U.S. Department of Energy
[redacted]
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

08-WTP-010

JAN 15 2008

Mr. L. J. Simmons, Project Manager
Bechtel National, Inc.
2435 Stevens Center Place
Richland, Washington 99354

Dear Mr. Simmons:

CONTRACT NO. DE-AC27-01RV14136 – DESIGN OVERSIGHT OF LOW-ACTIVITY WASTE (LAW) VITRIFICATION PROCESS CONTROL STRATEGY

The U.S. Department of Energy, Office of River Protection (ORP) Waste Treatment and Immobilization Plant Engineering Division completed a design oversight of the LAW Vitrification Facility process control strategy. The attached report is provided for your information.

The reviewers concluded the process control strategy for the LAW Vitrification Facility primary offgas system, secondary offgas system, melter feed preparation system, and melter appeared viable with one exception. The exception was potential precipitation of LAW concentrate received from the Pretreatment (PT) Facility.

Process control to preclude precipitation of significant quantities of solids in the Concentrate Receipt Vessels (CRV) was not developed. LAW feed is concentrated in the PT Facility and stored in the treated LAW concentrate storage vessel (TCP-VSL-00001). This vessel may be heated to preclude excessive precipitation. LAW concentrate is transferred from TCP-VSL-00001 to the LAW Vitrification Facility CRVs. The CRVs do not have heating capability and the waste will cool after transfer from the PT Facility, which could result in precipitation and an increase in weight percent solids beyond the capability of the CRVs.

ORP and Bechtel National, Inc. (BNI) raised the issue of precipitation of solids in TCP-VSL-00001 in its technical readiness assessment. As discussed above, this issue is potentially amplified in the CRVs. BNI stated this issue would be tracked and closed in conjunction with the joint ORP/BNI Technology Steering Group issue. This issue is being tracked in BNI's Action Tracking System, item 24590-WTP-ATS-QAIS-07-1229.

If you have any questions, please contact me, or your staff may contact James H. Wicks, Director, WTP Engineering Division, (509) 376-3522.

Sincerely,

John R. Eschenberg, Project Manager
Waste Treatment and Immobilization Plant Project

WTP:RAG

Attachment

cc w/attach:
BNI Correspondence

Attachment
08-WTP-010

THE WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) DESIGN OVERSIGHT REPORT

REVIEW OF LOW-ACTIVITY WASTE VITRIFICATION PROCESS CONTROL STRATEGY

December 2007

Design Oversight: D-07-DESIGN-054

Team Lead: Robert A. Gilbert

Robert A. Gilbert, WTP Engineering Division (WED)

Team Members: Ricky Bang, WED
Kris Thomas, WED
Lloyd McClure, ORP Consultant

EXECUTIVE SUMMARY

The U.S. Department of Energy, Office of River Protection (ORP) conducted a design oversight of Waste Treatment and Immobilization Plant (WTP) Project process control strategy for the Low-Activity Waste (LAW) Vitrification Facility. Specific objectives of the design oversight were to:

- Review the LAW vitrification process control strategy documented in the WTP integrated processing strategy description and system descriptions.
- Review LAW process flow diagrams and piping and instrumentation diagrams to verify features required for the process control strategy are included in WTP design.
- Assess the effectiveness of the process control strategy.
  - Determine if the process control strategy will meet contract and interface requirements.
  - Determine if the process control strategy will support plant throughput requirements.

Overall Conclusions

The control strategy was described in the WTP integrated process control strategy description, system descriptions, and software functional specifications. Piping and instrumentation diagrams were reviewed to confirm that the required control features were present in the design. The assessors concluded the process control strategy for the LAW Vitrification Facility primary offgas system, secondary offgas system, melter feed preparation system, and melter appeared viable with one exception. The exception was potential precipitation of LAW concentrate received from the Pretreatment Facility.

Specific process control set points are not completely specified in the design documentation. The WTP Contractor (Bechtel National, Inc.) stated the development of second stage software functional specifications was underway and would include required set points. The reviewers concluded this was acceptable given the stage of the project.

Process control to preclude precipitation of significant quantities of solids in the concentrate receipt vessels was not developed. LAW feed is concentrated in the Pretreatment Facility and stored in the treated LAW concentrate storage vessel (TCP-VSL-00001). This vessel may be heated to preclude excessive precipitation. The expected maximum operating point in TCP-VSL-00001 is 3.4 weight percent solids. LAW concentrate is transferred from TCP-VSL-00001 to the LAW Vitrification Facility concentrate receipt vesssels (CRVs), which are designed and tested to mix LAW concentrate with up to 3.8 weight percent solids. The CRVs do not have heating capability and the waste will cool after transfer from the Pretreatment Facility which could result in precipitation and an increase in weight percent solids.

ORP and Bechtel National, Inc. (BNI) raised the issue of precipitation of solids in TCP-VSL-00001 in its technical readiness assessment. As discussed above, this issue is potentially amplified in the CRV. BNI stated this issue would be tracked and closed in conjunction with the joint ORP/BNI Technology Steering Group issue. This issue is being tracked in BNI's Action Tracking System item 24590-WTP-ATS-QAIS-07-1229.

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LIST OF FIGURES

LIST OF ACRONYMS

ADS	air displacement slurry
ASX	Autosampling System
BNI	Bechtel National, Inc.
CARS	Consolidated Action Reporting System
CCTV	closed circuit television
CO	carbon monoxide
CO_X	carbon oxide
CRV	concentrate receipt vessel
DIW	Demineralized Water System
DOE	U.S. Department of Energy
EFRT	External Flowsheet Review Team
FRP	Waste Feed Receipt Process System
GFC	glass forming chemical
HEPA	high-efficiency particulate air
HLW	High-Level Waste [Facility]
HVAC	heating, ventilation, and air conditioning
ICD	Interface Control Document
IDF	Integrated Disposal Facility
ILAW	immobilized low-activity waste
IRP	issue response plan
ISARD	Integrated Sampling and Analysis Requirements Document
ISF	integrated storage facility
LAW	Low-Activity Waste [Facility]
LCP	LAW Concentrate Receipt Process System
LFP	LAW Melter Feed Process System
LOI	line of inquiry
LOP	LAW Primary Offgas Process System
LVP	LAW Secondary Offgas/Vessel Vent Process System
MFPV	melter feed preparation vessel
MFV	melter feed vessel
NaOH	sodium hydroxide
NO_X	nitric oxide
ORP	Office of River Protection
PCJ	process control
PFD	process flow diagram
P&ID	process and instrumentation diagram
PJM	pulse jet mixer
PSAR	preliminary safety analysis report
PT	Pretreatment [Facility]
RH	relative humidity
RLD	Radioactive Liquid Waste Disposal System
RPP	River Protection Project
SBS	submerged bed scrubber

SD	system description
SCR	selective catalytic reducer
SFS	software functional specification
Sr	strontium
TCP	Treated LAW Concentrate Storage Process System
TCO	thermal catalytic oxidizer
TRU	transuranic
TSG	Technology Steering Group
UFP	Ultrafiltration Process System
VOC	volatile organic compound
WED	WTP Engineering Division
WESP	wet electrostatic precipitator
WIPSD	WTP Integrated Process Strategy Description
WTP	Waste Treatment and Immobilization Plant

UNITS OF MEASURE

% wt	percent weight
cfh	cubic feet per hour
ft/min	feet per minute
ft/sec	feet per second
g/mL	grams per mililiter
gal/hr	gallons per hour
gal/min	gallons per minute
kg/hr	kilograms per hour
kg/m^3	kilograms per cubic meter
lb/hr	pounds per hour
MTG/d	metric tons of glass per day
ppm	part per million
psig	pound per square inch gauge
scfh	standard cubic feet per hour
scfm	standard cubic feet per minute
V	volts
WC	water column
wg	water gauge
w/o	weight percent

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection's (ORP) mission is to retrieve and treat Hanford's tank waste and close the tank farms to protect the Columbia River. In order to complete one major component of this mission, ORP awarded Bechtel National Inc. (BNI) a contract for the design, construction, and commissioning of the Waste Treatment and Immobilization Plant (WTP) at the Hanford Site in Richland. As part of its oversight responsibilities, ORP performs various assessments of BNI activities during the design and construction phase. This assessment evaluated the process control strategy for the Low-Activity Waste (LAW) Vitrification Facility.

2.0 BACKGROUND

The WTP Engineering Division (WED) has responsibility for the design oversight of the WTP. The WTP is comprised of three primary processing facilities: Pretreatment (PT), High-Level Waste (HLW) vitrification, and LAW vitrification. WED plans to perform a series of three assessments to evaluate process control strategies for each of the primary process facilities.

WTP process control strategies are documented in the WTP Integrated Processing Strategy Description, system descriptions, and software functional specifications. The WTP Integrated Processing Strategy Description provides a single document that links process flowsheet and upper tier processing related requirements with selected monitoring and control approaches for normal operations of the primary waste processing facilities. System descriptions provide an overview description of the system, including functions, requirements, design operating parameters and operational conditions and limits, and define the system technical basis and code requirements. Software functional specifications describe the function of instruments in the design and will provide process set points in the future.

3.0 OBJECTIVES, SCOPE, AND APPROACH

3.1 Objectives

The specific objectives of this oversight were:

- Review the LAW vitrification process control strategy documented in the WTP Integrated Processing Strategy Description and system descriptions.
- Review LAW process flow diagrams (PFD) and piping and instrumentation diagrams (P&ID) to verify features required for the process control strategy are included in WTP design.
- Assess the effectiveness of the process control strategy:
  - Determine if the process control strategy will meet contract and interface requirements.
  - Determine if the process control strategy will support plant throughput requirements.

