date: _____

*****

Task 10: Approval of Blending Procedures To Ensure Correct Constituents and Blend of Pozzolans.

Responsible Manager: J. DePriest

Signature of Responsible Manager:

_____

Completion Date: _____

*****

APPENDIX A

PROJECT SPECIFIC ABBREVIATIONS/ACRONYMS

207A	Pond 207A
207BN	Pond 207B - North ((C) Center, (S) South)
207C	Pond 207C
750	Pad 750
788	Pad 788
904	Pad 904
ADC	Automatic Density Control
ALARA	As Low as Reasonably Achievable
ANSI	American National Standards Institute
B&R	Brown and Root, Inc.
BFD	Block Flow Diagram
CCW	Contaminate Concentration in the Waste
CCWE	Contaminate Concentration in the Waste Extract
CFR	Code of Federal Regulations
cpm	counts per minute - a radiological unit of measure
CSS	Chemical stabilization/solidification
DAC	DOE Derived Air Concentration for radio nuclides
DBM	Design Basis Memo
DCS	Distributed Control System
DMR	Dry Mass Rate
Demob	Demobilization
DOE	Department of Energy
DOE/NVO	Department of Energy/Nevada Operations Office
DOT	Department of Transportation
DWGS	Drawings
DQO	Data Quality Objectives Levels I, II, III, IV
E&WM	Environmental and Waste Management - the EG&G Associate General Manager's organization directing these activities
EG&G	Contractor for DOE at Rocky Flats
EMG	Environmental Management Group of Halliburton NUS Environmental Corp. - Headquarters in Pittsburgh, PA
EPA	Environmental Protection Agency

ETG	Environmental Technologies Group of Halliburton NUS Environmental Corp. - Headquarters in Houston, TX
ESD	Emergency Shutdown
GET	EG&G provided General Employee Training
H&S	Health and Safety
HASP	Health and Safety Plan
HED	Halliburton NUS Environmental Corporation office in Denver
HEH	Halliburton NUS Environmental Corporation office in Houston
HNUS	Halliburton NUS Environmental Corporation
HSWA	Hazardous and Solid Waste Amendments - the RCRA amendments of 1984 that include new standards for disposal facilities and restrictions for land disposal of untreated hazardous wastes
HWR	High Water Ratio Pondsludge Processing Train
IDC	Item Description Code - A numeric code that describes each waste form type
IH	Industrial Hygiene
JSA	Job Safety Analysis
LDR	Land Disposal Restricted - those RCRA regulated hazardous wastes that must comply, that have treatment or waste constituent standards prior to land burial
LLMW	Low Level Mixed Waste - LLW containing both radioactive and hazardous components as defined by the Atomic Energy Act and RCRA respectively. For the purposes of this document, LLW is used to collectively reference mixed (RCRA) and non mixed wastes when controls for both waste types are the same. When it is necessary to discriminate, the wastes are specifically referenced as "mixed" or "straight" LLW
LLW	Low Level Waste - Material having no economic value and contaminated with transuranic elements (i.e. Americium & Plutonium) at a level of specific activity less than or equal to 100 nCi per gram of waste material, or wastes contaminated with Uranium in any quantity.
LLWMP	EG&G's RF Low Level Waste Management Plan #1-10000-EWQA
LSA	Low Specific Activity (as defined by 49CFR 173.403 (N))
LSG	Laboratory Service Group of Halliburton NUS Environmental Corp. - Headquartered in Pittsburgh, PA

LTR	Letter
LWR	Low Water Ratio Pondsludge Processing Train
M&TE	Measuring and Test Equipment
MH	Manhour
MHS	Material Handling Study
nci/l	nanocuries per liter of radioactive material
NDT	Non-Destructive Testing - those group of tests, such as R-T-R, that evaluate an items conformance without destroying it
NQA-1	Quality Assurance Program for Nuclear Facilities, full title: ASME-NQA-1-1989
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site - DOE permanent storage/disposal location
NVO-325	Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements dated October 1988, NTS-WAC, NVO-325-88
OSA	Operational Safety Analysis
OSHA	Occupational Safety and Health Administration
P&C	The Permitting and Compliance group within the Waste Programs department at EG&G
PA	Protected Area (formerly the Perimeter Security Zone)
P&ID's	Piping and Instrumentation Drawing
PC	Pondcrete Waste
PCP	Process Control Plan
PEL	OSHA Permissible Exposure Limit
PFD	Process Flow Diagram
PM	Preventive Maintenance
PO	Purchase Order
PP	Project Plan (unless otherwise stated, indicates latest version)
PPE	Personal Protective Equipment
PPM	Parts Per Million
PQE	Procurement Quality Engineering
PS	Pondsludge Waste - Liquids and Solids
PSZ	Perimeter Security Zone
pci/l	picocuries per liter of radioactive materials

psi	pounds per square inch (gauge)
QA	Quality Assurance
QACC	Quality Acceptance Criteria Checklist
QAI	Quality Assurance Instruction (HNUS)
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QC	Quality Control
QID	Quality Instruction Directive - the document that provides acceptance testing instructions for procured materials
RCM	Halliburton Recirculation Cement Mixer
RCRA	EPA Resource Conservation and Recovery Act
RCRASOP	RCRA Standard Operation Procedure - the governing document stating how Rocky Flats Plant identifies, treats, packages and stores hazardous and mixed waste
REF	References
RF	Rocky Flats Facility at Golden, CO
RFP	Rocky Flats Plant
RFPS	Rocky Flats Plant Standards
RFQ	Request for Quotation
RPT	Radiation Protection Technologist - the job title of personnel who provide radiation protection through controls and monitoring of areas, items and personnel
RWMS	Radioactive Waste Management Site - an NTS site waste management area
SC	Saltcrete Waste
SDRL	Supplier Data Requirements List
SEP	Solar Evaporation Ponds
SHSS	Site Health & Safety Supervisor
SOP	Standard Operating Procedure
SOT	Systems Operational Test (Sometimes referred to as SO Test)
SOW	Scope of Work (unless otherwise stated, indicates latest version), previously called Statement of Work
SPECS	Specifications
TCLP	Toxicity Characteristic Leaching Procedure

TIRL	Testing and Inspection Requirements List
TLV	Threshold Limit Value - 8 hours for air contaminants
TPH	Tons per Hour
TSCA	Toxic Substances Control Act
TSWP	Treatability Study Work Plan
VOL	Volume
WAC	Waste Acceptance Criteria (as specified in DOE-NVO-325-1988)
WBS	Work Breakdown Structure
WC	Waste Certification group within RFP that signs the paper work that certifies the waste form for disposal at NTS or elsewhere
WCO	Waste Certification Official - the person(s) who affirm by signature that wastes meet all NTS and other applicable criteria
WEMS	Waste and Environment Management System - a computer database, within the Waste Program department that manages RFP wastes
WI	Waste Inspection - A group within the Rocky Flats Site Quality Assurance Department that ensures conformance to applicable waste acceptance and certification criteria. Waste Inspection assesses container integrity, drum or box contents conformance, and container documentation, labeling, and marking
WIS	Waste Information Sheet - A document posted in waste generating areas that provides waste characterization information for the process(es). The document is controlled by building operations management and reviewed and approved by the appropriate Waste Guidance engineer
WO	EG&G Waste Operations -- when followed by number indicates a procedure
WQE	Waste Quality Engineering - The group within the Rocky Flats Quality Assurance department that certifies waste processing methods
WSRIC	The "Waste Stream and Residue Identification and Characterization" building books. These books are a reference document for operating personnel, and are used in conjunction with the Waste Information Sheets to provide documented characterization of the Rocky Flats wastes. These two documents are used by generators as a guide in identifying wastes during packaging; the Waste/Residue traveler, as completed and signed by the generator, is the official source for certifiable process knowledge waste characterization data for each filled

	waste container
WT	Weight

APPENDIX B

SPECIFICATIONS FOR POZZOLANS FOR 207C/CLARIFIER PROCESSING

1.0 CEMENT SPECIFICATIONS

ASTM C 150, TYPE V CEMENT

2.0 FLYASH SPECIFICATIONS

CHEMICAL ANALYSES PARAMETER	ASTM C618 SPEC. F/C
Silicon Dioxide, SiO2, %	31 ± 4% *
Aluminum Oxide, A12O3, %	20 ± 2% * #
Iron Oxide, Fe2O3, %	6 ± 1% *
Sum of SiO2, A12O3, Fe2O3, %	70/50 min
Calcium Oxide, CaO, %	28 ±4% *
Magnesium Oxide, MgO, %	---
Sodium Oxide, Na2O, %	---
Potassium Oxide, K2O, %	---
Sulphur Trioxide, SO3, %	5.0 max
Moisture Content, %	3.0 max
Loss of Ignition, %	6.0 max
Available Alkalies as Na2O, %	1.5 max
PHYSICAL ANALYSES	
Amount Retained on No. 325 Sieve, %	34 max
Pozzolanic Activity Index	
Portland Cement at 7 days, % of Control	75 min
Portland Cement at 28 days, % of Control	75 min
Lime at 7 days, psi	800/NA min
Water Requirement, % of Control	105 max
Autoclave Expansion, %	0.8 max
Specific Gravity	---
Increase of Drying Shrinkage, %	0.03 max
Reactivity with Cement Alkalies, %	
Reduction of Mortar Expansion, %	---
Mortar Expansion, %	0.020 max

* Additional Halliburton NUS specifications.
\# Attached memo of July 9, 1992 from S. Mathew slightly modifies this requirement.

3.0 LIME SPECIFICATIONS

Calcium Oxide	72 - 78%
Specific Gravity	2.3 - 2.4
Bulk Density (lbs/cu ft)	25 - 35 (settled)
Specific Heat at 100°F	0.29 BTU/lb
Screen Analysis	100 mesh, 99.8% passing 200 mesh, 99.0% passing

4.0 SUPER PLASTICIZER SPECIFICATIONS

Chemical Code:	Fly Ash Retarder
Halliburton Part Number:	516006410
Package Quantity:	50 pounds

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

July 9, 1992

TO: Ted Bittner

FROM: Shaj Mathew

SUBJ: Choice of Flyash to be used for 207C and 207 Clarifier Processing

The specifications of the flyash supplied by National Minerals Corporation (see Attachment 1) from Iatan, Weston, MO falls within the ranges defined in the Halliburton NUS specifications listed in the Instructions to Bidders for Supply of Class C flyash dated May 15, 1992 (see Attachment 2) except for the alumina concentration. The alumina concentration in the flyash supplied by National Minerals Corporation (22.83%) falls slightly outside the range (20 ± 2%) specified by Halliburton NUS. However, since the treatability study report provides a very wide range of accepted pozzolan compositions (see Treatability Study Report and Process Formulation Report for Pond 207C and Clarifier (Revision 0), July 1992, pp 3-62), the minor variation in the alumina composition in the Class C Flyash would have no negative input on the certifiability of the final product.

Attachments

APPENDIX D

HALLIBURTON NUS
Environmental Corporation

HNUS INSTRUCTION

QUALIFICATION OF PROCESSING CREWS

prepared by

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

REV. 0

August 21, 1992

Submitted : J. Schmidt

Approved: J. Schmidt for T. Bitten

:: schmidt\cover

TABLE OF CONTENTS

1.0 SCOPE

1.1 Purpose

To establish guidelines and responsibilities for the qualification of personnel to operate various HNUS processing systems.

1.2 General

The handling of radioactive, toxic waste in a manner safe both to the environment and to personnel requires a deliberate, formal qualification system be established to document training and qualification of personnel to operate these systems. All operational personnel and supervisors are subject to the provisions of this instruction.

1.3 Responsibilities

1.3.1 The HNUS Deputy Project Manager is responsible for the proper operation of the Qualification System.

1.3.2 The HNUS Training Supervisor is responsible for scheduling all generalized and specific EG&G training necessary to train operating personnel under this system. He also maintains records of all general pre-requisite training.

1.3.3 Each Subcontractor Project Supervisor is responsible for training his operating personnel to safely operate his system in support of the overall HNUS processing system. Project Supervisors will request necessary EG&G training quotas be obtained for their personnel by the HNUS Training Supervisor. Project Supervisors retain documentation of all specialized pre-requisite training (e.g. RCM training).

1.3.4 The HNUS Processing Supervisor is responsible to ensure that all personnel assigned to duties in his processing team are documented as qualified to perform that duty in the Qualification Book. The HNUS Processing Supervisor may schedule and conduct training for his entire processing team if desired.

1.3.5 All HNUS and subcontractor personnel are responsible for observing the provisions of this instruction. No person will allow himself to be assigned to an operational duty which he is not qualified to perform, in writing.

2.0 PROCEDURE

2.1 Organization

2.1.1 Each processing team will be formally organized. Attachment 1 provides an example.

2.2 Qualification Cards

2.2.1 Each person designated to serve as a member of a processing team will fill out the appropriate Qualification Card (Attachment 2A through 2S).

2.2.2 Each Qualification Card is divided into four segments - PRE-REQUISITES, KNOWLEDGE REQUIREMENTS, PRACTICAL FACTORS, and QUALIFICATION. Personnel authorized to sign various blocks on the Qualification Cards are listed in Attachment 3.

2.2.2.1 The PREREQUISITES section documents that the person has received the necessary generalized training to be assigned to the processing team.

2.2.2.2 The KNOWLEDGE REQUIREMENTS section lists knowledge items which the candidate must demonstrate to the examiner.

2.2.2.3 PRACTICAL FACTORS are of two types - WALK-THRU and ACTUAL. In order to qualify a processing crew to begin system operation, certain evolutions must be simulated since the various systems are not yet operational. This is a WALK-THRU - a demonstration to an on-site examiner that the candidate has the ability to operate the system.

2.2.2.4 There are three steps in the QUALIFICATION system. Provisionally qualified means the candidate has completed Section I, II, and III (Walk Thru). Fully qualified indicates completion of Section I, II, and III plus an oral examination. HNUS approval signifies approval of the qualification process for the candidate.

2.2.2.5 Qualification card terminology requires several definitions. Operate means to operate the equipment/system from start-up through shut-down. Walk thru means an on-site demonstration to an examiner that the candidate can successfully operate the system.

2.2.3 Upon completion of a qualification by a candidate, the HNUS Processing Coordinator will enter the qualification in the Qualification Book. If a candidate is DISQUALIFIED from duties for any reason, his name will be deleted from the Qualification Book.

2.2.4 Completed Qualification Cards will be delivered to the HNUS Training Supervisor for retention as a Quality Record.

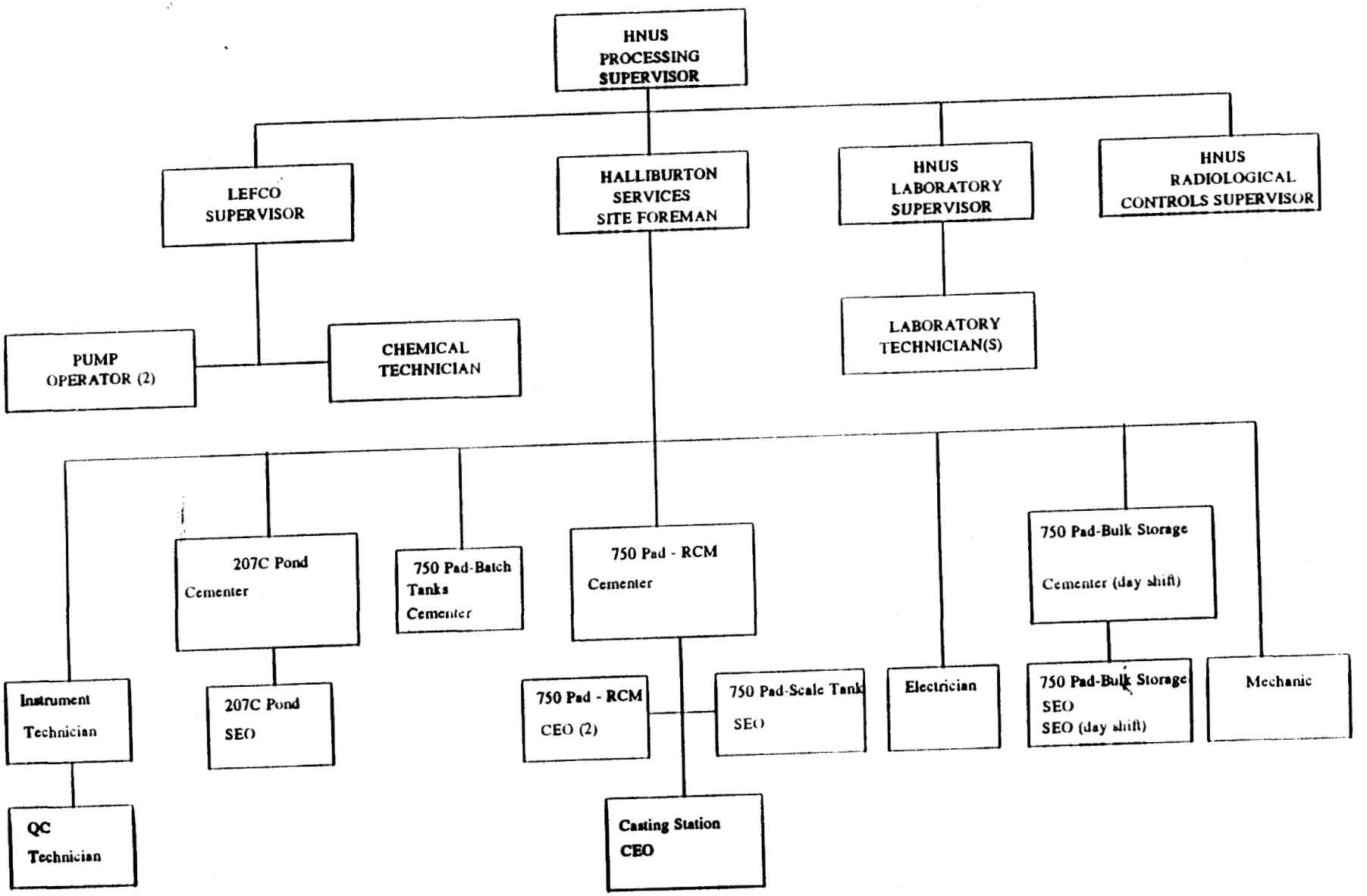
3.0 ATTACHMENTS

3.1 Attachment 1 - Sample Shift Operation Organizational Chart

3.2 Attachments 2A through 2S - Qualification Cards for C Pond Processing

3.3 Attachment 3 - Authorized Personnel to Sign Qualification Cards for C Pond Processing

ATTACHMENT 1
SOLAR POND 207C/CLARIFIER
SHIFT OPERATION ORGANIZATIONAL CHART



SEO = Service Equipment Operator
CEO = Cement Equipment Operator

A:\BRADWORKDISK

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Processing Supervisor

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B	_____
B.	Communications System	_____
C.	Interface with EG&G	_____
D.	Reporting Responsibilities	_____
E.	Job Safety Analysis	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operating Processing System	_____	_____
B.	Supervise Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-Thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Site Foreman
207C Pond Process