3.2 Scope

This assessment included review of the WTP Integrated Processing Strategy Description, system descriptions, PFDs, P&IDs, software functional specifications, and other design documentation associated with the LAW Facility. Interviews and discussions were also conducted with cognizant WTP Engineering management and staff.

3.3 Approach

This oversight was conducted within the guidelines of ORP M 220.1, *Integrated Assessment Plan*, and ORP Desk Instruction (DI) 220.1 "Conduct of Design Oversight." The lines of inquiry used during the assessment are provided in Appendix A. The approved design product oversight plan, *WTP Engineering Division Assessment of Low-Activity Waste (LAW) Vitrification Process Control Strategy*," is provided in Appendix B.

4.0 RESULTS

4.1 Feed Receipt and Preparation

The LAW Feed Receipt and Preparation System receives LAW concentrate from the Treated LAW Concentrate Storage Process System (TCP) in the WTP PT Facility. The waste is staged, sampled, adjusted in composition, and fed into the LAW melters. Figure 1 provides a diagram of the system.

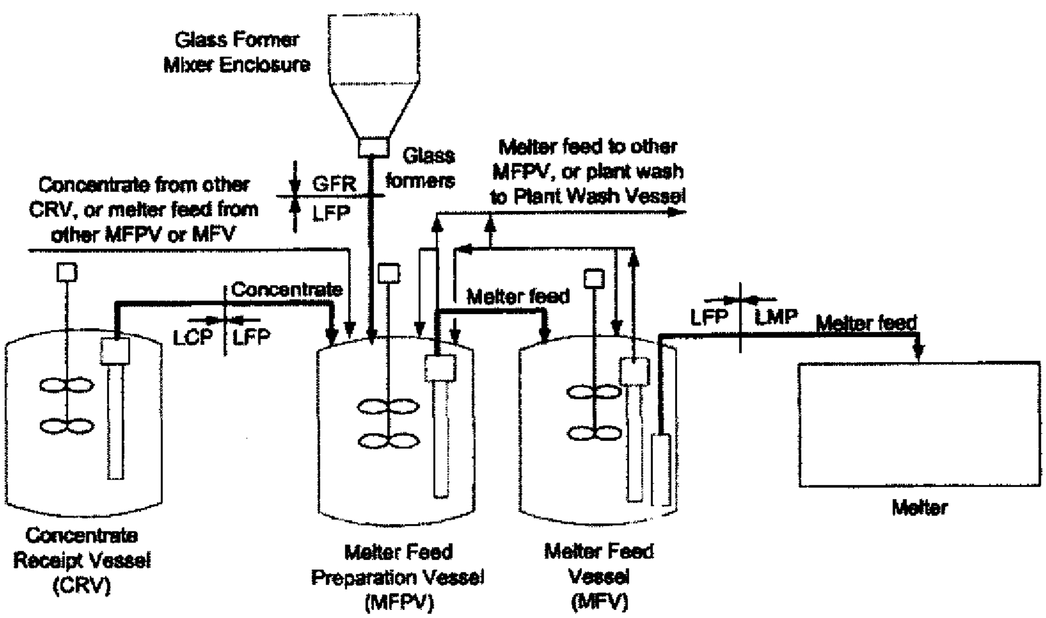

Figure 1. Diagram of the LAW Feed Receipt and Preparation System

The LAW Vitrification Facility equipment is sized to support a glass production rate of 30 MTG/d. Each melter feed preparation vessel (MFPV) and melter feed vessel (MFV) is sized to support a glass production rate of 15 MTG/d per melter. Each concentrate receipt vessel (CRV) is sized to hold a minimum of four MFPV batches of LAW concentrate. Before LAW concentrate is transferred to an MFPV, the CRV contents are thoroughly mixed and sampled. The sample is analyzed to confirm the chemical and radionuclide composition. A product control algorithm sets the amount of LAW concentrate and glass formers required to prepare a batch of melter feed that meets target immobilized low-activity waste (ILAW) compositions. The MFPV is sampled only if sample failure occurs in the CRV or process parameters indicate incomplete transfer of glass forming chemicals (GFC) or treated LAW.

Once the transfer to an MFPV is complete and the CRV sample analyses are available, glass formers are added to the MFPV. The glass formers are mixed with the LAW concentrate using mechanical agitation.

After a specified mixing duration, a batch of melter feed is transferred from the MFPV to the corresponding MFV. Although a sample can be obtained and analyzed from the MFV, this is a non-routine sample point for product compliance purposes. Air displacement slurry (ADS) pumps transfer the slurry from the MFV to the melter.

The only issue identified from the review of the process control strategy for the LAW feed receipt and preparation system is the potential for the undissolved solids concentration in the CRVs being greater than the design value of 3.8% wt solids. Process control to preclude precipitation of significant quantities of solids in the CRVs was not developed. LAW feed is concentrated in the PT Facility and stored in the treated LAW concentrate storage vessel (TCP-VSL-00001). This vessel may be heated to preclude excessive precipitation. The expected maximum operating point is 3.4 weight percent solids. LAW concentrate is transferred from TCP-VSL-00001 to the LAW Vitrification Facility CRVs. The CRV pumps are designed for up to 6% wt solids. The CRV agitators are designed for 3.8% wt solids and tested for 10% wt solids. The CRVs do not have heating capability and the waste will cool after transfer from the PT Facility.

In addition, precipitation of solids in TCP-VSL-00001 was raised as an issue in the Technical readiness assessment performed by ORP and BNI. As discussed above, this issue is potentially amplified in the CRV. ORP requested additional precipitation concerns in the LAW concentrate storage vessel be addressed by the Technology Steering Group (TSG) (07-WTP-278 [CCN 166903]). WTP Design Oversight Report D-07-DESIGN-053 documents the additional concerns. BNI stated precipitation concerns downstream of TCP-VSL-00001 would be tracked and closed in conjunction with the TSG issue. This issue is being tracked in BNI's Action Tracking System, item 24590-WTP-ATS-QAIS-07-1229.

The reviewers concluded the process control strategy for the LAW Vitrification Facility melter feed and preparation system appeared viable with one exception described above.

4.2 Melter Operation

The LAW melter system is designed to convert the mixture of pretreated LAW and glass-forming chemicals into glass. Figure 2 depicts a cutaway of a LAW melter. The feed is delivered to the melter via six feed pumps, each supplying a separate feed nozzle on the melter. Depending on slurry concentration, for a glass production rate of 15 MTG/d, the nominal feed rate will be approximately 190 gal/hr.

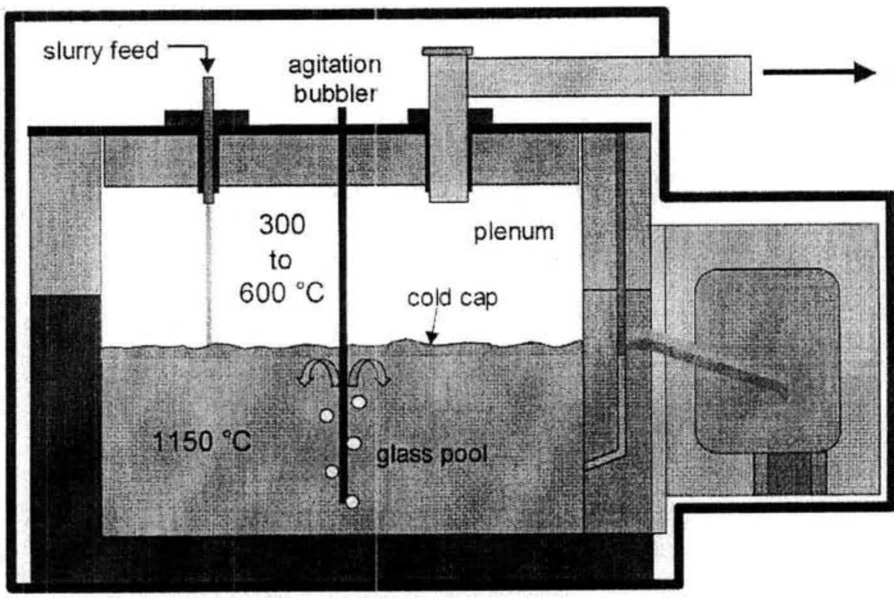

Figure 2. Cutaway of a LAW melter

The feed slurry will fall from the feed nozzles, which are located in the melter lid, onto the molten glass surface within the melter. The feed material will form a distinct layer, often referred to as the "cold cap," on the surface of the glass pool. Within this layer, several physical and chemical processes occur simultaneously as the feed material is heated from ambient to the melter glass pool temperature. First, the water in the feed will evaporate leaving a layer of dried waste and glass-forming chemicals. As the temperature of the dried material increases due to heat transfer from the glass pool, gases will evolve from the decomposition of salts, dehydration of inorganic compounds, and decomposition of organic compounds. Finally, in the lowest layers of the cold cap, the calcined feed material melts and enters the molten glass pool. At vent locations where bubblers break open the cold cap, these processes may not occur in distinct layers (as in a plug flow reactor) due to the turbulence and agitation in this zone.

Mixing is accomplished by a checkerboard array of bubblers. The bubbler controls must provide for continuous monitoring and recording of key bubbler operating parameters. These key parameters are: (1) mass flow of air, (2) bubbler air supply back pressure, (3) glass melt pool temperatures, and (4) glass melt density. Each of the 18 bubblers must be supplied with a separate injection mass flow controller. The mass flow rate will range from 0.1 to 1.5 scfm.