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instruction 438B - in Detail _____

B. Communications System _____

C. Grout Loop Systems _____

D. Generator Systems _____

E. Air Compressor Systems _____

F. Job Safety Analysis _____

III. PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate Processing System	_____	_____
B. Supervise Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-Thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Mechanic

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. All 207C/Pond Process Mechanical Equipment _____

B. Operating Instruction 438B - Overview _____

PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate Communications System	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Service Equipment Operator 750 Pad
Bulk System/Scale Tank

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instruction 438B - Overview _____

B. Communications System _____

III. PRACTICAL FACTORS		WALK THRU	ACTUAL
A.	Operate Blended Reagent System	_____	_____
B.	Operate Air Compressor System	_____	_____
C.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk Thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Electrician

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. 207C/Pond Process Electrical Equipment _____

B. Operating Instruction 438B - Overview _____

PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate All Generators	_____	_____
B. Operate Communications System	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Instrument Technician
750 Pad

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	Electrical and Electronic Instrumentation	_____
D.	Computer Operation	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operation, Adjust and Hook-up of Instruments	_____	_____
B.	Operation of Compupac System	_____	_____
C.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Quality Control Technician
750 Pad

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instructions 438B - Overview _____

B. Communications System _____

C. Computer Operation/Data Acquisition _____

D. Quality Control _____

E. Job Control Parameters _____

III. PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate Compupac System/Acquire Software	_____	_____
B. Disposition of Computer Generated Documents	_____	_____
C. Monitor Proper Operating Conditions	_____	_____
D. Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cementer 207C Pond
Averaging Tanks

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	Process Water System 207C Pond	_____
D.	Booster Pump System	_____
E.	Generator System	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate Averaging Tank 1, 2 & 3 System	_____	_____
B.	Operate Air Compressor System	_____	_____
C.	Operate Process Water System	_____	_____
D.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cementer 750 Pad
Batch Tanks

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instructions 438B - Overview _____

B. Communications System _____

C. Booster Pump System _____

D. RCM System _____

III. PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate Batch Tank 4/5 & 6/7 System	_____	_____
B. Operate Process Water System - 750 Pad	_____	_____
C. Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cementer 750 Pad
Bulk System

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instructions 438B - Overview _____

B. Communications System _____

III. PRACTICAL FACTORS		WALK THRU	ACTUAL
A.	Operate Blended Reagent System	_____	_____
B.	Operate Air Compressor System	_____	_____
C.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam) _____

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cement Equipment Operator 750 Pad
RCM

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____
H.	RCM Training School	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	Blended Reagent System	_____
D.	Generator System	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate RCM System	_____	_____
B.	Operate Grout Loop System	_____	_____
C.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cementer 750 Pad
RCM

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____
H.	RCM Training School	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	Blended Reagent System	_____
D.	Generator System	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate RCM System	_____	_____
B.	Operate Grout Loop System	_____	_____
C.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Cement Equipment Operator 750 Pad
Casting Station

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	RCM System	_____
D.	Generator System	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate Grout Loop System	_____	_____
B.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Field Supervisor - Lefco

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Communications System	_____
C.	Knowledge of Job Safety Analysis	_____
D.	Function of Radiation Work Permit	_____
E.	Site Responsibilities Organizational Flow	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate LEFCO Reclaim System	_____	_____
B.	Operate LEFCO Chlorination System	_____	_____
C.	Supervise Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Pump Operator - Lefco

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Submersible Pumps	_____
C.	Air Diaphragm Pumps	_____
D.	Tank Agitators	_____
E.	Scalping Screens	_____
F.	Dictaulic Pipe Systems	_____
G.	Communications Systems	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Operate Scalping Screen/Sump	_____	_____
B.	Operate Dilution Brine System	_____	_____
C.	Operate Pond Reclaim System	_____	_____
D.	Emergency Shut-down	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

Chemical Technician - Lefco

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. Operating Instructions 438B - Overview _____

B. Safety Precautions and Use of C.C.H. _____

C. Mix Criteria of C.C.H. Solution _____

D. Operation of Mil-Royal Metering Pump

E. Communications System

III. PRACTICAL FACTORS	WALK THRU	ACTUAL
A. Operate Chlorination System	_____	_____
B. Operate Clarifier Chlorination System	_____	_____
C. Operate Dilution Brine System	_____	_____
D. Emergency Shut-down	_____	_____

IV. QUALIFICATION

A. Provisionally Qualified (Section I, Section, II, and Walk-thru's in Section III) _____

B. Fully Qualified (Section I, II & III plus oral exam)

C. HNUS Approval _____

D. Entered in QUALIFICATION Book _____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Laboratory Supervisor

I. PRE-REQUISITE

A. OSHA Training - 24 Hours or 40 Hours _____ (Signature/Date)

B. EG&G Indoctrination Course _____

C. EG&G RAD Worker Training _____

D. LO/TO Training _____

E. QA Indoctrination _____

F. Health & Safety Indoctrination _____

G. Respirator Fit _____

II. KNOWLEDGE REQUIREMENTS

A. On-site Laboratory Operating Instruction - 316 _____

B. Operating Instruction 438B - Overview _____

C. Sampling Procedures - Section 6.9 _____

D. HNUS Laboratory QA Plan - Section QA-17 _____

E. Interface with EG&G _____

F. Familiarity with all Data Gathering Requirements _____

III. PRACTICAL FACTORS		WALK THRU	ACTUAL
A.	Oversee each type of Sampling Analysis	_____	_____
B.	Oversee Sample Packaging	_____	_____
C.	Data Deliverables to Process Supervisor	_____	_____
D.	Method Specific Training of Lab Personnel - HNUS Laboratory QA Plan - Section QA-17	_____	_____
E.	Oversee Maintenance of Laboratory Equipment	_____	_____
F.	Oversee all Local Sample Collection Activities	_____	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Laboratory Supervisor (continued)

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-thru's for Section III)	_____ (Signature/Date)
B.	Fully Qualified (Section I, II & III)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Laboratory Technician

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instructions 438B - Overview	_____
B.	Sampling Procedures - Section 6.9	_____
C.	HNUS Laboratory QA Plan - Section QA-17	_____
D.	Interface with HNUS Process Personnel	_____
E.	Familiarity with all Data Gathering Requirements	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	RF-01 Electronic Measurement of Waste Waters	_____	_____
B.	RF-02 Determinations of Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) in Waters by Microwave Drying	_____	_____
C.	RF-03 Determinations of Total Solids (TS) in Waters by Microwave Drying	_____	_____
D.	RF-04 Determination of Total Solids (TS) by EPA 160.3	_____	_____
E.	RF-05 Determination of Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) by EPA 160.2 and 160.1	_____	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Laboratory Technician

III. PRACTICAL FACTORS (continued)		WALK THRU	ACTUAL
F.	RF-06 Unconfined Compressive Strength (UCS) of Pondcrete Cylindrical Specimens	_____	_____ (Signature/Date)
G.	RF-07 Paint Can Test	_____	_____
H.	RF-08 Paint Filter Liquids Test	_____	_____
I.	RF-09 Slurry Density	_____	_____
J.	RF-10 Bulk Density by Multipyconometer	_____	_____
K.	RF-12 Accelerated Curing of Pondcrete Specimens	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-Thru's for Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

NAME _____ ORGANIZATION _____

QUALIFICATION CARD

HNUS Laboratory Tech: - Sampler

I. PRE-REQUISITE

A.	OSHA Training - 24 Hours or 40 Hours	_____ (Signature/Date)
B.	EG&G Indoctrination Course	_____
C.	EG&G RAD Worker Training	_____
D.	LO/TO Training	_____
E.	QA Indoctrination	_____
F.	Health & Safety Indoctrination	_____
G.	Respirator Fit	_____

II. KNOWLEDGE REQUIREMENTS

A.	Operating Instruction 438B - Overview	_____
B.	Operating Instruction 316 - Overview	
C.	Sampling Procedure - O/I 438B Section 6.9	_____
D.	Interface with HNUS Process Operators	_____
E.	Operating Instruction 316, Procedure RF11	_____

III. PRACTICAL FACTORS

		WALK THRU	ACTUAL
A.	Perform all Sampling per O/I 438B Section 6.9 and delivery to on-site lab.	_____	_____
B.	Perform method RF11, O/I 316	_____	_____

IV. QUALIFICATION

A.	Provisionally Qualified (Section I, Section, II, and Walk-Thru's for Section III)	_____
B.	Fully Qualified (Section I, II & III plus oral exam)	_____
C.	HNUS Approval	_____
D.	Entered in QUALIFICATION Book	_____

ATTACHMENT 3

Position	Sign Off Person
HALLIBURTON SERVICES	
SEO 207C/Pond Averaging Tanks	Site Foreman
Cementer 207 C/Pond Averaging Tanks	Site Foreman
Cementer 750 Pad Batch Tanks	Site Foreman
Cementer 750 Pad Bulk System	Bulk Material Handling Cementer
SEO 750 Pad Bulk System	Bulk Material Handling Cementer
CEO 750 Pad RCM	Duncan RCM Instructor
Cementer 750 Pad RCM	Duncan RCM Instructor
CEO 750 Pad Grout Loop	Site Foreman
Site Foreman	Project Manager/Project Engineer
Mechanic	Site Foreman
Electrician	Site Foreman
rument Tech.	Engineer Supervisor
Quality Control Tech.	Engineer Supervisor
LEFCO	
Lefco Supervisor	Lefco Project Manager
Pump Operator	Lefco Supervisor
Chemical Technician	Lefco Supervisor
HNUS Laboratory	
HNUS Laboratory Supervisor	On-Site Lab Manager
Laboratory Technician	Lab Supervisor
Laboratory Technician - Sampler	Lab Supervisor
HNUS	
HNUS Processing Supervisor	HNUS Project Manager

APPENDIX E

POZZOLAN BLENDING AND SAMPLING PROCEDURE

1.0 Introduction

The HNUS Pittsburgh Laboratory demonstrated, through extensive tests, that proper proportioning of the pozzolans is an important element in the successful solidification of the pond sludge waste. The pozzolan blend must be proportioned to meet the requirements of the job as specified in the Treatability Study and presented in Section 3.3 of this PCP.

2.0 General

2.1 The Winslow 25,000 lb type "T" beam scale used in the scale tank system at the Brighton Halliburton Service Center shall be verified to be in calibration. This scale shall be calibrated annually.

2.2 The scale used to weigh plasticizer shall be verified to be in calibration. This scale shall be calibrated at least every six months.

2.3 All reagents shall be stored and blended at the Brighton Halliburton Service Center, as shown in Figure 1.

3.0 Material Receiving

3.1 Bulk Materials

3.1.1 The manufacturer's material certifications (certs) for cement, flyash, and bulk lime shall be verified to meet specifications (as defined in Appendix B of the PCP) prior to off-loading into the storage tanks dedicated to the EG&G Rocky Flats Project. The original certs shall be forwarded to the HNUS Broomfield Office for filing as Quality Records, and to EG&G when requested.

3.1.2 A sample shall be taken of all pozzolan materials upon arrival at Brighton. The sample shall be approximately one gallon in volume and placed in a one gallon plastic bucket (with lid) labeled with a

code (see Table 1) referenced to the Bulk Materials Unloading Report (see Figures 3, 4, 5, 6).

3.1.3 Samples of incoming bulk materials shall be maintained in a dry storage area at the Brighton Service Center for a period of approximately two weeks and then delivered to HNUS at Broomfield.

3.2 Sacked Materials

3.2.1 The manufacturer's material certification for sacked plasticizer and sacked lime shall be verified to meet specifications (as defined in Appendix B of the PCP) before accepting delivery. The original certs shall be forwarded to the HNUS office.

3.2.2 A sample shall be taken of each shipment of sacked materials upon arrival at Brighton. The sample shall be approximately one quart in volume. The sample shall be placed in a plastic container (with lid), labeled with a code (see Table 1) referenced to the Bulk Materials Unloading Report (see Figures 3, 4, 5, 6).

3.2.3 Samples of sacked materials shall be maintained in a dry storage area at the Brighton Service Center for a period of approximately two weeks and then delivered to HNUS at Broomfield.

3.2.4 All sacked lime and sacked plasticizer shall be stored on pallets in a dry area at the Brighton Halliburton Service Center.

3.2.5 Sacked material shall be used on a first in, first out basis.

4.0 Blending Reagents

4.1 Each outgoing truck will be loaded with 2 scale tank loads of approximately 180 cf each; therefore each truck load will consist of approximately 360 cf (about

30,000 lbs) of blended reagent.

4.2 The initial blend shall be designated mix "C" (for 207C/Clarifier application). Other mixes may be required and will be designated with a unique mix name. The ratio of reagents (by weight) for mix "C" shall be 1 part cement to 2 parts flyash to .075 parts lime. Plasticizer shall be added to the mix at 0.1% by weight of pozzolans. A scale tank load shall consist of the following materials:

(a) 4700 lbs type V cement
(b) 350 lbs lime
(c) 14.5 lbs plasticizer
(d) 9400 lbs Type C flyash

The materials should be added to the scale tank in the order listed(a to d), since experience has shown that a more even distribution of additives is obtained when the smaller volume materials are sandwiched between larger volume components. Section 3.3 of this PCP discusses the acceptable operating range for the pozzolan composition (Tables 1 and 3).

4.3 After all components are added (cement, plasticizer, lime, and flyash), a weight ticket shall be generated with the following:

(a) date
(b) bulk delivery ticket number,
(c) trailer no.
(d) weight ticket attached to bulk material delivery ticket

4.4 After all of the reagents have been loaded into the scale tank, the blend shall be moved four times to insure proper mixing of the components. These movements shall be:

(a) Scale tank to No. 1 (220 cf) blend tank,
(b) No. 1 blend tank to No. 2 (440 cf) blend tank
(c) No. 2 blend tank to bulk truck
(d) Bulk truck to RFP on-site storage tank.

4.5 During the transfer of blended reagents from the No. 2 blend tank to the bulk truck, a sample shall be taken of the combined two scale tank load (which makes up a truckload), using the Halliburton ACCUSAMPLE device (see 7.0, blended reagent sampling). The sample shall be approximately 1 gallon in volume and placed in a one gallon plastic bucket (with lid), labeled with a code

(see Table 1) referenced to the Bulk Materials Delivery Ticket (Figure 1).

4.6 Samples of blended reagents shall be maintained in a dry storage area at the Brighton Service Center for a period of approximately two weeks and then delivered to HNUS at Broomfield.

4.7 For each truckload of reagents, a Bulk Materials Delivery Ticket (Figure 7) shall be filled out. The information on this document shall contain (as a minimum):

(a) date
(b) location of service center
(c) trailer number into which the blended materials were placed
(d) the weight of material in each of the two scale tank loads delivered into the bulk truck
(e) the total weight of reagents delivered to the bulk truck
(f) the name of the person who prepared the Bulk Materials Delivery Ticket.

4.8 A Certificate of Compliance (Figure 2) shall be prepared for each truckload of reagents delivered to RFP.

4.9 Each Certificate of Compliance shall be uniquely numbered and the bulk plant operator who blended the material shall record on it:

(a) date material was blended
(b) the bulk delivery ticket number to which the certificate of compliance applies
(c) the total weight of material listed on the applicable Bulk Material Delivery Ticket
(d) the signature of the bulk plant operator and date of signature.
(e) Approval signature by designated Halliburton Services representative and date of signature.