Pre-made glass, or frit, is used for melter startup. Temporary radiant heaters mounted inside the plenum will provide the heat for startup. When the melter reaches its operating temperature, frit will be added to begin establishing a molten glass pool. Once the glass depth is sufficient to form a conducting path between the electrodes, joule heating is initiated. Frit will continue to be fed until the melting cavity is filled sufficiently to sustain operation. At this time, the startup heaters will be removed. Additional frit will then be added to raise the molten glass pool to its normal operating level, followed by installation of the remaining normal melter operating lid components.

The rate of slurry feed to the melter is controlled by manually adjusting a single feed-rate set point. However, it is anticipated that the plenum temperatures measured in each of the three zones may be different, even with a uniform feed rate to each zone. This imbalance may lead to differences in cold cap thickness or coverage across the melter surface, which in turn may result in more feed entrainment or glass temperature instabilities. To compensate for these potential temperature differences, the rate of feeding to the outer zones (zones 1 and 3) is capable of being varied independently from the common set point by some incremental amount. Plenum temperatures in these zones will provide the feedback necessary to control the feed rate. The feed rate will be adjusted to maintain the plenum between 300 and 600°C. Adjustments are made based on plenum temperature trends collected over 1/2-hour to 1-hour intervals.

Monitoring of the feed pump operation is required. Due to the slug flow nature of pump operation, no direct measurement of feed slurry flow rate can be made. The theoretical feed rate of each pump is determined by counting the number of pump strokes since each stroke volume is identical and the volume of the stroke is known. Also, trending the motive air pressure provides the status of the ADS pump. The restricting orifice on the operating air supply causes this pressure to dip dramatically each time the feed line is blown clear at the end of the pump stroke. If the feed nozzle or lines are clogged, the magnitude of the pressure will be reduced. To ensure even feeding of the melter, online trending of the operating air pressure for the six pumps must be available to the operators. In addition, a pump failure alarm must be generated if the operating air pressure does not drop below a threshold value for several feed strokes in order to notify the operator of a potential feed line clog.

Offgas flow is not directly controlled. Primary offgas system pressure balancing is accomplished by controlling: (1) Film cooler and melter air inbleed; (2) adjusting flow control butterfly valves downstream of the wet electrostatic precipitator (WESP) before the high-efficiency particulate air (HEPA) filters; and (3) adjusting the exhauster/blower speed down stream of the HEPA filters.

Adjusting melter feed rate and increasing bubbler flow rate shall be used to control melter plenum temperature during slurry feeding to optimize throughput and stabilize melter operation. The melt pool temperature is adjusted by automatically controlling the power supplied to melter electrodes based on a glass temperature feedback control algorithm.

The resistance of the molten glass to electrical current flow provides the source of joule heating. Joule heating is controlled based on the average temperature of melt pool thermocouples. One leg of each of the 18 bubbler assemblies serves as a thermowell with 3 thermocouples located at approximately 3 inches, 20 inches, and 60 inches above the melter floor. The two lower thermocouples in each thermowell measure glass pool temperature while the upper thermocouple (60 inches) measures the plenum temperature. The glass temperature will be maintained at approximately 1150°C. The operating range will be 1150 ± 25°C. The melt pool temperature is adjusted by automatically controlling the power supplied to melter electrodes based on a glass temperature feedback control algorithm. A bulk temperature value is estimated based on averaging the readings of several thermocouples located throughout the glass pool. The upper glass melt temperature limit is required to maximize the life of the melters and the lower limit supports vitrification of melter feed slurry. Melt pool bubblers are used to increase production rates and help maintain consistent glass temperatures throughout the melters to avoid excessive hot or cold regions.

Each melter has two heated discharge chambers mounted on the melter's south wall. The glass is discharged by an air lift system. Glass discharge rates in the range of 1,000 to 2,000 kg/hr are needed to allow the glass to flow uniformly to the periphery of the container. A container fill requires pouring approximately 6,000 kg. Because of the restriction in melt level change, it is necessary to execute multiple pours to fill a container. It will take four cycles over a 10-hour period at a glass production rate of 15 MTG/d.

Glass discharge is initiated by operator action. A low melter glass level reading will alert operators to terminate glass discharge. A high container level will also indicate that it is time to stop glass discharge. Glass melt level is determined via pneumatic probes into the melt pool and a reference probe in the plenum head space. There are two observation methods for container level: an infrared camera that provides thermal imaging and a visible light camera (closed circuit television [CCTV]) for direct observation of the container. Also, to prevent container overfill, a load cell on the container support will send a signal at a predetermined weight to stop the airlift process. An auxiliary heater is attached around the pour spout of the discharge chamber. The operator manually plugs it to a power source, but only if the spout becomes obstructed with glass. Temperature indications are available for the pour spout.

Changes in glass level will change the glass pool resistance and the glass discharge flow rates. The level of the glass in the melter is determined using the measured differential pressure between the level probe and the density probe and the density probe and the plenum probe. A backup indication of melter level can be obtained from the riser air lances. Measuring the differential pressure between these air lances and the standby reference will indicate the level when airlift operations are not in progress. Changes in the melt pool level need to be limited during pouring cycles to minimize thermal shock of refractory at the slurry-glass interface. Glass level for the LAW melter is 30 ±1.5 inches. It is desirable to hold the level variation to less than ±1.5 inch to keep thermal cycling to a minimum.

The melter cooling system is designed such that most external shielded surfaces of the melter lid will not exceed 95°C. There are several cooling circuits around the melter. Cooling circuits are also provided for the six feed nozzles.

Review of the process control strategy for the LAW melter revealed no significant issues. The melter control system is based on successful operation of similar pilot and production scale melters at other sites.

4.3 Primary Melter Offgas

The LAW Primary Offgas Process System (LOP) is comprised of the melter offgas film coolers, submerged bed scrubbers (SBS), and wet electrostatic precipitators (WESP). The LOP cools the offgas, removes aerosols generated by the melter, and is used to control the melter plenum pressure. The film coolers minimize solids deposition on the piping walls by cooling the offgas to below the glass sticking temperature. The offgas is fed to the SBS for scrubbing of the entrained radioactive particulates and removal of aerosols. The WESP receives offgas from the SBS and further removes particulates and aerosols from the offgas. The offgas from the WESPs are combined with the vessel vents in the secondary offgas header.

Plant service air supplied to the film cooler is controlled to maintain the temperature and flow of offgas. Additional control air is fed into the primary offgas film cooler to control the melter plenum pressure. Temperature and pressure are monitored in line, and flow is calculated from feed and plant service air addition to the melter. The SBS is controlled by maintaining the temperature of solutions and vessel liquid level. The temperature of the SBS is controlled by cooling the vessel with a cooling jacket and two submerged cooling coils. The solution level in the SBS vessel is maintained by continuously overflowing the vessel to the SBS condensate vessel. The WESP receives all the offgas from the SBS. A high-voltage transformer/rectifier supplies power to the electrodes in the WESP, and is automatically controlled based on feedback from the spark rate sensor. Process air flow and temperature to the WESP is controlled to keep the conductors clean and dry. Control of the demineralized water supply to the WESP allows the unit to operate wet and be cleaned periodically.

Review of the process control strategy for the primary offgas process revealed no issues. The film coolers can be controlled by the plant service air addition, and has all required temperature and pressure instrumentation to ensure that the requirements for offgas flow and temperature are met. The SBS has the necessary controls to maintain temperature and liquid level. The control strategy for the WESP is adequate for operation and maintenance of the unit. Based on the review of process controls of the LOP, the approach appears viable and all required instrumentation was included on the P&ID.

4.4 Secondary Offgas

The LAW secondary offgas process system removes almost all remaining particulates, miscellaneous acid gases, nitrogen oxides, volatile organic compounds (VOC), and mercury. HEPA filters provide the final removal of radioactive particulates to protect downstream equipment from contamination. Exhausters are located downstream of the HEPA filters and discharge offgas to the mercury adsorbers. The mercury adsorbers are part of a mercury mitigation equipment skid, and use activated carbon to remove mercury and acid gases. The offgas is passed through a catalytic oxidizer/reducer skid to remove the remaining VOC and nitric oxide (NO_X). A downstream caustic scrubber further treats the offgas by removing acid gases and providing cooling. The stack is the release point for the processed melter offgas.

Offgas inlet temperature to the HEPA filters is controlled by the preceding electric heaters, and monitored at the preheater outlet to ensure that the relative humidity of the inlet feed stream is within acceptable limits. Pressure drop across each filter train is monitored to detect failed or obstructed filters. The flow would be routed to the redundant filter train upon detection of failure. The exhausters are sized to provide enough pressure gain to exhaust through downstream equipment. There are also controls for upsets. The mercury adsorbers receive the full flow of the offgas from the exhausters at exit pressure of the exhausters. The appropriate interlocks are activated upon detection of high offgas temperature or high carbon monoxide (CO) or carbon oxide (CO_X) concentration as it indicates that a carbon bed fire is occurring. The thermal catalytic oxidizer is controlled by heating the offgas through the use of a regenerative heat exchanger and electric heaters. The selective catalytic reducer (SCR) is controlled by receiving heated offgas from the thermal catalytic oxidizer and mixing the offgas stream with ammonia mixed with air from the C3 vent system. The caustic scrubber removes acid gases from the offgas stream using 5 molar sodium hydroxide (NaOH). The caustic scrubber normally operates with a pH of 9, but pH can be raised based on the halide concentration to protect the system from corrosion. Process water is added to the caustic collection tank to maintain scrub solution level. Scrubber bottoms are transferred to the PT Facility vessels RLD-VSL-00017a/b about every two days.