5.0 Transportation and Receiving at RFP

5.1 All bulk delivery trailers shall have EG&G supplied permanent bands placed on all hatch covers. These bands shall remain in place for the duration of the project.

5.2 After a trailer has been loaded, the pneumatic line shall be capped and sealed with an EG&G supplied band.

5.3 Loaded truck/trailers shall be delivered to 904 pad security inspection area.

5.4 After security inspection, the truck driver shall deliver the load to the designated PAC entrance.

5.5 At the PAC entrance, the truck driver shall turn the truck over to the designated equipment operator inside the restricted area, along with two copies of the bulk material delivery ticket, the original certificate of compliance, and one copy of the applicable material certifications.

5.6 The equipment operator designated to receive bulk trucks inside the restricted area shall pneumatically transfer the blended pozzolans into storage bins at the 750 pad. The storage bins into which the contents of each truck tank were pumped shall be noted on the supplied Bulk Delivery Tickets. The equipment operator who makes the transfers shall initial the Bulk Delivery tickets and deliver them, along with the rest of the associated documents to the shift foreman on duty. The equipment operator receiving bulk trucks shall coordinate his work with the 750 Pad Operator and ensure that all deliveries are noted on the 750 Pad Log.

5.7 At the end of each shift, all documents relating to delivery and receipt of blended materials shall be forwarded to the HNUS office at the 904 Pad.

6.0 Blended Reagent Handling at Project Site

6.1 Blended reagents received from the Brighton Service Center shall be placed in on-site storage bins designated by the letters "D" through "I" (see Figure 1). All movement of blended pozzolans into the bins, out of bins, between bins, or into the scale tank shall be documented, signed, and dated on the 750 pad log.

6.2 When sampling bins "A", "B", and "C" are all empty, they will be refilled from the storage bins. The contents of the freshly filled sampling bins shall be called a Pozzolan Batch (PB) and given a unique number (PBN). While a new Pozzolan batch is being loaded into the sampling bins, the blended reagents shall be sampled using a Halliburton ACCUSAMPLE (see 7.0, Sampling blended reagent). The sample volume shall be

approximately one gallon, and shall be labeled with the PBN, date and time.

6.3 Each on-site scale tank load shall be recorded on the Scale Tank (on-site) kept by the assigned operator. The operator shall record:

(a) Pozzolan Batch Number (PBN)
(b) total weight
(c) time and date loaded into scale tank.
(d) signature of recorder

7.0 Blended Reagent Sampling

7.1 Blended reagents, both at the Brighton service center and at RFP job site, shall be sampled using Halliburton's ACCUSAMPLE device (see Attachment A). The ACCUSAMPLE is an in-line device which opens periodically to capture small volumes of the material flowing through the line. The time delay between openings can be varied to insure that an adequate volume of sample is acquired which is representative of the total volume of material which flowed through the line during the sampling period.

8.0 Attachments

Figure 1 - Material Flow Diagram

Figure 2 - Halliburton Brighton Facility Certification of Compliance

Table 1 - Labeling Code for Samples

Figure 3 - Bulk Materials Unloading Report (Cement)

Figure 4 - Bulk Materials Unloading Report (Flyash)

Figure 5 - Bulk Materials Unloading Report (Lime)

Figure 6 - Bulk Materials Unloading Report (Plasticizer)

Figure 7 - Bulk Materials Delivery Ticket

Figure 8 - 750 Pad Pozzolan Log

Figure 9 - Scale Tank Log (on-site)

Attachment A - ACCUSAMPLE Specifications

P:\PHELPS\POZZBLND

LABELING CODE FOR SAMPLES

To be used on bulk materials unloading reports, and bulk materials delivery tickets.

CODE	SAMPLE TYPE
C	Cement
F	Flyash
L	Lime
P	Plasticizer
M	Mix (Blended Reagents)

TABLE 1

750 PAD
POZZOLAN LOG DATE: _____

BULK MATERIAL TICKET NO.	PLACED IN STORAGE TANK NO.	TRANSFERRED TO SAMPLE TANK NO.	POZZOLAN BATCH NO.	SIGNATURE

FIGURE 8

SCALE TANK LOG
(On-Site)

DATE: _____

TIME	WEIGHT	POZZOLAN BATCH NO.	SIGNATURE

FIGURE 9

APPENDIX F

RECLAIM SYSTEMS

1. 207C POND RECLAIM SYSTEM

The Pond Reclaim System is shown on Piping and Instrument Diagrams (P&ID) 39717-0053 sheets 1, 2, and 3. This System is operated by Lefco Pump Operator #1 at the Reclaim Pump, and Lefco Pump Operator #2 at the Scalping Screen (SC-02). EG&G personnel are responsible for final cleaning of the Pond bottom. The function of the system is to:

a. Reclaim 207C Pond slurry.

b. Remove oversize solid particles (greater than 10 mesh) and/or foreign trash from the slurry.

c. Provide slurry surge capacity for minor process flow variations and minor equipment maintenance/repairs.

d. Transfer the slurry to Averaging Tank No. 1 (S-16) at a controlled rate.

The reclaim system for 207C Pond consists of the following equipment:

- Electric Submersible Pump (240 gpm max. capacity, 7.5 hp).
- A hydraulically controlled Pump discharge Slurry Gate Valve.
- 3" floating discharge hose from Pump to piping manifold.
- 3" flanged HDPE piping manifold with hose connectors and valving (located inside berm).
- Crane with an effective reach of 132 feet for a 500 pound load.

The Submersible Pump will be suspended over the Pond by the HNUS-supplied crane. The floating discharge hose from the Pump's discharge will be connected to the piping manifold at the coupler nearest the desired reclaim location (refer to figure 1). The Pump's electrical power cable will be plugged into the GFI protected outlet from the Diesel Generator.

The designed reclaim system allows pumping from all areas within the Pond through placement of the crane and valving on the piping manifold. The Pump can be raised or lowered to various levels within the Pond to selectively reclaim either a high solids content material from the lower layers, or material with a low solids content from the upper brine layer of the Pond. The

hydraulically controlled Slurry Gate Valve on the discharge of the Submersible Pump can be opened or closed from a control panel to adjust the flow of material to the Scalping Screen. When the Valve is in the closed position, material flows to the Scalping Screen. Opening the Valve stops delivery to the Scalping Screen and recirculates the material back to the Pond. This homogenization effort will aid in dissolution of any remaining crystal layer during processing/reclaim operations. The Submersible Pump is fitted with a series of cutter blades on the bottom that further size material entering the pump. A framework around the cutter blades provides a 2" clearance between the blades and the Pond bottom to prevent damage to the Pond liner.

2. CLARIFIER RECLAIM SYSTEM

The Clarifier Reclaim and Chlorination System is shown on P&ID 39717-0053, sheet 2. The mechanical portion of the system will be operated by LEFCO Pump Operator #3, and the LEFCO Chlorination Technician will chlorinate the material. The function of this system is to:

a. Reclaim Clarifier slurry.

b. Remove oversize particles and trash from the slurry.

c. Provide slurry surge capacity for minor process flow variations.

d. Chlorinate Clarifier slurry with Calcium Hypochlorite crystals (CCH).

e. Transfer the slurry to Averaging Tanks No. 2/3 at a controlled rate.

The reclaim system for the Clarifier consists of the following equipment:

- 3" air double Diaphragm Pump.
- 3" flexible suction hose.
- 3" x 20' flexible discharge hose (rated to 300 psi) from pump to pipeline.
- 3" Driscoe HDPE piping (double contained) to Scalping Screen.
- Air compressor.
- Portable Pressure Washer System.

The air diaphragm pump will be mounted to the existing catwalk above the Clarifier structure. The discharge hose from the Pump will be connected to the pipeline to the Scalping Screen (SC-04). The suction hose to the pump will be manually placed at the

desired location within the Clarifier.

As the Clarifier contents are emptied, it will be necessary to wash down the residue from the Clarifier walls using the portable Pressure Washer System and process water. The Pressure Washer System will also be used to break up any solids remaining in the bottom of the sump.

HNUS recommends using a fresh water source for this system. The system uses a minimal amount (approximately 4 gpm) of water, and the anticipated usage will be limited to a period of a few hours. Cost estimates show that the cost of decontaminating this washing system (if pond water is used), exceeds the cost for any additional halfcrates generated from the use of fresh water.

3. AVERAGING TANK NO. 1 - OVERFLOW SYSTEM

Averaging Tank No. 1 includes an overflow system designed to return material to the 207C Pond Sump area during periods when the Tank level reaches the high end of its operating band (approximately 1600 gallons) and no additional material is required for operation of the process train. A Sonic Level Indicator on the Tank sends a signal to a pair of automated valves which control circulation of the slurry in the Tank. When the Tank high level set point is reached, the valves are automatically positioned by the signal and circulation is discontinued; material exiting the bottom of the Tank is then pumped to the Pond Sump (located in the northeast corner).

This design facilitates homogenization of the 207C Pond during normal process operations by allowing the circulation of the Pond contents. The high production rate of the Reclaim Pump will be utilized for efficient collection of solids and consolidation in the Pond Sump. The physical arrangement of the overflow system provides for transferring of material to the sump area, away from final cleanup operations, therefore minimizing workers' contact with hazardous materials contained in the Pond.

In the event that the automated overflow system malfunctions, there is a gravity overflow line that is physically installed at approximately the 2000 gallon level in Averaging Tank #1, such that if the automated system fails the excess slurry will gravity feed back to the Pond.

6580

HALLIBURTON NUS
Environmental Corporation

PROCESS CONTROL PLAN

207C POND AND CLARIFIER

PONDSLUDGE WASTE PROCESSING

DELIVERABLE # WBS 253 & 254

for

EG&G ROCKY FLATS

prepared by

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

Rev. 0

September 24, 1993

FOR REVIEW & COMMENT BY EG&G ROCKY FLATS

HNUS APPROVALS:

T. BITTNER, PROJECT MANAGER (DATE) 9/24/93

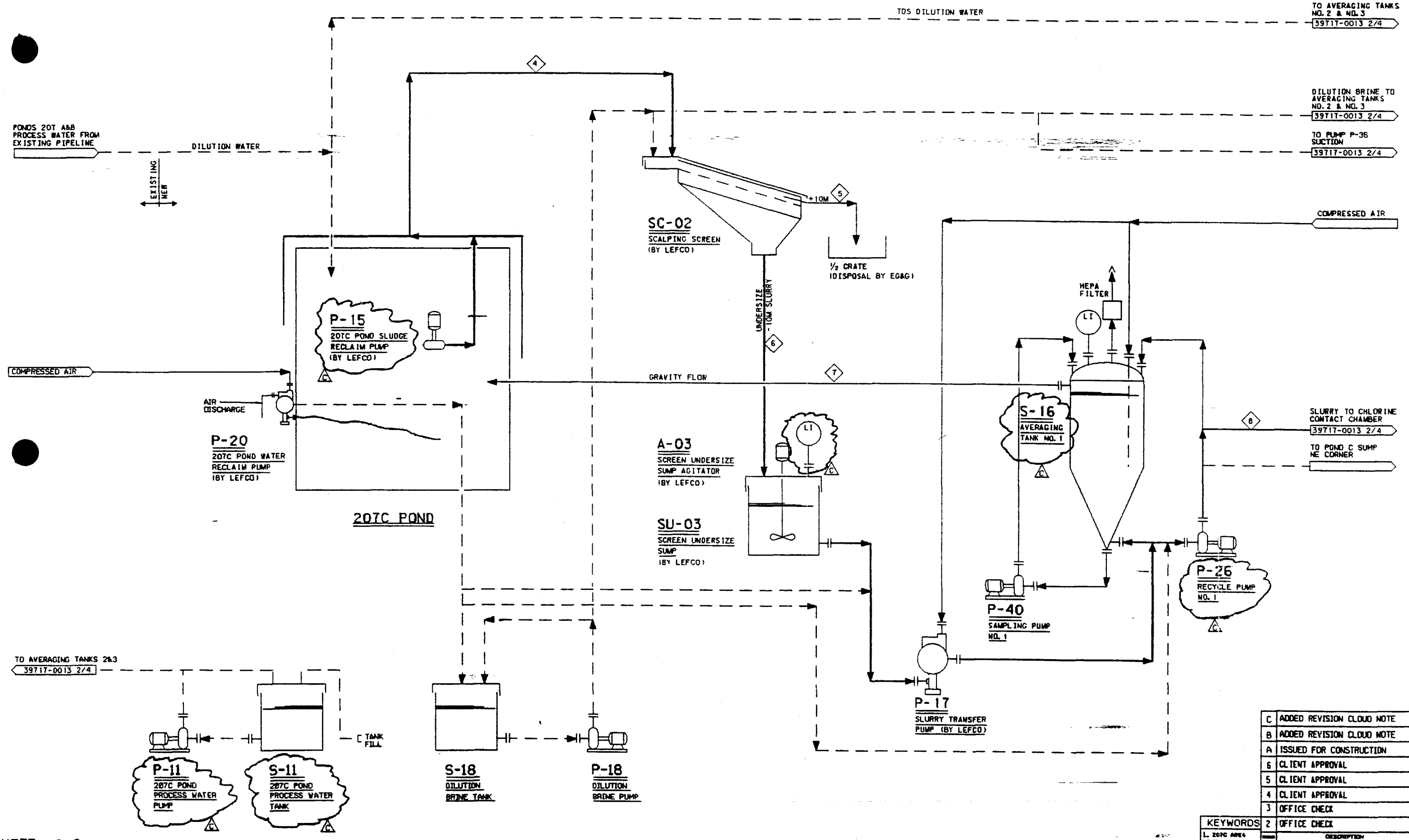
D. DOUGHERTY, PROGRAM MANAGER (DATE) 9/24/93

EG&G APPROVALS:

D. FERRIER, PROJECT MANAGER **(DATE)**

S. KEITH, PROGRAM MANAGER **(DATE)**

APPENDIX C



PART	QUAN.	DESCRIPTION	MATERIAL

NOTES:

1. ALL EQUIPMENT ITEM NUMBERS ON THIS DRAWING HAVE "430" PREFIX.
2. PIPING WITHIN SECONDARY CONTAINMENT WILL BE SINGLE WALL, OTHERWISE DOUBLE-WALL.
3. — — — DENOTES INTERMITTENT OR OPTIONAL FLOWS.
4. STPH - SHORT TONS PER HOUR.
5. THIS DWG. SHOWS MAJOR/CERTIFICATION INSTRUMENTS ONLY.
6. ALL FLOWS ARE FOR TREATING THE DILUTED CONTENTS OF 207C POND AND T88 CLARIFIER.
7. SECONDARY CONTAINMENT NOT SHOWN-SEE P&ID'S.
8. MATERIAL BALANCE IS BASED ON 10% SOLIDS FEED FROM POND 207C TO STABILIZATION. (REF. MATERIAL BALANCES FOR POND 207C, ISSUE: 2, REV. 4).
9. THIS IS A SEMI-BATCH PROCESS. THE FLOWS SHOWN ARE BASED ON AVERAGE RATES.

INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

NOTE: 8,9

DESCRIPTION	STRM NO. / UNITS	4	5	6	7	8
TOTAL FLOW	STPH	61.62	0	61.62	56.41	5.21
SOLIDS FLOW	STPH	6.16	0	6.16	5.64	0.52
LIQUID FLOW	STPH	55.46	0	55.46	50.77	4.69
TOTAL FLOW	GPM	200.0	-	200.0	183.1	16.9
SOLIDS WT%	WT%	10.00	100.00	10.00	10.00	10.00
SOLIDS S. G.	-	2.12	2.12	2.12	2.12	2.12
SLURRY S. G.	-	1.21	-	1.21	1.21	1.21

C	ISSUED FOR CONSTRUCTION	DRB	BCH	MH	
B	ISSUED FOR CONSTRUCTION	DRB	BCH	MH	
A	ISSUED FOR CONSTRUCTION	DRB	BCH	MH	
6	CLIENT APPROVAL	DRB	BCH	MH	
5	CLIENT APPROVAL	DRB	BCH	MH	
4	CLIENT APPROVAL	DRB	BCH	MH	
3	OFFICE CHECK	DRB	BCH	MH	
2	OFFICE CHECK	DRB	BCH	MH	
1	CLIENT APPROVAL	DRB	BCH	MH	

HALLIBURTON NUS Environmental Corporation

C	ADDED REVISION CLOUD NOTE	04/23/93						JR-1198
B	ADDED REVISION CLOUD NOTE	10/23/92						JR-1198
A	ISSUED FOR CONSTRUCTION	07/24/92						JR-1198
6	CLIENT APPROVAL	07/14/92						JR-1198
5	CLIENT APPROVAL	05/22/92						JR-1198
4	CLIENT APPROVAL	04/27/92						JR-1198
3	OFFICE CHECK	04/13/92						JR-1198
2	OFFICE CHECK	04/01/92						JR-1198
NO.	DESCRIPTION	DATE	RFP			CODE	CLIENT	JOB NO.