Review of the process control strategy for the primary offgas process revealed no issues. Pressure is monitored throughout the offgas system to determine if a blockage or constriction is occurring. The HEPA preheaters and filters have the required instrumentation to meet the inlet offgas relative humidity requirement. There are speed, temperature, and pressure instrumentation for the exhausters to ensure proper control. The mercury adsorbers are monitored for offgas outlet mercury, hydrogen chloride, and hydrogen fluoride concentrations. Each adsorber is also designed to include a water deluge system to be manually activated upon detection of a carbon bed fire. Temperature, pressure drop, and catalyst fouling are monitored on the thermal catalytic oxidizer. The control of the mixed ammonia/air injection rate in the selective catalytic reducer is based on NO_X and ammonia levels in the exit gas. Catalyst fouling is also monitored in the SCR. Level, pH, and temperature are monitored in the caustic scrubber. Based on the above, the approach to control the LAW Secondary Offgas/Vessel Vent Process System (LVP) appeared viable. All required instrumentation was included on the P&ID.

4.5 Effectiveness of Process Control Strategy

The process control strategy for the primary and secondary offgas systems measure process parameters real time. The strategy does not rely on sampling and waiting for results. Assuming instruments are procured, received, and installed properly, the system should not preclude melter operations or limit plant throughput.

Sample process control points for monitoring constituents required in permits were specified in the WTP Integrated Process Control Strategy Description. These were included in the offgas system design on the P&IDs.

The WTP Operations Research Model (24590-WTP-RPT-PO-05-001, 2005 WTP Operations Research Assessment, dated August 29, 2005) includes predictions on frequency of required maintenance and repair of primary and secondary offgas system components. This assessment projected that the overall LAW Vitrification facility including the offgas systems would exceed the Basis of Design required availability of 70%.

The LAW Melter Feed Process System (LFP) and melter process control strategy is based on considerable operating experience of pilot- and full-scale melters of very similar design and service. LAW feed receipt, addition of glass formers and other chemical adjustments, feed to the melter, and melter operations are all expected to meet contract waste processing requirements based on this relevant melter experience.

The LAW feed to the melter is dependent on sample analysis results being available in a timely manner. However, because the melter is not very sensitive to variations in any particular feed batch, the feed batches are allowed to be passed forward from the CRV to the MFPV following sampling, instead of held awaiting sample results. The CRV is designed to stage four batches of melter feed. Waste feed is mixed and sampled in the CRV to determine the amount of glass formers and sucrose needed for the melter feed recipe. The required glass former additions are made in the MFPV.

There are three process requirements that must be met before transferring a waste feed batch from the MFPV to the MFV. First, the sample results of the batch must be received. Second, the correct quantity of glass formers and reductants must be added. Third, the waste feed, glass former, and reductants must be uniformly blended. The MFPV is sampled periodically to verify uniform blending.

There is an overall concern with solids precipitating downstream of the ultrafiltration systems in the PT Facility. The TCP is one of the systems identified as a concern. Temperature control in the LAW Vitrification Facility vessels is very limited; therefore, any issue in the TCP could also be compounded downstream in the LAW Vitrification Facility. This is the overriding residual risk for the LAW feed receipt and melter feed system. There are also general concerns with PJM mixing issues raised by the External Flowsheet Review Team (EFRT) that still need to be resolved per the closure criteria of the EFRT issue M-3, "Inadequate Mixing System," Issue Response Plan. Of the systems evaluated, this concern only applies to TCP-VSL-00001.

5.0 CONCLUSIONS AND/OR FINDINGS

The control strategy was described in the WTP integrated process control strategy description, system descriptions, and software functional specifications. Piping and instrumentation diagrams were reviewed to confirm that the required control features were present in the design. The assessors concluded the process control strategy for the LAW Vitrification Facility primary offgas system, secondary offgas system, melter feed preparation system, and melter appeared viable with one exception. The exception was potential precipitation of LAW concentrate received from the Pretreatment Facility.

6.0 PERSONNEL CONTACTED AND REFERENCES

6.1 Personnel Contacted

BNI Engineering

- R. Hanson
- R. Peters

BNI Quality Assurance

– D. Kammenzind

6.2 References

07-WTP-278 (CCN 166903), letter, J.R. Eschenberg, ORP, to C.M. Albert, BNI, "Transmittal of the U.S. Department of Energy, Office of River Protection (ORP) Design Oversight Assessment on Post-Filtration Precipitation," dated October 29, 2007

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24590-LAW-3PS-LOP-T0001, *Software Functional Specification for LAW Primary Offgas Process (LOP) System*, Rev. A, December 12, 2003

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Appendix A. REVIEW OF WTP LAW PROCESS CONTROL STRATEGY LINES OF INQUIRY AND ASSESSMENT

LAW Vitrification Process Control Strategy

Lines of Inquiry [LOI]

Melter Feed and Melter - Assessors (Kris Thomas)

- Feed from Pretreatment Vessel TCP-VSL-00001

  References

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  - *What process controls are used to manage feed sent from Pretreatment to the LAW Vitrification Concentrate Receipt Vessels (CRV)?*

  The WTP Integrated Process Strategy Description (WIPSD), system description (SD), software functional specification (SFS), and calculation sheet were reviewed to address the LOI. The treated LAW Concentrate vessel function is to receive LAW waste feed from treated LAW evaporator separator vessel (TCP-VSL-00001). The batch capacity is 93,000 gallons, which is approximately 7 days of lag storage. Pulse jet mixers (PJM) provide the mixing capability for the vessel. The four main parameters monitored are pressure, temperature, level in the vessel, and density.

  Note: There is an overall concern with solids precipitating downstream of the filtration systems in the PT Facility. The TCP is one of the systems identified as a concern. Temperature control in the LAW Vitrification Facility vessels is very limited; therefore, any issue in the TCP could be compounded downstream. The expected maximum operating point is 3.4 weight percent solids. It was observed that two documents listed 20 weight percent solids as the maximum operating condition for TCP-VSL-00001 and associated transfer pumps. The first document was the process data sheet for TCP-VSL-00001 (24590-PTF-MVC-TCP-00001). The second document was the TCP system description (24590-PTF-3YD-TCP-00001). The process data sheet for the TCP PJMs (24590-PTF-M0D-M40T-00003) was updated in May of 2003 however this revision was not incorporated into a revision of the process data sheet for TCP-VSL-00001 or future revisions to the TCP system description. The concentrate receipt vessel (CRV) in LAW has a design capacity of 3.8% solids. The CRV pumps are designed for up to 6% solids (24590-LAW-MPD-LCP-00001 and 3). The agitators are designed for 3.8% solids (24590-LAW-MFD-LCP-00004 and 5) and tested for 10% solids (24590-

QL-POA-MFA0-00001-10-00001, *Final - Report Laboratory Test Report - Report of Slurries*). Clarification on process and administrative controls is needed to verify proper operation. The following letter from ORP requested additional precipitation concerns in the LAW concentrate storage vessel be addressed by the TSG (letter 07-WTP-278 [CCN 166903]). Design Oversight Report D-07-DESIGN-053 documents the additional concerns and is not limited to the TCP. Solids management in the LAW process vessels should be included as a D-07-DESIGN-053 action and be addressed by the TSG.

- *How is a LAW waste feed batch qualified for transfer?*

  Samples are taken to ensure the ion exchange process has sufficiently decontaminated the material.

  A gamma monitor with interlocks is installed on the LAW transfer line isolation valves and the PT Facility transfer valves for monitoring transfers from TCP-VSL-00001 to the LAW facility and to the TCP system from the Ultrafiltration Process System [UFP] and Waste Feed Receipt Process System [FRP] to ensure HLW will not be transferred to the LAW Facility.

  An in-line gamma monitor is installed at the LAW feed buffer tank discharge from the PT Facility. The monitor is connected to logic circuits that prevent transfer of feed to the LAW Facility if higher than expected radiation levels are detected.

- *How is temperature controlled and monitored?*

  TCP is equipped with a high pressure steam injection system to maintain the temperature of treated LAW to avoid solids precipitation.

- *What are the operating temperature ranges?*

  The expected temperature range is 100°F to 150°F with an expected nominal temperature of 122°F (TCP Calculation Sheet, Section 7). At this point in the design, setpoints for alarms have not been determined.

- *How is system pressure controlled and monitored?*

  Pressure is monitored by pressure indicators mounted in the TCP vessel. Vessel ventilation is controlled by the Pretreatment Vessel Vent Process System (PVP). At this point in the design, setpoints for alarms have not been determined.

- *What is the operating pressure ranges?*

  Nominal design pressure is -0.14 psig or -3.9 inch WC. Maximum pressure is 0 psig caused by ventilation system failure and the minimum design pressure is -0.22 psig or -6.1 inch WC).

- *What flow rate is required for transfer?*

  Designed flow rate from the treated LAW concentrate vessel to LAW CRV is 88 gal/min.

- *How is the flow rate monitored and controlled?*

  Primarily flow rate is monitored by tracking tank level. The capacity to determine mass transfer is also present using the density instrumentation in conjunction with the tank level. Tank level trip setpoints are tied to the transfer pumps and will stop pumps and close isolation valves if a high or low setpoint is reached.

- *What are the primary concerns with waste feed chemistry (e.g. Na ....)?*

  The primary chemistry concern is sodium precipitates. Concerns of solids are addressed above and are also previously documented in Design Oversight Report D-07-DESIGN-053.

- *How is chemistry controlled and monitored?*

  Chemistry is monitored by sampling. Chemistry control in TCP-VSL-00001 is limited to mixing and dilution with demineralized water.

- *What radionuclides are of concern?*

  The primary radionuclides of concern are cesium, strontium, and transuranic (TRU) waste components. Control of these radionuclides ensures the LAW glass specification is met which fulfills requirements of the contract and disposal criteria.

- *How are radionuclides controlled and monitored?*

  Radionuclides are monitored by sampling in the LAW concentrate storage vessel as well as in the LAW process vessels. Gamma monitoring as described above is also utilized for detecting cesium.