KEYWORDS
1. 207C AREA
2. POND SLUDGE
3. STABILIZATION
4. FLOW DIAGRAM
5. RECLAIM

	BY	DATE
DESIGNED	DRB	03/13/92
DRAWN	CEA	04/13/92
CHECKED	BCH	04/24/92
APPROVED	MH	

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE-PROCESS FLOW DIAGRAM
207C POND RECLAIM SYSTEM

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	39717-0013	C	1 of 4

207C AREA

P-27
CLARIFIER RECLAIM PUMP

788 CLARIFIER
(EXISTING)

+10M

SC-04
SCALPING SCREEN
(BY LEFCO)

½ CRATE
(DISPOSAL BY EG&G)

UNDERSIZE -10M SLURRY

788 AREA

COMPRESSED AIR

A-26
788 HOLDING SUMP AGITATOR
(BY LEFCO)

P-51
788 HOLDING SUMP RECIRCULATING PUMP (BY LEFCO)

SU-06
788 HOLDING SUMP
(BY LEFCO)

P-36
788 RECLAIM TRANSFER PUMP
(BY LEFCO)

FROM PUMP P-18
39717-0013 1/4

788 AREA

207C AREA

DILUTION BRINE FROM DILUTION BRINE TANK
39717-0013 1/4

HEPA FILTER

S-17
AVERAGING TANK NO. 2

P-41
RECYCLE PUMP NO. 2

P-42
RECYCLE PUMP NO. 3

S-19
AVERAGING TANK NO. 3

MASS RATE & DENSITY

COMPRESSED AIR

TDS

P-43
SAMPLING PUMP NO. 2

OVERLAND PIPELINE

SLURRY TO BATCH TANKS
39717-0013 3/4

P-24
AVERAGING TANK BOOSTER PUMP No. 1

P-25
AVERAGING TANK BOOSTER PUMP No. 2

TDS DILUTION WATER

PROCESS WATER
39717-0013 1/4

COMPRESSED AIR

Z-09
CHLORINATION SYSTEM (BY LEFCO)
(BY LEFCO)

S-62
CHLORINE CONTACT CHAMBER (BY LEFCO)

A-62
CHLORINE CONTACT CHAMBER AGITATOR (BY LEFCO)

SLURRY FROM RECYCLE PUMP NO. 1
39717-0013 1/4

MASS RATE & DENSITY

P-56
CHLORINATED SLURRY PUMP
(BY LEFCO)

NOTE: 9, 11

DESCRIPTION	STRM NO.	11	12	25		STRM NO.	9
	UNITS					UNITS	
TOTAL FLOW	STPH	5.37	0.00	0.14		STPH	0.02
SOLIDS FLOW	STPH	0.54	0.00	0.00		STPH	0.02
LIQUID FLOW	STPH	4.83	0.00	0.14		STPH	0.00
TOTAL FLOW	GPM	17.4	0.00	0.5		FT3/HR	0.36
SOLIDS WT%	WT%	10.00	36.00	6.00		WT%	100.00
SOLIDS S. G.	-	2.12	2.17	- -		-	2.35
SLURRY S. G.	-	1.73	1.28	1.18		-	-

NO.	ISSUE	BY	CHK'D	APP'D
C	ISSUED FOR CONSTRUCTION	DRB	WCH	MH
B	ISSUED FOR CONSTRUCTION	DRB	WCH	MH
A	ISSUED FOR CONSTRUCTION	DRB	WCH	MH
7	CLIENT APPROVAL	DRB	WCH	MH
6	CLIENT APPROVAL	DRB	WCH	MH
5	CLIENT APPROVAL	DRB	WCH	MH
4	CLIENT APPROVAL	DRB	WCH	MH
3	OFFICE CHECK	DRB	WCH	MH
2	OFFICE CHECK	DRB	WCH	MH

HALLIBURTON NUS Environmental Corporation

PART	QUAN.	DESCRIPTION	MATERIAL

NOTES:

1. ALL EQUIPMENT ITEM NUMBERS ON THIS DRAWING HAVE "430" PREFIX.
2. PIPING WITHIN SECONDARY CONTAINMENT WILL BE SINGLE WALL. OTHERWISE DOUBLE-WALL.
3. — — — DENOTES INTERMITTENT OR OPTIONAL FLOWS.
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5. THIS DWG SHOWS MAJOR/CERTIFICATION INSTRUMENTS ONLY.
6. ALL FLOWS ARE FOR TREATING THE DILUTED CONTENTS OF 207C POND AND 788 CLARIFIER.
7. SECONDARY CONTAINMENT NOT SHOWN - SEE P&ID'S.
8. STREAM NO. 12: UP TO 19% OF THE TOTAL FEED WEIGHT WILL BE DRAWN FROM THE 788 CLARIFIER ON AN INTERMITTANT BASIS.
9. MATERIAL BALANCE IS BASED ON 10% SOLIDS FEED FROM POND 207C TO STABILIZATION. (REF. MATERIAL BALANCES FOR POND 207C, ISSUE:2, REV. 4)
10. RECLAIM OF 788CLARIFIER MAY REQUIRE WATER FROM POND 207C. THE WATER IS NOT INCLUDED IN THE MATERIAL BALANCE.
11. THIS IS A SEMI-BATCH PROCESS. THE FLOWS SHOWN ARE BASED ON AVERAGE RATES.

INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

POND 207C AREA

NO.	DESCRIPTION	DATE	APP					JOB NO.
C	ADDED REVISION CLOUD NOTE	04/23/93						JR-1198
B	ADDED REVISION CLOUD NOTE	10/23/92						JR-1198
A	ISSUED FOR CONSTRUCTION	07/24/92						JR-1198
7	CLIENT APPROVAL	07/14/92						JR-1198
6	CLIENT APPROVAL	07/08/92						JR-1198
5	CLIENT APPROVAL	05/22/92						JR-1198
4	CLIENT APPROVAL	04/27/92						JR-1198
3	OFFICE CHECK	04/14/92						JR-1198
2	OFFICE CHECK	04/01/92						JR-1198

KEYWORDS
1. POND SLUDGE
2. BATCH PREPARATION
3. POND 207C
4. STABILIZATION
5. FLOW DIAGRAM
6. ELECTRICITY
7. [illegible]
8. [illegible]

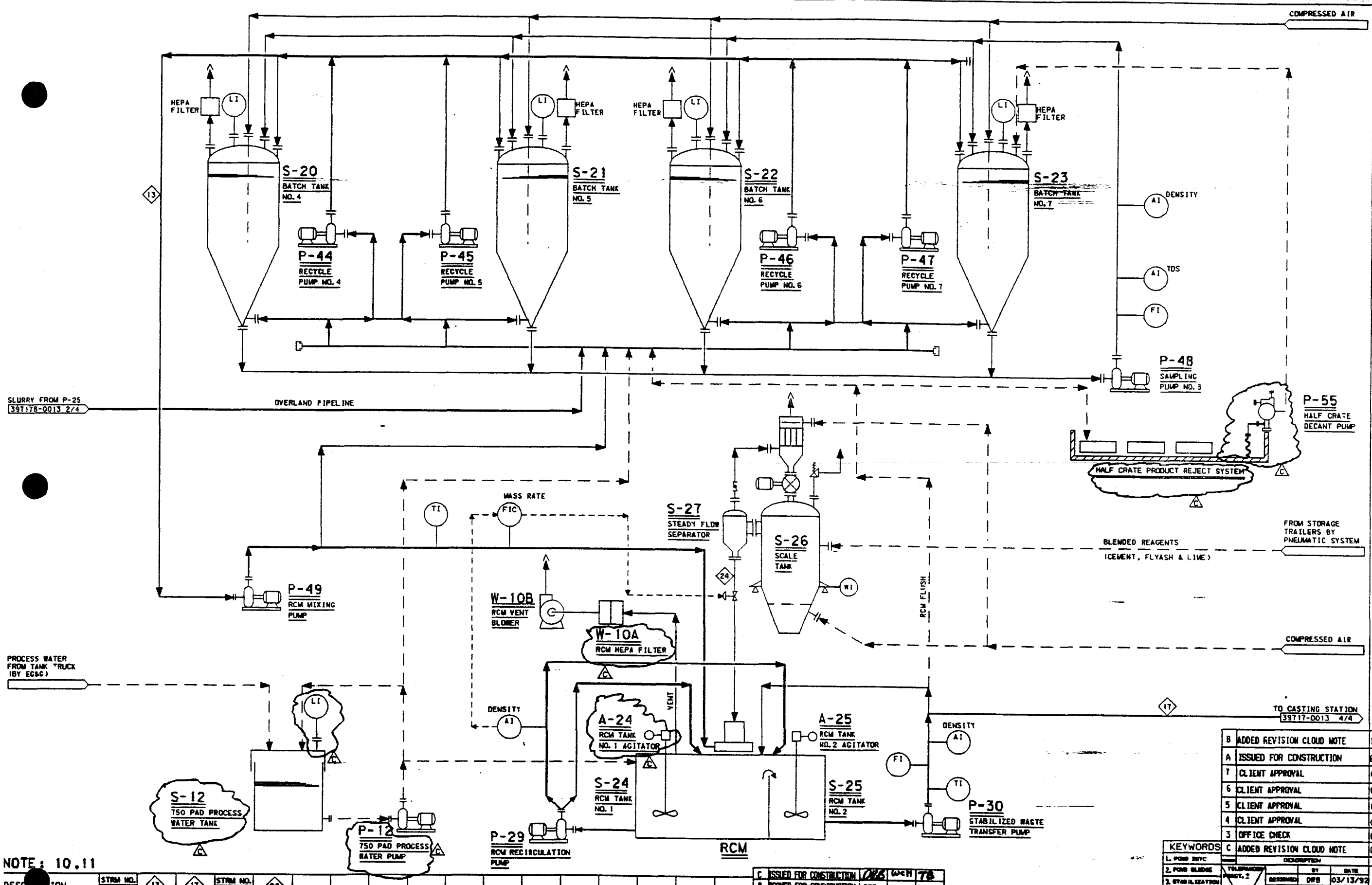
	BY	DATE
DESIGNED	DRB	03/13/92
DRAWN	CA	04/14/92
CHECKED	WCH	04/24/92
APPROVED	MH	

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE - PROCESS FLOW DIAGRAM
207C BATCH PREPARATION

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	39717-0013	C	2 of 4



NOTES:

1. ALL EQUIPMENT ITEM NUMBERS ON THIS DRAWING HAVE "430" PREFIX.
2. PIPING WITHIN SECONDARY CONTAINMENT WILL BE SINGLE WALL, OTHERWISE DOUBLE-WALL.
3. — — DENOTES INTERMITTENT OR OPTIONAL FLOWS.
4. STPH - SHORT TONS PER HOUR.
5. THIS DWG SHOWS MAJOR/CERTIFICATION INSTRUMENTS ONLY.
6. ALL FLOWS ARE FOR TREATING THE DILUTED CONTENTS OF 207C POND AND T88 CLARIFIER.
7. SECONDARY CONTAINMENT NOT SHOWN. SEE P&ID'S.
10. MATERIAL BALANCE IS BASED UPON 10% SOLIDS FEED FROM POND 207C TO STABILIZATION. (REF. MATERIAL BALANCES FOR POND 207C, ISSUE:2, REV. 4).
11. THIS IS A SEMI-BATCH PROCESS. THE FLOWS SHOWN ARE BASED ON AVERAGE RATES.

INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

NOTE: 10,11

DESCRIPTION	STRM NO. / UNITS	13	17	STRM NO. / UNITS	24
TOTAL FLOW	STPH	5.37	14.0	STPH	8.63
SOLIDS FLOW	STPH	0.54	9.17	STPH	8.63
LIQUID FLOW	STPH	4.83	4.83	STPH	0.00
TOTAL FLOW	GPM	17.4	29.6	FTS/HR	212.8
SOLIDS WT%	WT%	10.00	65.50	WT%	100.00
SOLIDS S. G.	-	2.12	2.79	-	2.85

PART	QUAL	DESCRIPTION	MATERIAL

C	ISSUED FOR CONSTRUCTION	DRB	WCH	MH				
B	ISSUED FOR CONSTRUCTION	DRB	WCH	MH				
A	ISSUED FOR CONSTRUCTION	DRB	WCH	MH				
7	CLIENT APPROVAL	DRB	WCH	MH				
6	CLIENT APPROVAL	DRB	WCH	MH				
5	CLIENT APPROVAL	DRB	WCH	MH				
4	CLIENT APPROVAL	DRB	WCH	MH				
3	OFFICE CHECK	DRB	WCH	MH				
2	OFFICE CHECK	DRB	WCH	MH				

B	ADDED REVISION CLOUD NOTE	10/23/92						JR-1198
A	ISSUED FOR CONSTRUCTION	07/24/92						JR-1198
7	CLIENT APPROVAL	07/14/92						JR-1198
6	CLIENT APPROVAL	07/08/92						JR-1198
5	CLIENT APPROVAL	05/22/92						JR-1198
4	CLIENT APPROVAL	04/27/92						JR-1198
3	OFFICE CHECK	04/14/92						JR-1198
C	ADDED REVISION CLOUD NOTE	04/26/92						JR-1198

KEYWORDS
1. POND 207C
2. POND SLUDGE
3. STABILIZATION
4. MIX RIG MIXER
5. FLUE GASSING
6. [illegible]
7. [illegible]

DESCRIPTION | DATE | APP | DOC | CLASS | JOB NO.

	BY	DATE
DESIGNED	DRB	03/13/92
DRAWN	CA	04/14/92
CHECKED	WCH	04/24/92
APPROVED	MH	

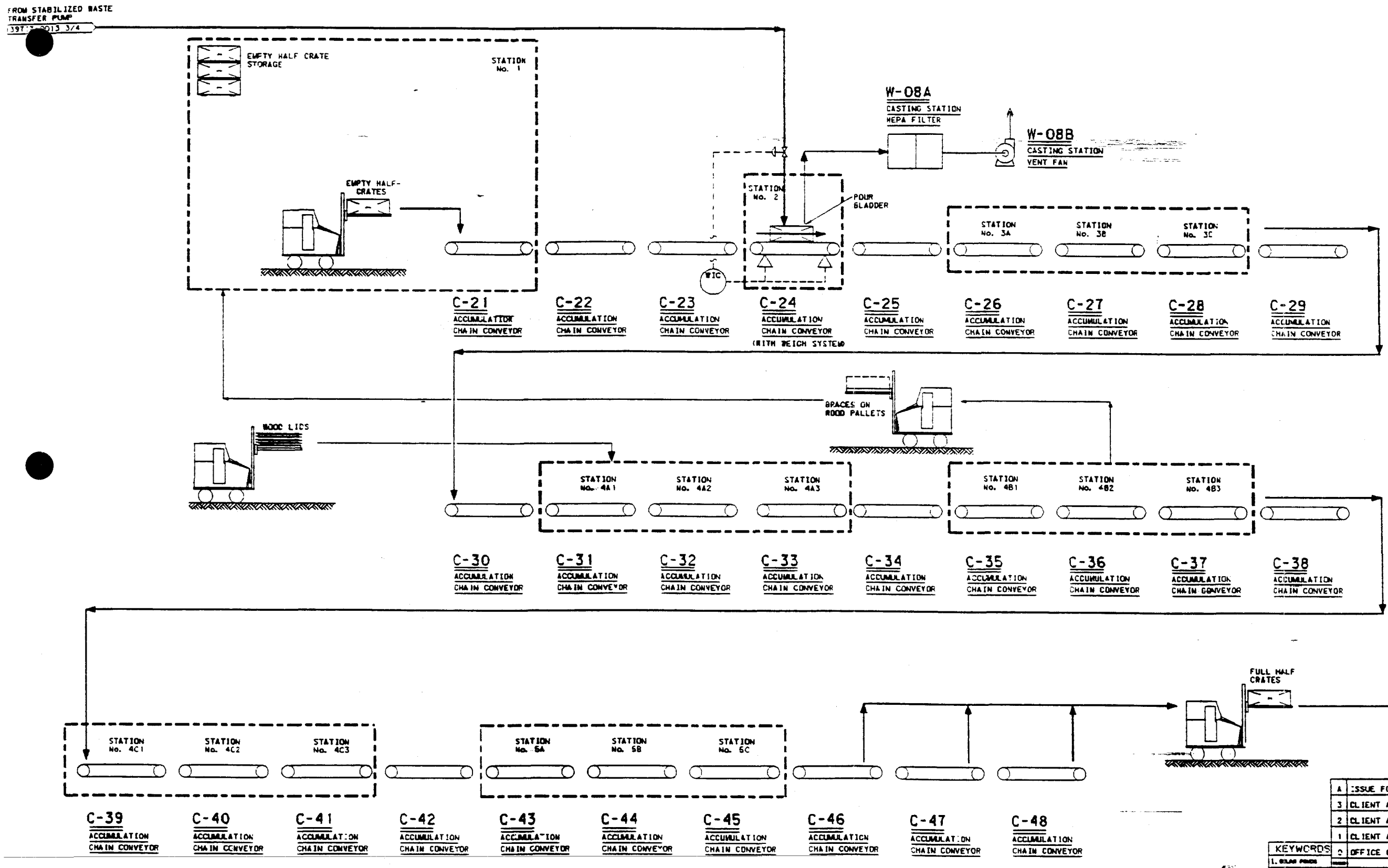
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/CONCRETE STABILIZATION PROJ.
POND SLUDGE PROCESS FLOW DIAGRAM
207C MIXING AND CASTING

SIZE D | 39T17-0013 | C | SHEET 3 of 4

HALLIBURTON NUS Environmental Corporation



PART	QUAN.	DESCRIPTION	MATERIAL

NOTES:

1. ALL EQUIPMENT ITEM NUMBERS ON THIS DRAWING HAVE "430" PREFIX.
2. STPH - SHORT TONS PER HOUR.
3. THIS DRAWING SHOWS MAJOR/ CERTIFICATION INSTRUMENTS ONLY.
4. STATION DESIGNATIONS:
   - No. 1 HALF CRATE ASSEMBLY AREA
   - No. 2 POURING AND INSPECTION STATION
   - No. 3 BAG CLOSURE AND INSPECTION STATION
   - No. 4 CRATE CLOSURE AND INSPECTION STATION
     - No. 4A LID INSTALLATION
     - No. 4B BRACE REMOVAL
     - No. 4C APPLY BANDING
   - No. 5 RADIOLOGICAL SURVEY STATION
5. EMPTY HALF CRATES RECEIVED WITH ALL INNER LINERS INSTALLED AND INSPECTED, READY FOR CASTING OF STABILIZED WASTES.