- *What are the physical properties of interest (rheology, % solids, etc.)?* (addressed below)

- *How are physical properties controlled and monitored?*

  Density is monitored by a density indicator. Density is controlled by diluting the vessels contents with demineralized water. The operating waste feed density range is defined by the TCP Calculation Sheet, Section 7. Minimum density of 1.33 g/mL, maximum density of 1.57 g/mL with an average density of 1.40 g/mL.

  Percentage of solids can also be monitored. This is accomplished by sampling and monitoring the current loading on the agitator motors. The maximum operating point for weight percentage solids in TCP-VSL-00001 is 20%.

- *What are the sampling requirements?*

  TCP-VSL-00001 is sampled by the Autosampling System (ASX) prior to batch transfers to the LAW vitrification facility to verify proper waste composition.

- *What are the mixing requirements?*

  Resolution of External Flowsheet Review Team (EFRT) issue M-3 involves developing requirements and verifying vessel design for mixing in WTP vessels mixed by pulse jet mixers (PJM). This is documented by the M-3 Issue Response Plan (IRP) 24590-WTP-PL-PET-07-0002. Table 1 of the IRP lists TCP-VSL-00001 as one of the vessels being evaluated.

- *What are system flushing requirements after a batch is transferred?*

  Transfer lines are flushed after each transfer operation as outlined by the TCP SD Section 8. Transfer lines are flushed with one line volume of process water toward the LAW Vitrification Facility and with two line volume flushes of process water back to the Pretreatment Facility.

Based on review of referenced documents the process control strategy appears adequate with the following exceptions. The potential for solids precipitating out as addressed by Design Oversight Report D-07-DESIGN-053 and ORP letter 07-WTP-278 still needs to be addressed. PJM mixing issues raised by the EFRT still need to be resolved per closure criteria of EFRT Issue M-3.

- CRV

  References

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24590-LAW-M6-LCP-P0002, *P&ID - LAW Concentrate Receipt Process System*, Rev. 2, July 12, 2007

24590-LAW-3PS-LCP-T0001, *Software Functional Specification for LAW Concentrate Receipt Process LCP System*, Rev. 1, November 29, 2004

24590-LAW-MVC-LCP-00002, *LAW Concentrate Receipt Process System (LCP) Data*, Rev. 1, July 25, 2007

- *What process controls are used to manage feed within and transferred from the CRV?*

  The WIPSD, SD, PFD, SFS, and P&ID were reviewed to address the LOI. The CRV function is to receive LAW waste feed from the PT Facility. The batch capacity of each CRV is 9115 gallons with a maximum operating volume of 15,435 gallons. The CRV is designed to stage four batches of melter feed. Waste feed is mixed and sampled in the CRV to determine the amount of glass formers and sucrose needed for the melter feed recipe. Once sampling is complete, waste feed can be transferred to the MFPV. Four main parameters are monitored in the CRV pressure, temperature, level in the vessel, and density.

- *How is a LAW waste feed batch qualified for transfer from the CRV?*

  The only process requirement for transferring a waste feed batch from the CRV to the MFPV is a sample of the batch must be taken prior to the transfer.

  Additional operational prechecks and permissives must be met prior to initiating transfer. During waste feed transfer trips and running checks are used to verify transfer. Transfer is stopped if any one of the trips or running checks fails (LCP SD paragraph 7.1.5). *What are the physical properties of interest (rheology, % solids etc.)?*

  Temperature and density are the only physical properties controlled in the CRV (LCP SD, paragraph 6.2.1).

- *How are physical properties controlled and monitored?*

  Density is monitored by a density indicator. Density is controlled by diluting the vessels contents with demineralized water. The operating waste feed density range is defined by the LCP Calculation Sheet, Section 8. Minimum density of 1.0 g/mL, maximum density of 1.46 g/mL with a nominal density of 1.38 g/mL.

  Percentage of solids can also be monitored. This is accomplished by sampling and monitoring the current loading on the agitator motors. The maximum operating point for weight percentage solids is 3.8%.

- *How is temperature controlled and monitored?* (addressed above)

  Temperature is monitored by a temperature indicator (thermocouple or resistance temperature detector) mounted in the CRV. Temperature is maintained by keeping the waste feed coming from the PT Facility at a sufficiently high temperature to ensure minimal solids precipitate. The expected temperature range is 77°F to 149°F with an expected nominal temperature of 123°F LCP Calculation Sheet, Section 8 (24590-LAW-MVC-LCP-00002). There is no process outside agitation and re-circulating waste feed through transfer pumps for maintaining temperature in the CRV. There are different temperature requirements based on the different waste envelopes delivered. Low temperature alarm setpoint is 104°F. In the case where agitation or re-circulation does not adequately address temperature issues, the waste feed can be transferred back to the PT Facility (LCP SD, paragraph 6.1).

- *What are the operating temperature ranges?* (addressed above)
- *Do CRVs have temperature control functions?*

  None, temperature is dependent on incoming waste feed temperature. Temperature of the vessel can also be affected by the temperature control of the wet process cell to a limited degree. Capacity of the HVAC system is such to maintain temperature of the cell and not maintain process control temperatures.

- *How is system pressure controlled and monitored?*

  Pressure is controlled by the LAW secondary offgas system (LCP SD, Table 9-1) and is connected through the vessel vent header. A constant volume of air is drawn through the vessel vent header. The volume of air drawn through the vessel vent header can be adjusted by a flow control damper as necessary to maintain negative pressure.

  High pressure alarm setpoint is -1.4 inch WC.

- *What is the operating pressure ranges?*

  Nominal design pressure is -0.1 psig or -2.8 inch WC. Maximum pressure is 0 psig caused by ventilation system failure and the minimum design pressure is a full vacuum (-14.7 psig, -407 inch WC).

- *What flow rate is required for transfer?*

  Designed flow rate from the CRV to the MFPV is 88 gal/min.

- *How is the flow rate monitored and controlled?*

  Primarily flow rate is monitored by tracking tank level. The capacity to determine mass transfer is also present using the density instrumentation in conjunction with the tank level. Tank level trip setpoints are tied to the transfer pumps and will stop pumps and close isolation valves if setpoint is reached. Flow can also monitored by remote mounted flow transmitters. Flow can also be controlled by flow control valves.

- *What are the primary concerns with waste feed chemistry (e.g. Na ....)?*

  The primary chemistry concern is sodium precipitates. ORP requested additional precipitation concerns in the LAW concentrate storage vessel be addressed by the TSG (letter 07-WTP-278 [CCN 166903]). Sodium loading is taken into account by the glass algorithm and glass formers are varied based on concentration. Solids management in the CRV should be included as D-07-DESIGN-053 action and be addressed by the TSG.

  High nitrates in the waste feed are also a concern. High nitrate feed requires the addition of a reductant in order to control melter foaming. Sucrose will be used as the baseline reductant for WTP. It is normally added with the glass formers.

- *What radionuclide's are of concern?*

  The primary radionuclides of concern are cesium, strontium, and TRU waste components. Control of these radionuclides ensures the LAW glass specification is met which fulfills requirements of the Contract (Specification 2.2.2.8, Radionuclide Concentration Limitations) and disposal criteria.

- *How are radionuclides controlled and monitored?*

  Radionuclides are monitored by sampling the CRV. Waste feed that is out of specification can be routed back to the PT Facility.

- *What are the sampling requirements?*

  Waste feed is sampled in the CRV by the Autosampling System (ASX).
  The waste feed must be sample prior to transfer to the MFPV. At designated time intervals, the ASX circulates waste feed and intermittently takes samples (LCP SD paragraph 6.2.10). The samples are then analyzed and, from the samples, the appropriate quantities of glass formers and reductants are selected.

- *What are the mixing requirements?*

  LCP SD, Section 4, paragraph 4.1.4 provides the mixing requirements for the LCP. Two types of mixing are required liquid-liquid and solid-liquid. Mixing requirements are based on the need to (1) re-suspend settled solids and maintain suspension of solids within vessels and (2) sufficiently mix the contents of the vessels for sampling.

  Each CRV has an agitator, which functions in meeting the overall mixing requirements of the LCP. Primary function of the agitator in the CRV is to ensure samples taken are representative. Although function of the CRV agitator is well defined ,the LCP SD is unclear on the mixing times required. LCP SD paragraph 6.1.1. The system mixing time of 30 minutes is documented in the following test report, 24590-QL-POA-MFA0-00001-10-000001.

- *Has mechanical mixing of CRV been demonstrated?*

  The agitator vendor Philadelphia Mixers performed scale testing of the LCP and LFD mechanical mixing systems. Testing was satisfactory based on BNI test and simulant specifications and is documented by the following test report, 24590-QL-POA-MFA0-00001-10-000001.

- *What are system flushing requirements for the CRV and associated transfer piping?*

  Transfer lines are flushed after each transfer operation (transfer to CRV, sampling, transfer to MFPV) as outlined by the LCP SD Appendix A – Sequence Diagrams for Normal Operations.

  LCP SD, Section 6, paragraph 6.2.7 provides the requirements for vessel wash down. Each CRV is equipped with two rotary spray nozzles to support maintenance activities approximately every 16 months. The water supply comes from the Demineralized Water System (DIW). The wash solution is transferred to the plant wash vessel (RLD-VSL-00003). The plant wash vessel contents are then transferred back to the PT Facility plant wash vessel (PWD-VSL-00044).

- *What is used to control and monitor waste level in the vessel?*

  Two redundant level transmitters (radar) are used to continuously monitor the level of waste feed in the vessel. The level transmitters are interlocked with the controls of the incoming feed to maintain proper level in vessel LCP SFS paragraph 5.1.1. Table 7-1 of the LCP SD provides setpoints for vessel level. Low-low level alarm "B" setpoint is 6 inches above the agitator impeller the associated trip stops the agitator. Low-low level alarm "C" has a setpoint of 2,351 gallons (34 inches) and the associated trip stops the transfer pump. High-high level alarm is set at 14,996 gallons (165 inches) and the associated trip closes transfer valves.

- *What is the function of the overflow systems, and what initiates operation?*

  The overflow system prevents overfilling of the CRV and release of waste feed into the facility. Vessels overflow is routed through a common header to the C3/C5 drains/sump collection vessel (RLD-VSL-00004). The overflow piping is required to have the equivalent capacity of incoming feed (LCP SD paragraph 4.3.1).

- What initiates operation of the overflow system? (addressed above)

- *How have the PSAR requirements been met?*

  Two accident scenarios outlined by the PSAR relate to the LCP and LAW Melter Feed Process System (LFP). The first leaks and spill from vessels and pipes in the process cells. This could result in expose to workers of radioactive contamination or direct radiation. The second accident scenario involved consequences of direct radiation if a misbatch occurred from pretreatment. (LAW PSAR paragraph 3.3.3.1)

LAW PSAE Table 3A-24 addresses the selected control strategy.

Accident Type	Controls	Contribution to Facility Worker Safety	Design Basis Event Description
Liquid Spill/ Overflow/ Spray Leak	Access to C5 and R5 areas will be controlled in accordance with the Radiation Protection Program including surveys and dosimetry, Radiological Work Permits, and Job Hazard Analyses.	This control reduces the likelihood of worker direct radiation exposure during waste processing activities.	3.3.6.3
Mistransfer from the PT Facility	A gamma monitor with interlocks on the LAW transfer line isolation valves and the PT transfer valves will be used to noitor transfers from TCP to LAW and from UFP and FRP to TCP to assure that high dose rate material will not be transferred to the LAW Facility.	Prevents the transfer of out of specification (high gamma) feed from the PT facility.	3.3.6.1

Based on review of referenced documents the process control strategy for the CRV appears adequate. The CRV has minimal temperature control functions compounding any precipitation issues that occur upstream of the vessel. It is recommended that potential solid precipitation issues be addressed by the TSG as part of the resolution to Design Oversight Report D-07-DESIGN-053 and ORP letter 07-WTP-278.

- Melter Feed Preparation Vessel (MFPV)

<u>*References*</u>

24590-WTP-3YD-50-00002, *WTP Integrated Processing Strategy Description*, Rev, 0, July 12, 2004

24590-LAW-3YD-LFP-00001, *System Description for Low-Activity Waste Melter Feed Process System (LFP)*, Rev. 1, June 6, 2005

24590-LAW-M5-V17T-00001, *Process Flow Diagram LAW Concentrate Receipt and Melter 1 Feed (System LCP, GFR, and LFP)*, Rev. 5, September 27, 2005

24590-LAW-M5-V17T-00002, *Process Flow Diagram LAW Concentrate Receipt and Melter 2 Feed (System LCP, GFR, and LFP)*, Rev. 5, September 27, 2005

24590-LAW-M6-LCP-00001, *P&ID - LAW Concentrate Receipt Process System Concentrate Receipt Vessel LCP-VSL-00001*, Rev. 5, November 6, 2006

24590-LAW-M6-LCP-00002, *P & ID - LAW Concentrate Receipt Process System Concentrate Receipt Vessel LCP- VSL-00002*, Rev. 5, November 6, 2006

24590-LAW-M6-LCP-00003, not in database

24590-LAW-M6-LCP-00004, not in database

24590-LAW-3PS-LFP-T0001, *Software Functional Specification for LAW Melter Feed Process LFP System*, Rev. .0, March 23, 2005

24590-LAW-MVC-LFP-00002, *SUPERCEDED - LAW Melter Feed Vessel Sizing*, Rev. B, October 9, 2003

- *What process controls are used to manage feed within and transferred from the MFPV?*

  The WIPSD, LFP SD, PFD, LFP SFS, and P&ID were reviewed to address the LOI. The MFPV function is to receive LAW waste feed from the CRV. The MFPV mixes the waste feed with the required quantities of glass formers and reductants as determined by sampling the CRV. The batch capacity of each MFPV is 3,300 gallons with a maximum operating volume of 7,689 gallons. Once mixing is complete, waste feed can be transferred to the MFV. Four main parameters are monitored in the MFPV pressure, temperature, level in the vessel, and density.

- *How is a LAW waste feed batch qualified for transfer from MFPV?*

  There are three process requirements that must be met before transferring a waste feed batch from the MFPV to the MFV. First, the sample results of the batch must be received. Second, the correct quantity of glass formers and reductants must be added. Third, the waste feed, glass former, and reductants must be uniformly blended. MFPV is sampled periodically to verify uniform blending.

  Additional operational prechecks and permissives must be met prior to initiating transfer. During waste feed, transfer trips and running checks are used to verify transfer. Transfer is stopped if any one of the trips or running checks fails. LFP SD paragraph 7.1.1

- *How is temperature monitored?*

  Temperature is monitored by a temperature indicator (thermocouple or resistance temperature detector) mounted in the MFPV.

- *What are the operating temperature ranges?*

  The expected temperature range is 77°F to 150°F with an expected nominal temperature of 137°F LFP Calculation Sheet, Section 8 (24590-LAW-MVC-LFP-00002). There is no process outside agitation and re-circulating waste feed through transfer pumps for maintaining temperature in the CRV. There is no Low Temperature Setpoint Alarm.

- *Do MFPVs have temperature control functions?*

  None, temperature is dependent on incoming waste feed temperature. Temperature of the vessel can also be affected by the temperature control of the wet process cell to a limited degree. Capacity of the HVAC system is such to maintain temperature of the cell and not maintain process control temperatures.

- *How is system pressure controlled and monitored?*

  Pressure is controlled by the LAW secondary offgas system (LFP SD, Table 9-1) and is connected through the vessel vent header. A constant volume of air is drawn through the vessel vent header. The volume of air drawn through the vessel vent header can be adjusted by a flow control damper as necessary to maintain negative pressure.

  High pressure alarm setpoint is -0.3 inch WC relative to C5 cell.

- *What is the operating pressure ranges?*

  Nominal design pressure is -0.1 psig or -2.8 inch WC. Maximum pressure is 0 psig caused by ventilation system failure and the minimum design pressure is a full vacuum (-14.7 psig, -407 inch WC). System ranges are the same as the CRV. Vessel ventilation is connected into a common vent header as described by the pressure control and monitoring summary.

- *What flow rate is required for transfer?*

  Designed flow rate from the MFPV to the MFV is 50 gal/min.

- *How is the flow rate monitored and controlled?*

  Primarily flow rate is monitored by tracking tank level. The capacity to determine mass transfer is also present using the density instrumentation in conjunction with the tank level. Tanks level trip setpoints are tied to the transfer pumps and will stop pumps and close isolation valves if setpoint is reached. Flow can also monitored by remote mounted flow transmitters. Flow can also be controlled by flow control valves.

- *What are the primary concerns with waste feed chemistry (e.g. Na ....)?* (addressed previously)

- *How is chemistry controlled and monitored?* (addressed previously consistent with process for CRV)

- *What radionuclides are of concern?* (addressed previously consistent with process for CRV)

- *How are radionuclides controlled and monitored?* (addressed previously consistent with process for CRV)

- *What are the physical properties of interest (rheology, % solids etc.)?*

  Temperature and density are the only physical properties monitored and controlled in the MFPV. Rheology of the waste feed changes dramatically as glass formers are added. MFPV have design capacity to handle high solids content.

- *How are physical properties controlled and monitored*

  Density is monitored by a density indicator. Density is controlled by diluting the vessels contents with demineralized water. The operating waste feed density range is defined by the LCP Calculation Sheet, Section 8. Minimum density of 1.0 g/mL, maximum density of 1.80 g/mL with an average density of 1.70 g/mL.

  Percentage of solids can also be monitored. This is accomplished by sampling and monitoring the current loading on the agitator motors. The maximum operating point for weight percentage solids is 64%.

- *What are the sampling requirements?*

  LCP SD, Section 4, paragraph 4.4.2 provides the original sampling requirements for the MFPV. Per the original design strategy, the MFPV is sampled only if sample failure occurred in the CRV. MFPV was also sampled during initial start up to verify glass formers were successfully added and the agitator system is functioning properly (LCP SD paragraph 7.1.8).

  To satisfy the recommendations of EFRT issue M-16, "Misbatching of Melter Feed," the following changes were made to 24590-WTP-PL-PR-04-0001, *Integrated Sampling and Analysis Requirements Document* (ISARD). Samples are drawn by the ASX from each MFPV after transfer of waste from the CRV and after the addition/mixing of the modeled GFC components. One sampling event is performed every 16 hours prior to transfer of material to the MFV, but this is not a hold point since the change in feed composition is gradual and a single transfer from the MFPV to the MFV is not expected to cause and upset in the melter.

- *What are the mixing requirements?*

  Each MFPV has a mechanical agitator, which functions in meeting the overall mixing requirements. The MFPV must continuously mix the vessel contents for a minimum time of 2 hours to achieve the required uniform blending (LFP SD paragraph 6.2.1). The agitator operation can be monitored by current sensors. The low current alarm has a setpoint of 10.6 amps.

- *What is the feed rate of glass formers?*

  Glass former are received in the MFPV from a glass former mixer at an approximate rate of 220 cfh. The operating range of the feed rate is a maximum of 392 cfh and a minimum of 132 cfh (LCP SD paragraph 6.2.1). Glass formers are added to the MFPV only after waste feed has been received from the CRV. Glass former addition rate is controlled by a flow control valve.