750 PAD AREA

DESCRIPTION	STRM NO. / UNITS
TOTAL FLOW	STPH
SOLIDS FLOW	STPH
LIQUID FLOW	STPH
TOTAL FLOW	GPM
SOLIDS WTX	WTX
SOLIDS S. G.	-

A	ISSUE FOR CONSTR.	DRB	BR	HH
3	CLIENT APPROVAL	DRB	BR	HH
2	CLIENT APPROVAL	DRB	BR	HH
1	CLIENT APPROVAL	DRB	BR	HH
0	OFFICE CHECK	DRB	BR	HH

HALLIBURTON NUS Environmental Corporation

A	ISSUE FOR CONSTRUCTION	07/24/92	UR-1198
3	CLIENT APPROVAL	07/14/92	UR-1198
2	CLIENT APPROVAL	05/22/92	UR-1198
1	CLIENT APPROVAL	04/23/92	UR-1198
0	OFFICE CHECK	04/23/92	UR-1198

KEYWORDS
1. SOLAR PONDS
2. STABILIZATION
3. 207C POND
4. FLOW DIAGRAM
5. CASTING STATION EQUIPMENT

	BY	DATE
DESIGNED	DRB	03/13/92
DRAWN	RL	04/22/92
CHECKED	BR	04/24/92
APPROVED	HH	04/24/92

SUBMITTED
APPROVED DOE
APPROVED

SCALE: NONE

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJECT
POND SLUDGE PROCESS FLOW DIAGRAM
207C POND CASTING STATION

SIZE	DRAWING NUMBER	REVISION	SHEET
D	39717-0013	A	4 of 4

PART	QUAN.	DESCRIPTION	MATERIAL

SYSTEM BY HNUS

PROCESS WATER (SOURCE BY HNUS)

2"-430-WA-303-AZ1

BA-355

2"-430-WA-303-AZ1

AVERAGING TANKS NO. 2 & NO. 3 (S-17, S-19)
39717-0053 3/5

FROM SAMPLING PUMP NO. 1 P-40
39717-0053 3/5

AVERAGING TANK NO. 1 S-16
39717-0053 3/5

4"-430-SG-301-AR1

CP

NOTE 2

6"-430-CP-301-AR4

BA-356

2"-430-WA-366-AZ1 (DILUTION WATER)

SYSTEM BY LEFCO

CP

X"-430-CP-308-XXX

4"-430-SY-308-XXX

SCALPING SCREEN SC-02
39717-0053 2/5

COMPRESSED AIR BY HS

BA-710

FLR

AIR DISCHARGE

FLEXIBLE HOSE

P-20
207C POND WATER RECLAIM PUMP (BY LEFCO)

BA-889

BA-888

BA-886

BA-884

BA-890

BA-887

BA-885

POND RECLAIM SYSTEM

P-15
207C POND SLUDGE RECLAIM PUMP (BY LEFCO)

207C POND

2"-430-WA-704-AR1

2"

BA-720

3"x2"

3"-430-WA-704-AR1

BA-712

TO AVERAGING TANK No 2&3 SUCTION
39717-0053 3/5

BA-719

2" HOSE CONNECTION

BA-853

PI 425

3" OVERFLOW TO AVERAGING TANK CONTAINMENT
39717-0053 3/5

3"-430-WA-707-AR1

S-11
207C POND PROCESS WATER TANK CAPY: 4,186 GAL.

3"x1"

3"-430-WA-706-AR1

FILL LINE

BA-717

P-11
207C POND PROCESS WATER PUMP 5 HP

2"-430-WA-703-AR1

BY HNUS

AR1 AR1 AA2

3"-430-WS-304-AA2

BA-301

3"-430-WS-304-AR1

6"-430-CP-304-AR4

Ca(OCl)2 FEED (MANUAL)

AA2 AZ1

1"-430-WS-307-AA2

BA-305

1"-430-WS-307.1-AZ1

AZ1 AR1

1"-430-WS-307-AR1

SCALPING SCREEN SC-02
39717-0053 2/5

3"X1"

BA-304

3"-430-WS-326-AA2

3"X2"

BA-500

BA-501

(NOTE 5)

(HOSE HEADER)

SP 4
(TYPICAL)

AA2 AZ1

BA-306

3"-430-WS-326.1-AZ1

AZ1 AR1

3"-430-WS-326.1-AR1

AVERAGING TANKS NO. 2&3 S-17 & S-19 AND CHLORINATION SYSTEM Z-09
39717-0053 3/5

BA-709

TO PUMP P-36 SUCTION
3"-430-WS-702-AR1
39717-0053 2/5

BA-707

3"-430-WA-701-AR1

TO PUMP P-17
39717-0053 2/5

TO AVERAGING TANK #1
39717-0053 3/5

AR1 AZ1

3"-430-WS-708-AR1

AZ1 AA2

3"-430-WS-708-AZ1

3"-430-WS-708-AA2

BA-708

BA-708

S-18
DILUTION BRINE TANK

CAPY: 3000 GAL

LI 311

2"-430-WS-364-AA2

BA-303

3"X2"

PI 302

BA-868

BA-869 SAMPLE VALVE

2 CH-688

SP 2

3"X2"

P-18
DILUTION BRINE PUMP 40 HP

BA-302

4"-430-WS-305-AA2

4"X3"

BA-502
NC

(MODULE 207C-02)

20T C SECONDARY CONTAINMENT (CONTINUOUS WITH AVERAGING TANKS CONTAINMENT)

C	ADDED REVISION CLOUD NOTE	10/23/92	JR-119
B	GENERAL REVISION PER FACPs MARKED UP TO REFLECT FIELD CHANGES	09/17/92	JR-119
A	ISSUE FOR CONSTRUCTION	07-24-92	JR-119
4	CLIENT REVIEW & COMMENT	07-17-92	JR-119
3	CLIENT REVIEW & COMMENT	07-08-92	JR-119
D	ADDED REVISION CLOUD NOTE	04/21/93	JR-119

KEYWORDS
1. 20T C AREA
2. POND SLUDGE
3. STABILIZATION
4. RECLAIM
5.

NOTES:
1. PLACE ALL VALVES IN EASY TO ACCESS LOCATIONS.
2. GRAVITY FLOW LINE. ROUTE WITHOUT POCKETS.
3. ALL EQUIPMENT NUMBERS IN THIS DRAWING HAVE A "430" PREFIX.
4. CONTAINMENT FOR PIPES BETWEEN MODULES IS PROVIDED BY A SINGLE PIPE RACK TYPE CONTAINED STRUCTURE.

(D) INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

REFERENCE DRAWINGS: PFD'S 39717-0013 1 THRU 4 A 04-23-93

NO.	ISSUE	BY	CHK'D	APP'D
D	ISSUE FOR CONSTRUCTION	DRB	WCH	TB
C	ISSUE FOR CONSTRUCTION	DRB	WCH	HH
B	ISSUE FOR CONSTRUCTION	DRB	WCH	HH
A	ISSUE FOR CONSTR.	DRB	WCH	HH
4	CLIENT REV. & COM.	DRB	WCH	HH
3	CLIENT REV. & COM.	DRB	WCH	HH
2	CLIENT REV. & COM.	DRB	WCH	HH

HALLIBURTON NUS Environmental Corporation

	BY	DATE
DESIGNED	DRB	04-06-92
DRAWN	JRR	04-06-92
CHECKED	WCH	04-06-92
APPROVED	DRB	07-24-92

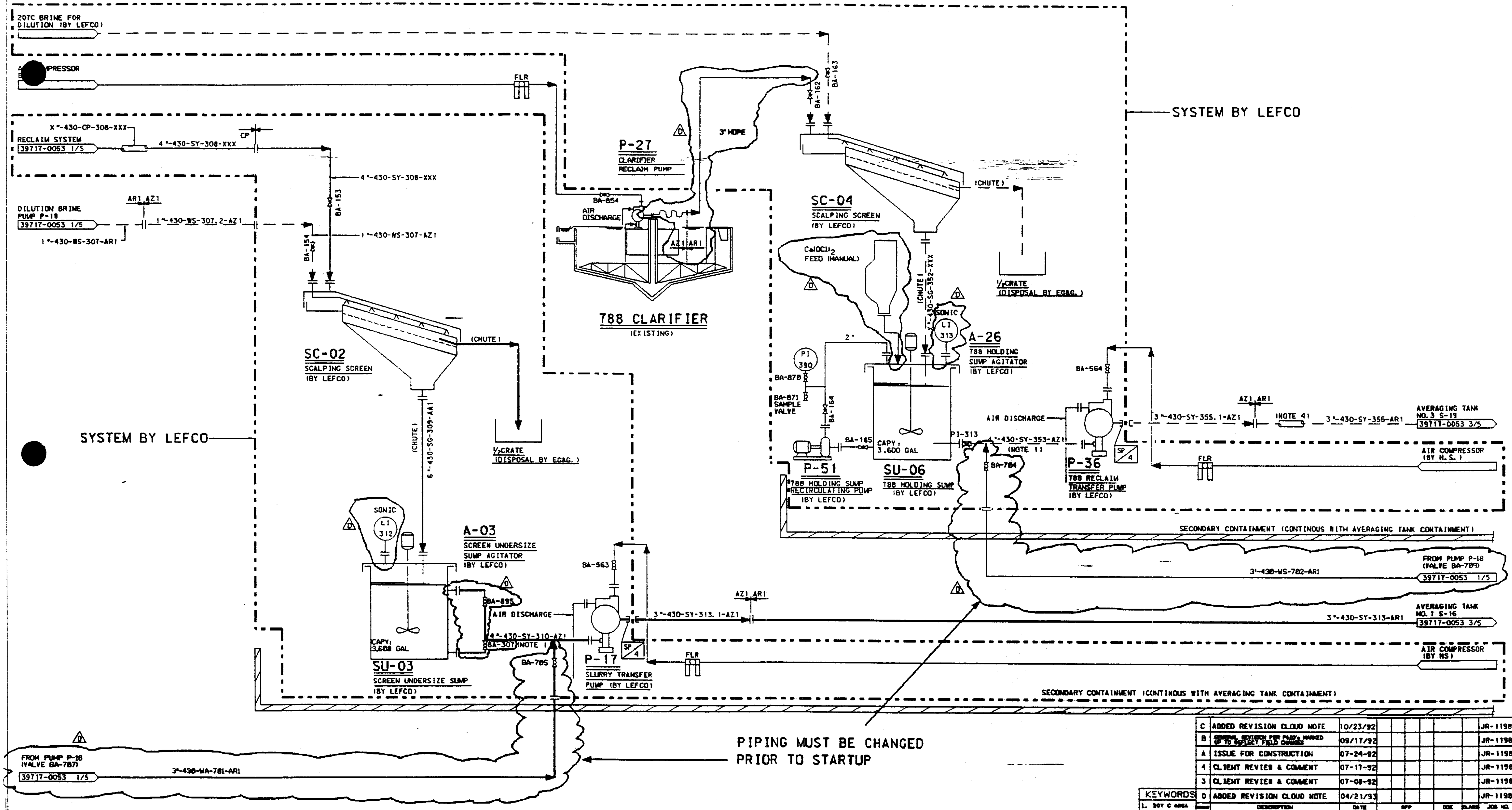
SCALE: NONE

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/CONCRETE STABILIZATION PRO.
POND SLUDGE PIPING & INSTR DIAGRAM
20T-C POND RECLAIM SYSTEM

SIZE D | DRAWING NUMBER 39717-0053 | REV D | SHEET 1 of 5


SYSTEM BY LEFCO
20TC BRINE FOR DILUTION (BY LEFCO)
AIR COMPRESSOR
X"-430-CP-308-XXX
RECLAIM SYSTEM
39717-0053 1/5
4"-430-SY-308-XXX
CP
DILUTION BRINE PUMP P-18
39717-0053 1/5
1"-430-WS-307-AR1
1"-430-WS-307.2-AZ1
1"-430-WS-307-AZ1
AR1 AZ1
BA-153
BA-154
SC-02
SCALPING SCREEN
(BY LEFCO)
(CHUTE)
6"-430-SG-309-AA1
1/2 CRATE
(DISPOSAL BY EG&G.)
SONIC
LI 312
A-03
SCREEN UNDERSIZE SUMP AGITATOR
(BY LEFCO)
CAPY: 3,600 GAL
SU-03
SCREEN UNDERSIZE SUMP
(BY LEFCO)
BA-895
AIR DISCHARGE
4"-430-SY-310-AZ1
BA-307
(NOTE 1)
BA-705
BA-563
P-17
SLURRY TRANSFER PUMP (BY LEFCO)
SP 4
3"-430-SY-313.1-AZ1
AZ1 AR1
3"-430-SY-313-AR1
AVERAGING TANK NO. 1 S-16
39717-0053 3/5
FLR
AIR COMPRESSOR (BY NS)
SECONDARY CONTAINMENT (CONTINOUS WITH AVERAGING TANK CONTAINMENT)
FROM PUMP P-18 (VALVE BA-787)
39717-0053 1/5
3"-430-WA-781-AR1
PIPING MUST BE CHANGED PRIOR TO STARTUP
P-27
CLARIFIER RECLAIM PUMP
BA-654
AIR DISCHARGE
AZ1 AR1
3" HDPE
788 CLARIFIER
(EXISTING)
BA-162
BA-163
SC-04
SCALPING SCREEN
(BY LEFCO)
(CHUTE)
1/2 CRATE
(DISPOSAL BY EG&G.)
Ca(OCl)2 FEED (MANUAL)
X"-430-SG-352-XXX
SONIC
LI 313
A-26
788 HOLDING SUMP AGITATOR
(BY LEFCO)
PI 390
BA-870
BA-871 SAMPLE VALVE
BA-164
BA-165
P-51
788 HOLDING SUMP RECIRCULATING PUMP
(BY LEFCO)
CAPY: 3,600 GAL
SU-06
788 HOLDING SUMP
(BY LEFCO)
PI-313
4"-430-SY-353-AZ1
(NOTE 1)
BA-704
AIR DISCHARGE
BA-564
P-36
788 RECLAIM TRANSFER PUMP
(BY LEFCO)
3"-430-SY-355.1-AZ1
AZ1 AR1
(NOTE 4)
3"-430-SY-355-AR1
AVERAGING TANK NO. 3 S-19
39717-0053 3/5
AIR COMPRESSOR (BY H.S.)
FROM PUMP P-18 (VALVE BA-789)
39717-0053 1/5
3"-430-WS-782-AR1

NOTES:

1. MINIMIZE LENGTH OF SUCTION PIPING.
2. PLACE ALL VALVES IN EASY TO ACCESS LOCATION.
3. ALL AGITATED TANKS SHALL HAVE BAFFLES.
4. CONTAINMENT FOR PIPES BETWEEN MODULES IS PROVIDED BY A SINGLE PIPE-RACE TYPE CONTAINED STRUCTURE.
5. ALL EQUIPMENT NUMBERS IN THIS DRAWING HAVE A "430" PREFIX.

(cloud symbol) INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

PFD'S 39717-0013	1 THRU 4	A	04-25-93
REFERENCE DRAWINGS			

NO.	ISSUE	BY	CHK'D	APP'D
D	ISSUE FOR CONSTRUCTION	DRB		TB
C	ISSUE FOR CONSTRUCTION	DRB	WCH	HH
B	ISSUE FOR CONSTRUCTION	DRB	WCH	HH
A	ISSUE FOR CONSTR.	DRB	WCH	HH
4	CLIENT REV. & COM.	DRB	WCH	HH
3	CLIENT REV. & COM.	DRB	WCH	HH
2	CLIENT REV. & COM.	DRB	WCH	HH

HALLIBURTON NUS
Environmental Corporation

	DESCRIPTION	DATE	RFP	DOE	CLASS	JOB NO.
C	ADDED REVISION CLOUD NOTE	10/23/92				JR-1198
B	GENERAL REVISION PER P&ID's MARKED UP TO REFLECT FIELD CHANGES	09/17/92				JR-1198
A	ISSUE FOR CONSTRUCTION	07-24-92				JR-1198
4	CLIENT REVIEW & COMMENT	07-17-92				JR-1198
3	CLIENT REVIEW & COMMENT	07-08-92				JR-1198
D	ADDED REVISION CLOUD NOTE	04/21/93				JR-1198

KEYWORDS
1. 20T C AREA
2. POND SLUDGE
3. STABILIZATION
4. WASH REMOVAL
5.