- *What are the concerns for the glass former addition process (e.g. dust control)?*

  Dust control issues have been identified as a problem with glass former transport. The dust issue is a cleanliness issue and not a direct hazard to personnel. Glass former mixers are equipped with dust collectors for removing the dust created during blending. In addition, the glass former mixers will mix demineralized water with glass formers at a rate of 20 gal/min. After mixing, a LAW batch will contain 4% water by weight (Balance of Facilities GFR SD, paragraph 6.7).

- *Has mechanical mixing of MFPV been demonstrated?*

  The agitator vendor Philadelphia Mixers performed scale testing of the LCP and LFD mechanical mixing systems. Testing was satisfactory based on BNI test and simulant specifications and is documented by the following test report, 24590-QL-POA-MFA0-00001-10-000001.

- *What are system flushing requirements for the MFPV and associated transfer piping?*

  Transfer lines are flushed after each transfer operation (transfer from CRV, sampling, transfer to the MFV).

- *What is used to control and monitor waste level in the vessel?*

  Two redundant level transmitters (radar) are used to continuously monitor the level of waste feed in the vessel. The level transmitters are interlocked with the controls of the incoming feed to maintain proper level in the vessel. Table 7-2 of the LFP SD provides setpoints for vessel level. Low-low level alarm "B" setpoint is 1.75 feet and the associated trip stops the agitator. Low-low level alarm "C" has a setpoint of 2.2 feet and the associated trip stops the transfer pump. Low level alarm is set at 2.82 feet. High level alarm is set at 10.17 feet. High-high level alarm is set at 10.79 feet and the associated trip closes transfer valves.

- *What is the overflow systems function?* (addressed previously same system as the CRV)

Based on review of referenced documents the process control strategy for the MFPV appears adequate. The MFPV has minimal temperature control functions compounding any precipitation issues that occur upstream of the vessel. While the MFPV is designed to handle large percentages of solids, it is still recommended that potential solid precipitation issue relative to the MFPV be considered by the TSG as part of the resolution to Design Oversight Report D-07-DESIGN-053 and ORP letter 07-WTP-278.

- ***Melter Feed Vessel (MFV)** - Lloyd McClure*
  - *What process controls are used to manage feed within and transferred from the MFV?*

    This question duplicates other questions below.
  - *How is a LAW waste feed batch qualified for transfer from MFPV?*

    The system description (SD) for the LFP (24590-LAW-3YD-LFP-00001, Rev. 1) describes the controls for the MFVs in general terms.

    The MFVs (LFP-VSL-00002 and -00004) have a maximum operating volume of 7,689 gallons for receiving blended melter feed from the MFPVs for feed to the corresponding LAW melter (LMP-MLTR-00001 or -00002). Batches of melter feed are transferred into the MFV from the MFPV at a nominal rate of 50 gal/min. Although a sample can be obtained and analyzed from the MFV, this is a non-routine sample point for product compliance purposes. Each MFV has a melter feed batch capacity of 3,330 gallons with a target cycle time of 16 hours [24590-LAW-M4C-20-00002]. The ADS pumps transfer the slurry from the MFV to the melter at a continuous rate of approximately 1.0 to 3.2 gal/min to meet the required plant throughput.

    The MFV SD document states: "After a specified mixing duration, a batch of melter feed is transferred from the MFPV to the corresponding MFV at a nominal rate of 50 gal/min."

    The MFPV will be mixed a minimum of 2 hours prior to transfer to the MFV. The MFPV will normally be continuously mixed. [SD 24590-LAW-3YD-LFP-00001, Section 6.2.1]

    Scale testing was done by the mixer vendor, Philadelphia Mixers, to size the LCP, LFP, and Radioactive Liquid Waste Disposal System (RLD) mixers (24590-QL-POA-MFA0-00001-10-00001, *Final - Report Laboratory Test Report - Report of Slurries*). Results indicated that the mixers will meet the requirements of the data sheet 24590-LAW-MFD-LFP-00007 and -00009 for a uniform blend in 2 hours. Additional testing is being conducted under 24590-LAW-TSP-RT-02-019, *Assess LAW MELTER Feed Composition Variability Due to Processing*, by the Vitreous State Laboratory, The Catholic University of America.

    The sequence for transferring a batch of melter feed begins with the operator choosing the MFPV, the MFPV transfer pump, and the MFV. Operational prechecks are performed on the MFPV, MFV, agitators, pump, instruments, and valves to ensure the system is ready to transfer the melter feed. The operator may temporarily stop the MFPV and MFV agitators to obtain an initial level reading without the vortex effect on the liquid surface. The final level is calculated, and the operator aligns the valves for transfer. When these conditions are met, the operator starts the transfer pump. The operator stops the transfer pump when the predetermined final level has been achieved.

The operator may temporarily stop the MFPV and MFV agitators to determine the final volume change after the transfer is complete while allowing for pipe drainage. The operator will also compare the volume transferred from the MFPV with the volume received in the MFV before flushing the transfer lines. If the difference in volumes is outside a prescribed limit, the valves will be checked for proper alignment and the transfer line will be checked for leaks.

The following prechecks are required prior to operation of this sequence:

- Level instrumentation in MFPV and MFV is operational.
- Agitators in MFPV and MFV are operational.
- Transfer pump in MFPV is operational.
- Vessel vent system is operational.
- Sump level instrumentation is operational.
- Valves are aligned for transfer from chosen MFPV to chosen MFV.

The following conditions must be present before starting this sequence:

- MFPV has undergone mixing for minimum duration.
- MFPV has sufficient capacity for transfer of batch volume.
- MFV has sufficient capacity for receipt of batch volume.

The following trips stop this sequence:

- Level is low-low in MFPV.
- Level is high-high in MFV.
- Pressure is high-high in pump discharge line.

Running checks for this sequence include:

- Change in MFV level is consistent with change in MFPV level.
- Pressure is not high in MFV vapor space.
- Sump level is not high in process cell.

The basis for transfer is operator control as described above. The MFPV is sampled only if sample failure occurs in the CRV or if process parameters indicate incomplete transfer of glass forming chemicals or treated LAW.

Before LAW concentrate is transferred to an MFPV, the CRV contents are thoroughly mixed and sampled. The sample is analyzed to confirm the chemical and radionuclide composition. A product control algorithm sets the amount of LAW concentrate and glass formers required to prepare a batch of melter feed that meets target ILAW compositions.

- *How is temperature monitored?*

  LFP-TT-1147 vessel temperature and LFP-TT-2147 vessel temperature.

- *What are the operating temperature ranges?*

  There is no set temperature range.

- *Do MFVs have temperature control functions?*

  There is no temperature control.

- *How is system pressure controlled and monitored?*

  Each MFV vents to the HEPA filter preheaters via the vessel vent header. Pressure is measured by LFP-PT-1160 and LFP-PT-2160.

  The normal operating pressure in the MFV headspace is - 4-inch WC at the control valve (Table 7-2 24590-LAW-3YD-LOP-00001). The pressure is controlled by this valve.

  The high pressure alarm is -0.3 inch WC relative to C5 cell.

- *What are the operating pressure ranges?*

  Vessel head space should be at least a -1.4 inch WC during normal operations [24590-LAW-MVC-LFP-00001] and -0.3 inch WC when the vessel is opened for maintenance (the area is considered C3 during maintenance) - based on 24590-WTP-DB-ENG-01-001, Figure 12-1.

  Feed to the melter is not allowed if the MFV head space pressure is too high.

  Sampling, line flushes and vessel washdowns are not allowed if pressure is too high in the vapor space of the vessel.

  The LCP, LFP, and RLD vessels are all designed for full vacuum. See 24590-LAW-MVD-LFP-00007, 8 ,10, and 11; 24590-LAW-MVD-LCP-00004 and 5; and 24590-LAW-MVD-RLD-00001, 6, and 7.

  It is assumed that the criterion for a "pressure too high" for feeding to the melter is the "negative 1.4" WC during normal operations."

- *What flow rate is required for transfer?*

  Not specified – only the nominal pump rate of 50 gal/min is specified.

- *How is the flow rate monitored and controlled?*

  There is no control on feed rate - only the nominal pump rate of 50 gal/min is specified.

- *What are the primary concerns with waste feed chemistry (e.g. Na ....)?*

  The primary components of interest are cesium-137, sodium (Na), and sulfate. The concentrations of these components and others are measured and controlled in other upstream vessels.

- *How is chemistry controlled and monitored?*

  The chemistry in the MFV is controlled in upstream vessels. There are no chemical adjustments in the MFV.

- *What radionuclides are of concern?*

  Primarily cesium-137. There are also limits on other radionuclides, such as strontium-90, technetium-99, and TRUs. The measurement and control of these components are in other upstream vessels.

- *How are radionuclides controlled and monitored?*

  The primary measurement and control point for cesium-137 concentration is at the outlet of the ion exhange columns in the PT Facility. There are monitors to detect if the cesium-137 in the outlet stream is too high. The contents of the ion exchange product vessel in the PT Facility will also be sampled and analyzed for cesium-137 per the ISARD (Sample Point PT28 – Page B-36).

  Cesium-137 is again measured in the CRV per the ISARD (Sample Point LAW1a – Page B-44).

  There is then an additional sample and analysis from the MFPVs (Sample Point LAW6 – Page B-47).

- *What are the physical properties of interest (rheology, % solids etc.)?*

  These limits are adjusted upstream of the MFV.

- *How are physical properties controlled and monitored?*

  These limits are adjusted upstream of the MFV.