	BY	DATE
DESIGNED	DRB	04-20-92
DRAWN	JRK	04-20-92
CHECKED	WCH	05-07-92
APPROVED	DRB	07-24-92

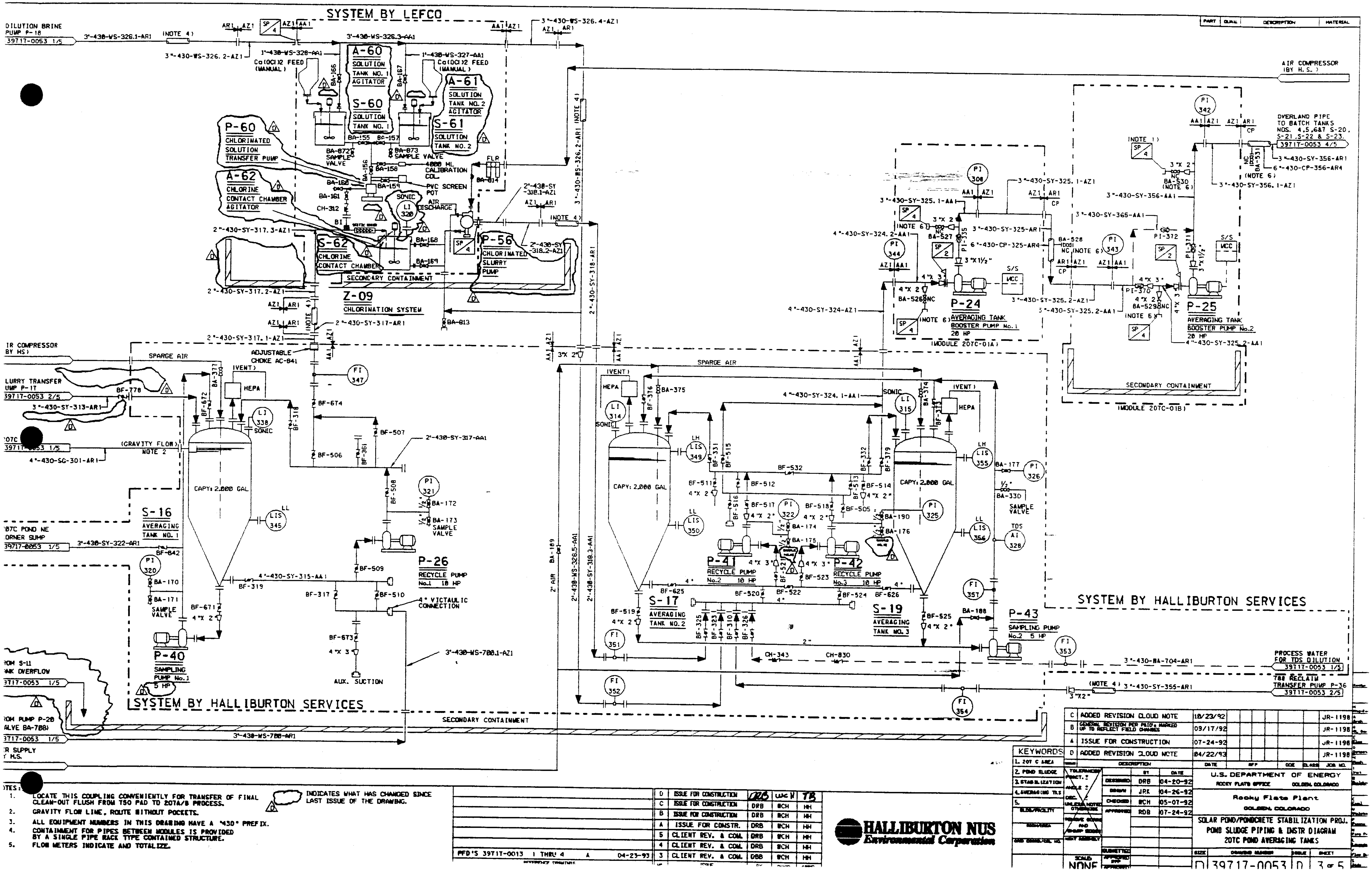
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
20TC POND OVERSIZE REMOVAL

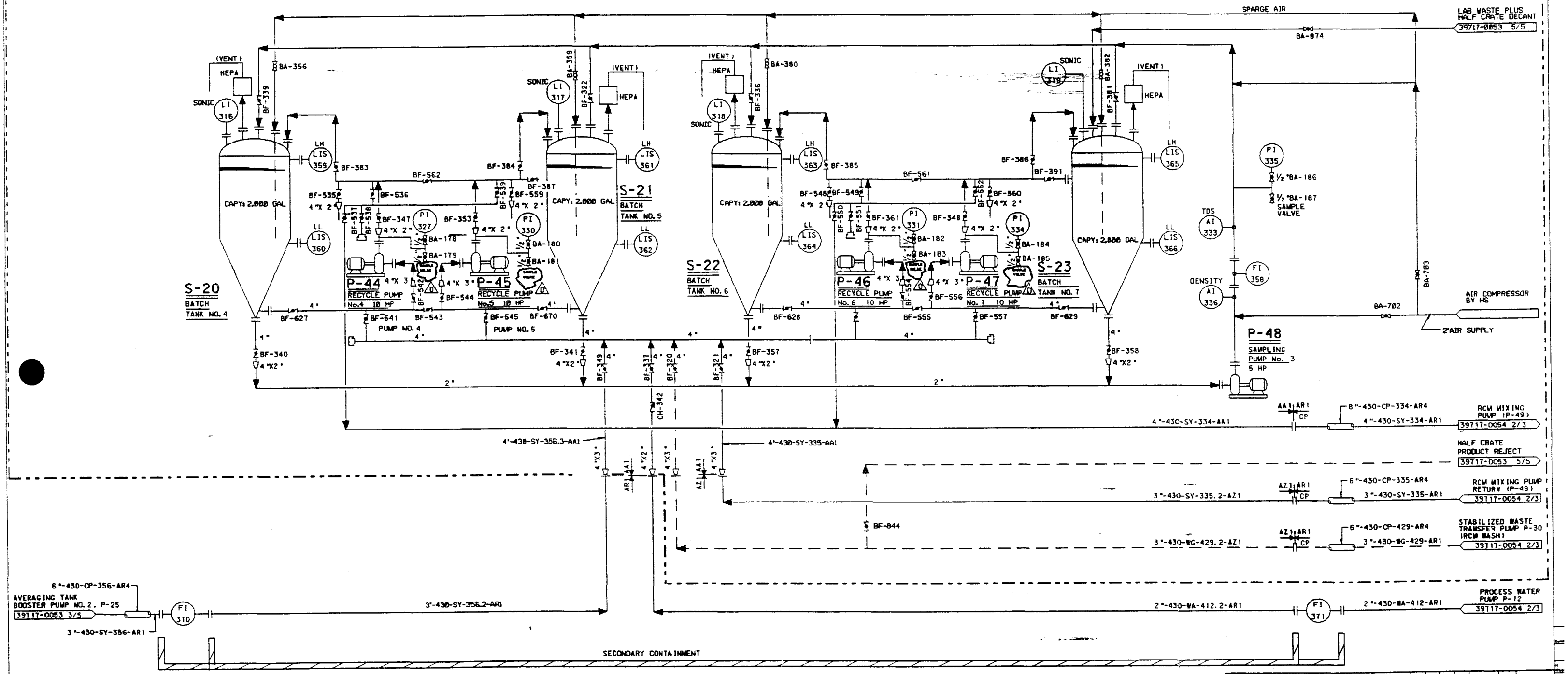
SCALE: NONE

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	39717-0053	D	2 of 5


SYSTEM BY LEFCO
SYSTEM BY HALLIBURTON SERVICES
SYSTEM BY HALLIBURTON SERVICES
Z-09 CHLORINATION SYSTEM
S-16 AVERAGING TANK NO. 1
S-17 AVERAGING TANK NO. 2
S-19 AVERAGING TANK NO. 3
P-40 SAMPLING PUMP No. 1 5 HP
P-26 RECYCLE PUMP No. 1 10 HP
P-41 RECYCLE PUMP No. 2 10 HP
P-42 RECYCLE PUMP No. 3 10 HP
P-43 SAMPLING PUMP No. 2 5 HP
P-24 AVERAGING TANK BOOSTER PUMP No. 1 20 HP
P-25 AVERAGING TANK BOOSTER PUMP No. 2 20 HP
P-56 CHLORINATED SLURRY PUMP
P-60 CHLORINATED SOLUTION TRANSFER PUMP
A-60 SOLUTION TANK NO. 1 AGITATOR
A-61 SOLUTION TANK NO. 2 AGITATOR
A-62 CHLORINE CONTACT CHAMBER AGITATOR
S-60 SOLUTION TANK NO. 1
S-61 SOLUTION TANK NO. 2
S-62 CHLORINE CONTACT CHAMBER
CAPY: 2,000 GAL
SECONDARY CONTAINMENT
(MODULE 20TC-01A)
(MODULE 20TC-01B)
AIR COMPRESSOR (BY H.S.)
OVERLAND PIPE TO BATCH TANKS NOS. 4,5,6&7 S-20, S-21, S-22 & S-23. 39717-0053 4/5
PROCESS WATER FOR TDS DILUTION 39717-0053 1/5
788 RECLAIM TRANSFER PUMP P-36 39717-0053 2/5
DILUTION BRINE PUMP P-18 39717-0053 1/5
NOTES:
1. LOCATE THIS COUPLING CONVENIENTLY FOR TRANSFER OF FINAL CLEAN-OUT FLUSH FROM 750 PAD TO 20TA/B PROCESS.
2. GRAVITY FLOW LINE, ROUTE WITHOUT POCKETS.
3. ALL EQUIPMENT NUMBERS IN THIS DRAWING HAVE A "430" PREFIX.
4. CONTAINMENT FOR PIPES BETWEEN MODULES IS PROVIDED BY A SINGLE PIPE RACK TYPE CONTAINED STRUCTURE.
5. FLOW METERS INDICATE AND TOTALIZE.
INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.
PFD'S 39717-0013 1 THRU 4 A 04-23-93
HALLIBURTON NUS Environmental Corporation
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO
Rocky Flats Plant
GOLDEN, COLORADO
SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
20TC POND AVERAGING TANKS
D 39717-0053 D 3 of 5
SCALE NONE

PART	QUAN.	DESCRIPTION	MATERIAL

SYSTEM BY HALLIBURTON SERVICES



REV	DESCRIPTION	DATE						
C	ADDED REVISION CLOUD NOTE	08/23/92						JR-1198
B	GENERAL REVISION PER FIELD MARKED UP TO REFLECT FIELD CHANGES	09/17/92						JR-1198
A	ISSUE FOR CONSTRUCTION	07-24-92						JR-1198
D	ADDED REVISION CLOUD NOTE	04/22/93						JR-1198

KEYWORDS
1. 207 C AREA
2. POND SLUDGE
3. STABILIZATION
4. BATCH TANKS
5.

	BY	DATE
DESIGNED	DRB	04-20-92
DRAWN	JPK	04-20-92
CHECKED	WCH	05-07-92
APPROVED	NH	07-24-92

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
207C POND BATCH TANKS

SCALE: NONE

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	39717-0053	D	4 of 5

NOTES:
1. INDICATORS SHALL BE READABLE FROM CONTROL VALVE (●).
2. ALL EQUIPMENT NUMBERS IN THIS DRAWING HAVE A "430" PREFIX.

⚠ INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

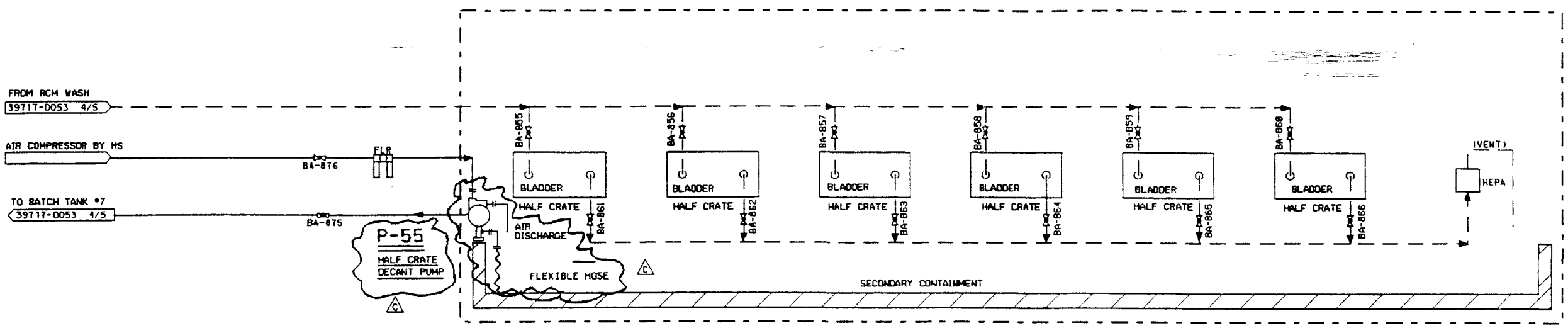
D	ISSUE FOR CONSTRUCTION	DRB	WCH	TB
C	ISSUE FOR CONSTRUCTION	DRB	WCH	NH
B	ISSUE FOR CONSTRUCTION	DRB	WCH	NH
A	ISSUE FOR CONSTR.	DRB	WCH	NH
4	CLIENT REV. & COM.	DRB	WCH	NH
3	CLIENT REV. & COM.	DRB	WCH	NH
2	CLIENT REV. & COM.	DRB	WCH	NH

PFD'S 39717-0013 1 THRU 4 A 04-23-93

HALLIBURTON NUS Environmental Corporation

PART	QUAN.	DESCRIPTION	MATERIAL

SYSTEM BY HALLIBURTON SERVICES



HALF CRATE PRODUCT REJECT SYSTEM

NOTES:

△C INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

C	ISSUE FOR CONSTRUCTION	10/23/93	DRB	WCH	TB
B	ISSUE FOR CONSTRUCTION	09/17/92	DRB	WCH	MH
A	ISSUE FOR CONSTRUCTION	09/17/92	DRB	WCH	MH
1	ISSUE FOR CLIENT REVIEW, COMMENT AND APPROVAL	09/17/92	DRB	WCH	MH
0	ISSUE FOR OFFICE CHECK	04/22/93	WCH	BY	JZ

HALLIBURTON NUS Environmental Corporation

B	ADDED REVISION CLOUD NOTE	10/23/93						JR-1198
A	ISSUE FOR CONSTRUCTION	09/17/92						JR-1198
1	ISSUE FOR CLIENT REVIEW, COMMENT AND APPROVAL	09/17/92						JR-1198
C	ADDED REVISION CLOUD NOTE	04/22/93						JR-1198

KEYWORDS
1. 207 C AREA
2. POND SLUDGE
3. STABILIZATION
4. RCM BARN
5.
BLDG/FACILITY
BUILDING
SAID CONSTRUCT. NO.

ISSUE	DESCRIPTION	DATE	WFO	DOE	CLASS	JOB NO.

TOLERANCES UNLESS NOTED OTHERWISE: FRACT. ± ANGLE ± DEC. .X ± .XX ± .XXX ± REMOVE BURRS AND SHARP EDGES VERY SMOOTH

	BY	DATE
DESIGNED	DRB	09/16/92
DRAWN	RSL	09/16/92
CHECKED	WCH	09/17/92
APPROVED		
SUBMITTED		
APPROVED RFP		
APPROVED RFP		

SCALE: NONE

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
207C POND RCM WASH

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	39717-0053	C	5 of 5

PART	QUAN	DESCRIPTION	MATERIAL

SYSTEM BY HALLIBURTON SERVICES

PNEUMATIC CONVEYING
CEMENT, FLYASH, LIME
BF-892
W-12
NON-HAZ DUST COLLECTOR
WT
GA-891
FROM AIR COMPRESSOR

LOAD LINE BF-564
PSV-893
PSV-614
BF-563
BF-565

Z-05A
TRAILER-FIELD STORAGE
1
2
3

BF-567
PSV-615
BF-566
BF-568

BF-570
PSV-616
BF-569
BF-571

GA-572
GA-573
GA-574

PI 416
PI 417
PI 418

GA-575
GA-576
GA-577

PSV-623
GA-610
AIR COMPRESSOR

GA-578
GA-579
GA-580

BF-582
PSV-617
BF-581
BF-583

Z-05B
TRAILER-FIELD STORAGE
1
2
3

BF-585
PSV-618
BF-584
BF-586

BF-588
PSV-619
BF-587
BF-589

PI 419
PI 420
PI 421

GA-590
GA-591
GA-592
GA-611

GA-593
GA-594
GA-596

BF-607
BF-606

BF-598
PSV-620
BF-597
BF-599

Z-05C
TRAILER-FIELD STORAGE
1
2
3

BF-601
PSV-621
BF-600
BF-602

BF-604
PSV-622
BF-603
BF-605

PI 422
PI 423
PI 424

GA-607
GA-608
GA-609
GA-612
GA-613

X"-430-SP-457-XXX
CEMENT, FLYASH, LIME (PNEUMATIC CONVEYING) TO SCALE TANK 39717-0054 2/3

TO SCALE TANK (AIR COMPRESSOR) 39717-0054 2/3

NO.	DESCRIPTION	DATE	APP	CODE	CLASS	JOB NO.
A	ISSUE FOR CONSTRUCTION	07-24-92				JR-1198
2	CLIENT REVIEW & COMMENT	07-17-92				JR-1198
1	CLIENT REVIEW & COMMENT	07-08-92				JR-1198
B	ADDED REVISION CLOUD NOTE	04-26-93				JR-1198

KEYWORDS
1. 207 C AREA
2. POND SLUDGE
3. REAGENT
4. FEED SYSTEM
5.
B.DIA/FACILITY
REFERENCE
DATE CORRECTOR NO.

TOLERANCES UNLESS NOTED OTHERWISE
PROJECT: ±
ANGLE: ±
DEC: ±
REMOVE BURRS AND SHARP EDGES
DEPT SUPERVISOR

	BY	DATE
DESIGNED	DRB	06-18-92
DRAWN	LA	06-18-92
CHECKED	WCH	06-18-92
APPROVED	DRB	07-24-92
GEOMETRIC		
APPROVED APP		
APPROVED DATE		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
207-C POND REAGENT FEED SYSTEM

SIZE D | DRAWING NUMBER 39717-0054 | ISSUE B | SHEET 1 OF 3

SCALE: NONE

⚠B INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

NO.	ISSUE	BY	CHK'D	APP'D
B	ISSUE FOR CONSTR.	DRB	WCH	TJS
A	ISSUE FOR CONSTR.	DRB	WCH	HH
2	CLIENT REV. & COM.	DRB	WCH	HH
1	CLIENT REV. & COM.	DRB	WCH	HH

REFERENCE DRAWINGS

HALLIBURTON NUS Environmental Corporation

PART	QUAL	DESCRIPTION	MATERIAL

SYSTEM BY HALLIBURTON SERVICES

(PNEUMATIC CONVEYING)
FROM FIELD
STORAGE TANKS
39717-0054 1/3

CEMENT, FLYASH, LIME

X"-430-SP-457-XXX

BF-648

S-26
SCALE
TANK

BF-649

S-27
STEADY
FLOW
SEPARATOR

WI 591

WI 592

BA-655

FROM AIR COMPRESSOR
39717-0054 1/3

COMPRESSED AIR
BY HS

BF-650 (5)

24
BA-867

BF-651 (6)

PI 427

PI 428

W-10A
RCM HEPA
FILTER

W-10B
RCM VENT
BLOWER
5 HP

UJR 450-10

FI 431

8"-430-CP-418.2-AR4
AA1,AR1
CP

4"-430-WH-418.3-AA1

4"-430-WH-418.2-AR1

AR1,AA1

WY 449

FROM WIC 590
39717-0054 3/3

WV 448

2"-430-WH-452-AA1

BA-419

26

BA-676 3"X 2"

25

BA-652

8"-430-CP-418.2-AR4
AA1,AR1
CP

4"-430-WH-418.1-AA1

4"-430-WH-418.2-AR1

AI 413

UR 450-9

TI 421

PI 405

SAMPLE
VALVE
27

SECONDARY CONTAINMENT (CONTINUOUS WHITH CASTING CONTAINMENT)

3"-430-SY-344-AA1

TI 408

UJR 450-7

UJR 450-8

FI 409

MASS RATE
AND DENSITY DENSITY

SP FIC 409

AI 410

NOTE 1

3"-430-SY-335-AR1

6"-430-CP-335-AR4

BATCH TANK RECYCLE
PUMP HEADER
39717-0053 4/5

AR1,AZ1
CP

3"-430-SY-335-AZ1

AZ1,AA1

BF-643

4"

BF-642

3"

16

17

BF-641

30

EMERGENCY
DUMP LINE

AZ1,AR1
CP

BA-416
NC

9

3"-430-WG-429.1-AZ1

6"-430-CP-429-AR4

3"-430-WG-429-AR1

RCM WASH TO
BATCH TANKS
39717-0053 4/5

SYSTEM BY HALLIBURTON SERVICES

3"-430-SY-335.1-AA1

BF-439

IVENT

BF-644

FV 409

BF-412

A-25
RCM TANK NO. 2
AGITATOR

BF-646

7

A-24
RCM TANK NO. 1
AGITATOR

32

AA1,AZ1

2"-430-WA-414-AA1

BA-852

2"
CH-693

2"-430-WA-414-AZ1

AZ1,AA2

2"-430-WA-415-AA2

BA-423

AA2,AZ1

2"-430-WA-415-AZ1

PROCESS WATER
(SOURCE BY HNUS)

SP 4

BA-411
NC

BA-849 21

BA-850 22

BA-851 23

BA-846 18

BA-847 19

BA-848 20

2"-430-WA-430-AA2

LI 407

S-12
750 PAD
PROCESS WATER
TANK

CH-687

3"X 2"
(TYP. 4)

BA-425

BA-427

PI 402

BA-426

AA2,AZ1

AZ1,AR1

BATCH TANKS
NOS. 4,5,6&7 S-20,
S-21,S-22,S-23
39717-0053 4/5

2"-430-WA-412-AZ1

2"-430-WA-412-AA2

2"-430-WA-412-AR1

BA-653

SP 4

BA-656
(NOTE 3)

(HOSE HEADER)

MIX PUMP
BY PASS

PI 415

10

BF-632

13

BF-636

PI 430

BF-638

11

BA-698
NC

3

BF-637
NC

BA-682

S-24
RCM TANK NO. 1

BF-639

4

S-25
RCM TANK NO. 2

8

BF-640

13

BF-657

4"-430-SY-334-AR1

8"-430-CP-334-AR4

DENSITY

AI 430

AR1,AA1
CP

RECYCLE PUMP
P-44,P-45,P-46,& P-47
39717-0053 4/5

2

BF-634

BF-631

4"-430-SY-334.1-AA1

P-49
RCM MIXING
PUMP
60 HP

P-29
RCM RECIRCULATION
PUMP 50 HP

P-30
STABILIZED WASTE
TRANSFER PUMP
40 HP

12

BF-654

BF-635

15

SP 2

3"X 2"

BA-424

P-12
750 PAD
PROCESS WATER
PUMP 10 HP

(NOTE 3)

NC
BA-699

SECONDARY CONTAINMENT

3"-430-WA-456-AA2

(MODULE 20TC-07)

SECONDARY CONTAINMENT

NOTES:
1. OPERATOR INPUTS OUTPUT-DENSITY SETPOINT FROM FORMULATION TABLE
2. ALL EQUIPMENT NUMBERS IN THIS DRAWING HAVE A "430" PREFIX

⚠ INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

D	ISSUE FOR CONSTRUCTION	DRB	WCH	MH
C	ISSUE FOR CONSTRUCTION	DRB	WCH	MH
B	ISSUE FOR CONSTRUCTION	DRB	WCH	MH
A	ISSUE FOR CONSTR.	DRB	WCH	MH
5	CLIENT REV. & COM.	DRB	WCH	MH
4	CLIENT REV. & COM.	DRB	WCH	MH
3	CLIENT REV. & COM.	DRB	WCH	MH

PFD'S 39717-0013 1 THRU 4 A 04-23-93

C	ADDED REVISION CLOUD NOTE	10/23/92		JR-1198
B	GENERAL REVISION PER PAID's MARKED UP TO REFLECT FIELD CHANGES	09/17/92		JR-1198
A	ISSUE FOR CONSTRUCTION	07-24-92		JR-1198
0	ADDED REVISION CLOUD NOTE	04/23/93		JR-1198

KEYWORDS	DESCRIPTION	DATE	RFP	DOE	CLASS	JOB NO.
1. 20TC AREA						
2. POND SLUDGE						
3. STABILIZATION						
4. CEMENT MIXING						
5.						
B.O.S./FACILITY						

TOLERANCES UNLESS NOTED OTHERWISE: FRACT. ± ANGLE ± DEC. .X ±, .XX ±, .XXX ±
REMOVE BURRS AND BREAK SHARP EDGES
DO NOT SCALE DRAWING

	BY	DATE
DESIGNED	DRB	03-13-92
DRAWN	JPK	04-24-92
CHECKED	WCH	04-24-92
APPROVED	DRB	07-24-92

SUBMITTED
APPROVED RFP
APPROVED DOE

SCALE: NONE

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
POND SLUDGE PIPING & INSTR DIAGRAM
20TC POND PRE-CAST MIXING

SIZE	DRAWING NUMBER	REVISION	SHEET
D	39717-0054	D	2 OF 3

HALLIBURTON NUS
Environmental Corporation

SYSTEM BY HALLIBURTON SERVICES

PART	QUAN.	DESCRIPTION	MATERIAL

FROM STABILIZED WASTE TRANSFER PUMP P-30
39717-0054 2/3

3"-430-WH-452-AA1

W-08A CASTING STATION HEPA FILTER

HS 642 S/S

W-08B CASTING STATION VENT FAN

ALL EQUIPMENT, CONTROLS & INSTRUMENTATION ARE PROVIDED BY UNITED MFG. CO. EXCEPT WHERE NOTED.

EMPTY HALF CRATE STORAGE

EMPTY HALF-CRATES

STATION NO. 1

C-21 ACCUMULATION CHAIN CONVEYOR

C-22 ACCUMULATION CHAIN CONVEYOR

C-23 ACCUMULATION CHAIN CONVEYOR

FOAM BLADDER

STATION NO. 2

C-24 ACCUMULATION CHAIN CONVEYOR (WITH WEIGH SYSTEM)

C-25 ACCUMULATION CHAIN CONVEYOR

STATION NO. 3A

C-26 ACCUMULATION CHAIN CONVEYOR

STATION NO. 3B

C-27 ACCUMULATION CHAIN CONVEYOR

STATION NO. 3C

C-28 ACCUMULATION CHAIN CONVEYOR

C-29 ACCUMULATION CHAIN CONVEYOR

WOOD LIDS

BRACES ON WOOD PALLETS

STABILIZED WASTE TRANSFER PUMP PIPELINE
39717-0054 2/3

SECONDARY CONTAINMENT

STATION NO. 4A1

C-30 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4A1

C-31 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4A2

C-32 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4A3

C-33 ACCUMULATION CHAIN CONVEYOR

C-34 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4B1

C-35 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4B2

C-36 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4B3

C-37 ACCUMULATION CHAIN CONVEYOR

C-38 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4C1

C-39 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4C2

C-40 ACCUMULATION CHAIN CONVEYOR

STATION NO. 4C3

C-41 ACCUMULATION CHAIN CONVEYOR

C-42 ACCUMULATION CHAIN CONVEYOR

STATION NO. 5A

C-43 ACCUMULATION CHAIN CONVEYOR

STATION NO. 5B

C-44 ACCUMULATION CHAIN CONVEYOR

STATION NO. 5C

C-45 ACCUMULATION CHAIN CONVEYOR

C-46 ACCUMULATION CHAIN CONVEYOR

C-47 ACCUMULATION CHAIN CONVEYOR

C-48 ACCUMULATION CHAIN CONVEYOR

FULL HALF CRATES

TO STORAGE ON 750 PAU

NOTES:
1. ALL EQUIPMENT ITEM NUMBERS ON THIS DRAWING HAVE "430" PREFIX.
2. ALL CONVEYORS - 1½HP MOTORS EACH
3. STATION DESIGNATIONS:
   - * NO. 1 EMPTY HALF CRATE STORAGE AND ASSEMBLY
   - NO. 2 [illegible] INSPECTION
   - NO. 3 BAG CLOSURE AND INSPECTION
   - NO. 4 CRATE CLOSURE AND INSPECTION
   - NO. 4A INSTALL LID
   - NO. 4B REMOVE BRACE
   - NO. 4C INSTALL BANDING
   - NO. 5 RADIOLOGICAL SURVEY

INDICATES WHAT HAS CHANGED SINCE LAST ISSUE OF THE DRAWING.

PFD'S 39717-0013 1 THUR 4 A 07-24-92

C	ISSUE FOR CONSTRUCTION	DRB	WCH	HH
B	ISSUE FOR CONSTRUCTION	DRB	MCH	HH
A	ISSUE FOR CONSTR.	DRB	BR	HH
4	CLIENT REV. & COM.	DRB	BR	HH
3	CLIENT REV. & COM.	DRB	BP	HH
2	CLIENT REV. & COM.	DRB	BR	HH

HALLIBURTON NUS Environmental Corporation

C	ADDED REVISION CLOUD NOTE	10/23/92	JR-1198
B	GENERAL REVISION PER P&ID's MARKED UP TO REFLECT FIELD CHANGES	09/17/92	JR-1198
A	ISSUE FOR CONSTRUCTION	07-24-92	JR-1198
4	CLIENT REVIEW & COMMENT	07-17-92	JR-1198
3	CLIENT REVIEW & COMMENT	07-08-92	JR-1198
2	CLIENT REVIEW & COMMENT	05-29-92	JR-1198
1	CLIENT REVIEW & COMMENT	05-07-92	JR-1198

KEYWORDS
1. 287C AREA
2. POND/SLUDGE
3. P&ID
4. CASTING STATION
5.

DESCRIPTION	BY	DATE
DESIGNED	DRB	03-13-92
DRAWN	RL	04-22-92
CHECKED	BP	04-24-92
APPROVED	DPB	07-24-92

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJECT
POND SLUDGE PIPING & INSTR DIAGRAM
287C POND CASTING STATION

SCALE: NONE
SIZE: D
DRAWING NUMBER: 39717-0054
ISSUE: C
SHEET: 3 of 3

PART	QUAN.	DESCRIPTION	MATERIAL

INSTRUMENT SYMBOLS

VENTURI TUBE
FLOW ELEMENT

PITOT TUBE
FLOW ELEMENT

TURBINE METER
FLOW ELEMENT

TYPE
FLOW THRU INSTRUMENT
(TYPE: PD, MAG, VORTEX, ETC.)

QUICK CHANGE FITTING
FLOW ELEMENT
SR = SENIOR FITTING
JR = JUNIOR FITTING
SM = SIMPLEX FITTING

FLOW ELEMENT
(ORIFICE PLATE) ALSO
RESTRICTION ORIFICE (FO)

FI
ROTAMETER

PI
PRESSURE GAUGE
WITH SEAL

PD
PULSATION DAMPENER

X
DISTRIBUTED CONTROL
SYSTEM (DCS)
FUNCTION DISPLAYED

LOCAL MOUNTED

X
DISTRIBUTED CONTROL
SYSTEM (DCS)
FUNCTION NOT NORMALLY
DISPLAYED

LOCAL PANEL-FRONT MOUNTED

LOCAL PANEL-INTERIOR MOUNTED

INDICATES FUNCTION DEVICE
INDICATES FUNCTION
INSTRUMENT TYPE PREFIX
XXX / XXX
LOOP NUMBER

IF THE LETTER "Y" OCCURS AS A PART OF THE INSTRUMENT TYPE DESIGNATION A FUNCTION DEVICE WILL BE REQUIRED. FOR AN EXPLANATION OF FUNCTION DEVICE SYMBOLS, SEE INSTRUMENT DESIGN CRITERIA EJ-650.01.21-1

MCC / YYY
MOTOR CONTROL CENTER
YYY = MCC EQUIPMENT TAG

GEN
COMBINATION STARTER IS
INTERGRAL WITH GENERATOR

INDICATES INTERLOCK FUNCTION
INDICATES SYSTEM NUMBER

"X" OPTIONALLY INDICATES A SPECIAL DCS FUNCTION. SEVERAL FUNCTIONS MAY EXIST IN COMBINATION:

- HH = HIGH HIGH ALARM
- H = HIGH ALARM
- LL = LOW LOW ALARM
- L = LOW ALARM
- SEL = SELECT

THE FOLLOWING DCS DESCRIPTORS SHALL BE USED ONLY FOR INSTRUMENTS TAGGED WITH SPECIAL PREFIX "XC-", "VA-", OR "VX-", IF NOT COVERED BY A STANDARD INSTRUMENT DETAIL.

- AI = ANALOG INPUT
- AO = ANALOG OUTPUT
- DI = DISCRETE INPUT
- DO = DISCRETE OUTPUT
- PI = PULSE INPUT
- PO = PULSE OUTPUT

INSTRUMENT IDENTIFICATION PREFIXES 1)

	INSTR. PREFIX	CONTROLLING: ON/OFF	CONTROLLING: INDICATING	CONTROLLING: BLIND	CONTROLLING: SELF-ACTUATED REGULATING VALVES	MEASURING: RECORDING ONLY	MEASURING: INDICATING ONLY	MEASURING: TRANSMITTING	ALARM: LOW	ALARM: HIGH	ALARM: LOW LOW	ALARM: HIGH HIGH	VALVES: SAFETY RELIEF VALVES	VALVES: FINAL CONTROL ELEMENT VALVES	MISC.: WELLS	MISC.: COMPUTING OR MODIFYING RELAY
INSTR. TYPE			-IC	-C	-CV	-R	-I	-T	-L	-H	-LL	-HH	-SV	-V	-W	-Y
ANALYZER	A		AIC	AC		AR	AI	AT	AL	AH	ALL	AHH		AV		AY
FLAME SENSING	B						BI		BL		BLL					BY
CONDUCTIVITY	C		CIC	CC		CR	CI	CT		CH		CHH		CV		CY
DENSITY (S.G.)	D		DIC			DR	DI	DT						DV		DY
VOLTAGE	E					ER	EI	ET	EL	EH	ELL	EHH				EY
FLOW	F		FIC	FC	FCV	FR	FI	FT	FL	FH	FLL	FHH		FV		FY
HAND	H	HS	HIC	HC	HCV						HLL			HV		HY
CURRENT	I					IR	II	IT	IL	IH	ILL	IHH				IY
POWER	J		JC			JR	JI	JT	JL	JH	JLL	JHH				JY
LEVEL	L		LIC	LC	LCV	LR	LI	LT	LL	LH	LLL	LHH		LV		LY
MOISTURE	M		MIC	MC		MR	MI	MT		MH		MHH				MY
PRESSURE	P		PIC	PC	PCV	PR	PI	PT	PL	PH	PLL	PHH	PSV	PV		PY
PUSH BUTTON		PB														
SPEED	S		SIC	SC	SCV	SR	SI	ST	SL	SH	SLL	SHH				SY
TEMPERATURE	T		TIC	TC	TCV	TR	TI	TT	TL	TH	TLL	THH	TSV	TV	TW	TY
VIBRATION	V					VR	VI	VT		VH		VHH				VY
WEIGHT	W			WC			WI	WT	WL	WH						WY
POSITION	Z		ZIC	ZC		ZR	ZI	ZT								ZY
PRESS. DIFF.	PD		PDIC	PDC	PDCV	PDR	PDI	PDT	PDL	PDH	PDLL	PDHH		PDV		PDY
MOTOR																
VALVE																
MISCELLANEOUS	X		XIC	XC		XR	XI	XT								
MULTIVARIABLE 5)	U		UIC	UC		UR	UI	UT								

SPECIAL PREFIXES — TYPE

- EOV- ELECTRIC SOLENOID VALVE (AND ASSOCIATED COMPONENTS)
- FRC- FLOW RATIO CONTROL
- FQI- FLOW TOTALIZER
- KC- TIMER FUNCTION
- RO- RESTRICTION ORIFICE
- XA- ALARM
- XC- MISCELLANEOUS CONTROLLER

INSTRUMENT IDENTIFICATION NUMBER BREAKDOWN

PSV - 1 - 103 - A

- PREFIX (NOTE 1)
- TRAIN NUMBER (OPTIONAL)
- LOOP NUMBER
- SUFFIX (ALPHA FOR DUPLICATE INSTRUMENTS, NUMERIC FOR UJR PEN NUMBERS)

NOTES:

1. ALL PREFIXES MUST BE SELECTED FROM THE MATRIX INSTRUMENT IDENTIFICATION PREFIXES ELSEWHERE ON THIS PAGE OR FROM THE LIST OF SPECIAL PREFIXES ABOVE.
2. NUMBER OF INSTRUMENT SHALL BE 3 DIGITS PLUS AN OPTIONAL SUFFIX CHARACTER (E.G. 235 OR 234A) AND NUMBERS SHALL NOT RELATE TO EQUIPMENT TAGS.

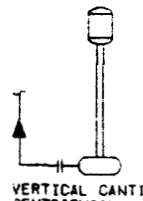
FOOTNOTES TO ABOVE COMBINATIONS:

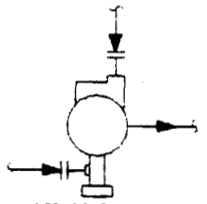
1. BLANK = IMPROBABLE COMBINATION
2. THE ABOVE IDENTIFICATION PREFIXES ARE TO BE FOLLOWED BY THE NUMERIC LOOP NUMBER PORTION OF THE NUMBER.
3. COMBINATION DEVICES WILL COMBINE PREFIXES SUCH AS HHLL.
4. MODIFIERS FOR HAND CONTROLS:

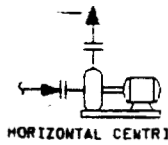
O/C	OPEN/CLOSE
OSC	OPEN/STOP/CLOSE
S/S	START/STOP
R/S	RUN/STOP (RUN PERMITTED FROM CONTROL ROOM)
HOA	HAND/OFF/AUTOMATIC
JOG	JOG
RESET	RESET
H/O	HAND/OFF
CA	OFF/AUTOMATIC
SEL	SELECTOR SWITCH (FOR MULTIPOINT INDICATOR, ETC.)
H/L	HIGH/LOW SPEED SELECTOR
FOR/REV	FORWARD/REVERSE
A/O/C	AUTO/OPEN/CLOSE
A/M	AUTO/MANUAL

5. UJI AND UJR SHALL BE USED FOR MULTIPOINT INDICATOR OR RECORDER.
6. ESD MEANS EMERGENCY SHUT-DOWN.
7. "(VF)" FURNISHED BY VENDOR WITH ASSOCIATED EQUIPMENT.

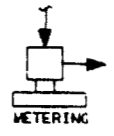
PUMP SYMBOLS


VERTICAL CANTILEVER CENTRIFUGAL


AIR DIAPHRAGM


HORIZONTAL CENTRIFUGAL


PROGRESSIVE CAVITY


METERING

A	ISSUE FOR CONSTR.	DRB	BCH	MH	
5	CLIENT REV. & COM.	DRB	BCH	MH	
4	CLIENT REV. & COM.	MAM	BCH	MH	
3	CLIENT REV. & COM.	MAM	BCH	MH	
2	CLIENT REV. & COM.	MAM	BCH	MH	

HALLIBURTON NUS Environmental Corporation

A	ISSUE FOR CONSTRUCTION							DT-24-92	JR-1198
5	FOR CLIENT REVIEW & COMMENT							DT-17-92	JR-1198
4	FOR CLIENT REVIEW & COMMENT							DT-08-92	JR-1198
3	FOR CLIENT REVIEW & COMMENT							05-29-92	JR-1198
2	FOR CLIENT REVIEW & COMMENT							05-07-92	JR-1198
1	FOR CLIENT REVIEW & COMMENT							12-12-91	JR-1198

KEYWORDS
1. P&ID'S
2. LEGEND
3. ALL
4. AREAS
5.

DESIGNED MH 11-12-91
DRAWN VM 11-13-91
CHECKED RJ 11-13-91
APPROVED DRB 07-24-92

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
PIPING & INSTRUMENTATION
LEGEND SHEET

SCALE: NONE
SIZE D | DRAWING NUMBER 39717-0050 | REVISION A | SHEET 1 of 2

650GILL A.DGN-09

VALVE SYMBOLS

- GATE VALVE
- GLOBE VALVE
- BALL VALVE
- BALL VALVE, 3 WAY
- PLUG VALVE
- CHECK VALVE
- PINCH VALVE
- AUTOMATIC RECIRCULATION CONTROL VALVE
- BUTTERFLY VALVE
- NEEDLE VALVE
- BLOCK & BLEED BALL VALVE
- BLOCK & BLEED PLUG VALVE
- RELIEF VALVE (SPRING)
- THREE-WAY AUTOMATED CONTROL VALVE
- AUTOMATED CONTROL VALVE
- DOWNSTREAM PRESSURE REGULATOR (PCV) (SELF CONTAINED)
- UPSTREAM PRESSURE REGULATOR (PCV) (SELF CONTAINED)
- EXCESS FLOW VALVE
- SLIDE GATE

CROSS REFERENCE SYMBOLS

- CONTINUATION OF PROCESS AND UTILITY LINES
- ABC — VENDOR PACKAGE INTERCONNECTING POINT FOR PIPING. "ABC" IS VENDOR'S IDENTIFICATION CODE.
- X-YYY / ZZZ — THE OCTAGON SYMBOL IS USED TO CROSS-REFERENCE CONTINUATION OF UTILITY LINES BETWEEN P&ID'S. THE LINE SERVICE DESIGNATION, "ZZZ", APPEARS INSIDE THE OCTAGON. THE CONTINUATION DRAWING NUMBER, "X-YYY" APPEARS ADJACENT TO THE OCTAGON.
- CONTINUATION OF
- CONTROL SIGNALS

PIPING SYMBOLS

- BLIND FLANGE
- SPECTACLE BLIND OPEN
- SPECTACLE BLIND CLOSED
- CAP
- LINE SIZE CHANGE SEE PIPING SPEC. FOR TYPE OF FITTING
- STATIC MIXER
- COUNTER BALANCED DRAIN
- BLEED RING
- BASKET STRAINER
- PS — PERMANENT STRAINER
- STARTUP STRAINER
- Y-TYPE STRAINER
- T — TRAP
- IN-LINE SEPARATOR
- AF — CHEMICAL INJECTION POINT
  - AF = ANTIFOAM
  - BI = BIOCIDE
  - CI = CORROSION INHIBITOR (NOT USED)
  - CA = CAUSTIC (NOT USED)
  - EB = EMULSION BREAKER (NOT USED)
  - FC = FLOCCULANT
  - SI = SCALE INHIBITOR (NOT USED)
  - PO = POLYMER (NOT USED)
- SP / X — SPECIALITY ITEM (STRAINERS, TRAPS, ETC.)
  - 1 = QUICK DISCONNECT HOSE COUPLINGS (DRY)
  - 2 = START-UP STRAINERS
  - 3 = SIGHT GLASS
  - 4 = QUICK DISCONNECT HOSE COUPLINGS (SLURRY SERVICE)
- SG — SIGHT FLOW GLASS

LINE SYMBOLS

- MAJOR PROCESS LINES
- MINOR PROCESS LINES
- INTERMITENT FLOW
- (E) — LINE HEAT TRACED (E = ELECTRIC)
- PIPING WITH SECONDARY CONTAINMENT
- PNEUMATIC SIGNAL LINES
- CAPILLARY LINES
- HYDRAULIC LINES
- ELECTRONIC OR ELECTRICAL SIGNAL LINES
- DISTRIBUTED CONTROL SYSTEM SOFTWARE LINK
- VENDOR PACKAGE LIMITS, PERMACON LIMITS
- MODUAL LIMITS
- WORK STATION LIMITS
- AA1, AC1 — LINE NUMBER CHANGE WITH SPEC CHANGE
- LINE NUMBER CHANGE WITHOUT SPEC CHANGE

MISCELLANEOUS SYMBOLS

- EDUCTOR
- HR — HOSE REEL
- FLEXIBLE CONNECTION
- FIRE HOSE PIN RACK
- HOSE CONNECTION
- COUPLING B/CAP
- QUICK COUPLING
- FLR — FILTER, LUBRICATOR, REGULATOR
- UT — ALARM BEACON CONTROLLED FROM DCS
- H — HYDRAULIC MOTOR

MISC. ABBREVIATIONS

CO	CLEAN-OUT
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
CWO	CHAIN WHEEL OPERATED
FC	FAIL CLOSE
FL	FAIL LAST POSITION
FO	FAIL OPEN
FP	FULL PORT
NC	NORMALLY CLOSED
NNF	NORMALLY NO FLOW
NO	NORMALLY OPEN
RTD	RESISTANCE TEMPERATURE DETECTOR
SC	SAMPLE CONNECTION
SO	STEAM OUT (NOT USED)
TC	THERMOCOUPLE
T/T	TANGENT TO TANGENT
UG	UNDERGROUND
VB	VORTEX BREAKER
VF	VENDOR FURNISHED WITH ASSOCIATED EQUIPMENT

PIPING LINE NUMBER

EXAMPLE LINE NUMBER — XX - XXX - AA - XXX - AAX - XAX - A

- XX — NORMAL LINE SIZE
- XXX — AREA No.
- AA — LINE SERVICE SYMBOL
- XXX — SEQUENCE No.
- AAX — PIPING MATERIAL CLASS
- XAX — PIPING INSULATION CLASS (OMITTED WHEN INSULATION NOT REQUIRED)
- A — HEAT TRACING TYPE (OMITTED WHEN HEAT TRACING NOT REQUIRED)

LINE SERVICE SYMBOL

- AP - PLANT AIR
- CP - CONTAINMENT PIPE
- DF - FUEL OIL
- SD - DUST COLLECTION
- SG - SOLIDS, GRAVITY CONVEYED (SLURRY OR DRY SOLIDS)
- SP - SOLIDS, PNEUMATICALLY CONVEYED
- SY - SLURRY WATER
- WA - PROCESS WATER
- WB - FILTER PRESS WATER
- WE - FILTRATE
- WG - FLUSH WATER
- WH - MIXED CEMENT
- WJ - FERROUS SULFATE (NOT USED)
- WS - BRINE

SEQUENCE NO.

000 THRU 999

VALVE TYPE

- BA - BALL VALVE
- BF - BUTTERFLY VALVE
- CH - CHECK VALVE
- CV - CONTROL VALVE
- DI - DIVERTER VALVE
- GK - KNIFE GATE VALVE
- GL - GLOBE VALVE
- NV - NEEDLE VALVE
- PI - PINCH VALVE

PIPING INSULATION CLASS

FIRST DIGIT - INSULATION MATERIAL SYMBOL
- 2 - CALCIUM SILICATE
- 6 - FIBERGLASS

SECOND DIGIT - INSULATION SERVICE SYMBOL
- H - HEAT CONSERVATION
- P - PERSONEL PROTECTION

THIRD DIGIT - TEMPERATURE RANGE SYMBOL
- REFER TO PROJECT INSULATION SPECIFICATION

HEAT TRACING SYMBOL

E - ELECTRICAL

VALVE IDENTIFICATION

AA - XXX
- VALVE TYPE
- SEQUENCE (FOR OPERATING USE)

RCM VALVES — (X)

PIPING MATERIAL CLASS

FIRST DIGIT - FLANGE AND PRESSURE RATING SYSTEM
- A - ANSI CLASS 150 — METAL PIPING
- B - ANSI CLASS 300 — METAL PIPING

SEE PIPING SPECIFICATION 432-081-00-001-01 FOR NON-METAL PIPING PRESSURE RATING OR FLANGE DIMENSIONS.

SECOND DIGIT - MATERIALS OF CONSTRUCTION
- A - CARBON STEEL (INCLUDES GALV.)
- R - HIGH DENSITY POLYETHYLENE
- Z - FLEXIBLE HOSE

THIRD DIGIT - SEQUENCE NUMBER

FOR HDPE PIPING
- AR1 - SDR 7
- AR2 - SDR 9
- AR3 - SDR 11
- AR4 - SDR 17

FOR STEEL PIPING
- AA1 - SLURRY SERVICE SCH 80
- AA2 - NON-SLURRY PROCESS FLUIDS, SCH 80-2" & BELOW, SCH 40-OVER 2"
- AA3 - POTABLE WATER GALVANIZED
- AA4 - LOW PRESSURE APPLICATIONS -VICTAULIC ENDS
- AA5 - PLANT AIR SCREWED ENDS

FOR FLEXIBLE HOSE
- AZ1 - 150 PSI RATED PRESSURE HOSE
- AZ2 - 250 PSI RATED PRESSURE HOSE
- AZ3 - LOW PRESSURE, HIGH FLEXIBLE PVC CONTAINMENT HOSE

PART	QUAN.	DESCRIPTION	MATERIAL

A	ISSUE FOR CONSTUCTION						07-24-92	JR-1198
5	FOR CLIENT REVIEW & COMMENT						07-17-92	JR-1198
4	FOR CLIENT REVIEW & COMMENT						07-08-92	JR-1198
3	FOR CLIENT REVIEW & COMMENT						05-29-92	JR-1198
2	FOR CLIENT REVIEW & COMMENT						05-07-92	JR-1198
NO.	DESCRIPTION						DATE	RFP / ECR / CLASS / JOB NO.

A	ISSUE FOR CONSTR.	DRB	WCH	HH	
5	CLIENT REV. & COM.	DRB	WCH	HH	
4	CLIENT REV. & COM.	DRB	WCH	HH	
3	CLIENT REV. & COM.	MAM	WCH	HH	
2	CLIENT REV. & COM.	MAM	WCH	HH	

KEYWORDS
1. P&ID'S
2. LEGEND
3. ALL
4. AREAS
5.

		BY	DATE
TOLERANCES FRACT. ±	DESIGNED	MM	11-12-91
ANGLE ±	DRAWN	VM	11-13-91
DEC. ± UNLESS NOTED OTHERWISE	CHECKED	AB	11-13-91
REMOVE BURRS AND SHARP EDGES	APPROVED	BPB	07-24-92
NEXT ASSEMBLY			
SUBJECT TO			
APPROVED BPB			

HALLIBURTON NUS Environmental Corporation

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE — GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SOLAR POND/PONDCRETE STABILIZATION PROJ.
PIPING & INSTRUMENTATION DIAGRAM
LEGEND SHEET

SIZE D | DRAWING NUMBER 70717-0050 | REV 4 | SHEET 2 of 2