- *What are the sampling requirements?*

  Sampling the MFVs is not a routine operation. The vessels will be sampled during startup and commissioning to confirm the glass formers were successfully added and the agitator system is functioning properly. Vessels may also be sampled during production for tracking melter feed composition.

- *What are the mixing requirements?*

  The mechanical agitator is continuously operated to mix the tank contents. If the vessel contents are not properly agitated, the solids in solution may settle out and could result in transfer problems.

- *Has mechanical mixing of MFV been demonstrated?*

  Scale testing was done by the mixer vendor, Philadelphia Mixers, to size the LAW LCP, LFP, and RLD mixers, see 24590-QL-POA-MFA0-00001-10-00001, *Final - Report Laboratory Test Report - Report of Slurries*. The results of the tests indicated that the mixers will meet the requirements of the data sheet 24590-LAW-MFD-LCP-00004 for a uniform blend in 1/2 hour.

- *What are system flushing requirements for the MFV and associated transfer piping?*

  The LFP SD (24590-LAW-3YD-LFP-00001, Rev. 1) describes line flushing and vessel washing in general terms.

After each transfer of melter feed, the lines from the bulge to the origination and destination vessels must be flushed with demineralized water. When a line flush is requested, the DIW valves are aligned to the respective receiving vessel and the flush is sent for a specified time duration. A typical flush is one pipe volume to remove residual melter feed still in the lines. Before the water flush may begin, the operator must verify that the receiving vessel has sufficient room to accept the estimated volume of flush water.

In addition to the receipt of line flushes, the MFPV may also require dilution water to maintain the rheological properties of the melter feed within bounding conditions for mixing and pumping [24590-101-TSA-W000-0004-72-13]. A sequence similar to the line flush sequence may be used to dilute a vessel's contents.

Washing down the MFPVs and MFVs for preventative maintenance is an infrequent operation. Each MFPV is equipped with two spray nozzles. Each MFV is equipped with three spray nozzles. The vessels will be washed down before the agitators, pumps, or instruments are changed out. Before the sequence begins, the vessels should be emptied to the lowest possible level, either by transferring vessel liquids forward to the melter, transferring vessel liquids to a MFPV or MFV, or diluting down the vessel heel and sending the contents to the plant wash vessel. Once the vessel is ready, the vessel's internal spray nozzles are turned on and used to remove solids accumulated on the vessel walls or vessel head. Rinse water from the vessel is sent to the plant wash vessel.

- *What is used to control and monitor waste level in the vessel?*

The LFP SD (24590-LAW-3YD-LFP-00001, Rev. 1) describes level control in general terms.

The operator may temporarily stop the MFPV and MFV agitators to obtain an initial level reading without the vortex effect on the liquid surface. The final level is calculated, and the operator aligns the valves for transfer. When these conditions are met, the operator starts the transfer pump. The operator stops the transfer pump when the predetermined final level has been achieved.

The following conditions must be present before starting this sequence:

- MFPV has undergone mixing for minimum duration.
- MFPV has sufficient capacity for transfer of batch volume.
- MFV has sufficient capacity for receipt of batch volume.

The following trips stop this sequence:

- Level is low-low in MFPV.
- Level is high-high in MFV.
- Pressure is high-high in pump discharge line.

Running checks for this sequence include:

- Change in MFV level is consistent with change in MFPV level.
- Pressure is not high in MFV vapor space.
- Sump level is not high in process cell.

Level instrumentation is as follows (per SD):

High-High Level Alarm	10.79 ft
High Level Alarm	10.17 ft
Low-Level Alarm	2.82 ft
Low-Level Alarm B (stops agitator)	1.75 ft
Low-Level Alarm C (stops transfer pump)	2.20 ft

The tank level is measured by a radar system (24590-LAW-M6-LFP-00001, *P&ID-LAW Melter Feed Process System Melter 1 Feed Preparation and Feed*).

Starting and stopping transfers is totally under operator control. The SD, Section 6.1, paragraph 2 discusses the law product control algorithm. The document that is being developed to provide the guidance is 24590-LAW-RPT-RT-04-0003, *Preliminary ILAW formulation Algorithm Description*. Based upon volume calculated from the level measurement, the operator transfers a batch from the CRV to the MFPV and from the MFPV to MFV (see 24590-LAW-3YD-LFP-00001, Sections 7.1.1 and 7.1.3). A typical batch size is provided in 24590-LAW-M6C-LFP-00001 and 00002 for the MFPV and MFV with the levels shown in Attachments 10.1 and 10.2 for the MPFVs. The calculations are referenced in Table 6.1 in the SD.

- *What is the overflow system's function?*

  Each MFV overflows to its corresponding MFPV, which in turn overflows to the C3/C5 drains/sump collection vessel via a common header.

- *What initiates operation of the overflow system?*

  This is a passive system – overflow would occur only if the vessel is filled to a level corresponding to the level of the overflow line.

- *How is feed to the melter controlled?*

  The LFP SD (24590-LAW-3YD-LFP-00001, Rev. 1) describes the transfers from the MFVs to the melters in general terms.

  Each LAW melter is fed with six ADS feed pumps (total) or two ADS feed pumps per each of the three melter zones. Control of the six ADS pumps is coordinated to provide uniform feed delivery and helps maintain/establish cold cap integrity. ADS pumps are designed with built-in redundancy. The melter is designed to allow one feed nozzle/ADS pump combination per melter zone to be inoperable.

The ADS pump is a 1-gallon chamber near the bottom of the MFV. Each ADS pump has a corresponding vent valve assembly and an actuator assembly. The bottom of the chamber is hinged to open by the actuator assembly to fill the chamber with slurry. After the bottom of the chamber is closed, air is supplied through the vent valve: assembly to pressurize the chamber. The slurry is transferred to the melter using the plant service air pressure as the motive force. The air blows the line clear of feed with each pump stroke. Other physical configuration attributes of the melter feed system which prevent a sustained siphoning of feed slurry into the melters (i.e., line size, elevated routing) are addressed in the LAW Melter Process System (LMP) SD.

The vertical pump discharges at a maximum flow rate of 50 gal/min through a valve bulge (LFP-BULGE- 00001 or -00002) to route the melter feed or plant wash to one of the following:

- Either MFPV (in the event of melter shutdown)
- Same MFV (to recirculate for sampling)
- Plant wash vessel (prior to vessel washdown)

The vertical pumps and transfer lines are flushed with demineralized water after every pump shutdown.

The melter is constantly being fed a mixture of glass formers and concentrate via the ADS pumps. ADS pumps provide the melter with a continuous and consistent feed rate, which is not impacted during the batch transfers from the MFPV to the MFV. The operator selects the feed rate, and the PCJ system determines the cycle time for the ADS pumps in each melter zone.

The following conditions must be present before starting this sequence:

- Glass pool average temperature is within nominal operating range of 1125°C and 1175°C.
- Melter glass level is within nominal operating range of 28.5 inches and 31.5 inches

The ADS control system involves four steps of the pump cycle: (1) bottom of chamber opens; (2) the pump chamber fills with melter feed; (3) bottom of chamber closes; and (4) pressurized air is supplied to the pump chamber, which forces the melter feed into the slurry line to the melter. The pump chamber fill time increases when the vessel level drops to a minimum level, but the increase in time is negligible compared to the valve realignment time. The cycles of individual ADS pumps are operated out of phase to maintain a continuous feed.

Demineralized water is added to the melter during the transition from idling to feeding using the ADS pumps to lower the melter plenum temperature below 800°C. The water cools down the glass pool surface prior to feed addition to limit the extent of feed carryover during the start of feeding. When steady state feeding has been achieved, the melter plenum temperature is maintained between 350°C and 450°C [24590-101-TSA-W000-0009-148-00002]. A line flush of an individual ADS pump with demineralized water is automatically activated after feeding and every 4 hours during feeding. A screen flush of an individual ADS pump with demineralized water is manually performed before and after feeding, and every day during feeding, upon completion of a line flush. The water is transferred directly to the melter.

The basis for and control of waste transfer from the MFVs to the melters in the SD is not specific. Control of the feed is only stated in very general terms. The SFS also does not provide any control logic.

Apparently, this will primarily be under operator control primarily based on plenum temperature measurements. Even though the SD indicates "the PCJ system determines the cycle time for the ADS pumps in each melter zone," this logic for the PCJ system does not appear to have been developed.

Based on the above, the approach to control of the MFV appeared viable. All required instrumentation was included on the P&IDs.

Melter - *Lloyd McClure*

- *What process controls are used to manage feed within the melter and being poured into a container?*

  ILAW product quality and chemical composition are met by adjusting the composition of the melter feed in MFPV.

  For feed to the melter, see item 23 above.

  Glass pouring is described in item 12 below.

  Additional information on melter feed below is provided in LMP SD (24590-LAW-3YD-LMP-00001, Rev. 1).

7.4 Operating Values, Prerequisites, and Interlocks

7.4.1 Operating Values

The LMP operating range values are identified here.

Glass pool temperature	1150 ± 25°C
Discharge chamber temperature	1100 ± 25°C
Plenum temperature (manually controlled through slurry feeding)	300 °C to 600 °C
Plenum Vacuum	-5 inch H_2O (reference to shield annulus).
Glass pool level (manually controlled)	30 ± 1.5 inch

The ADS pump transfers feed to the melter in "slugs" with an air chase. Approximately 1 gallon of feed per pump is injected over a 5- to 10-second period (6 to 12 gal/min on an instantaneous basis) and repeated every 50 to 120 seconds to meet the feed rate. If this feed is added directly to the hot glass surface, large fluctuations in melter pressure may occur as the water in the feed flashes to steam. To prevent these fluctuations from occurring during the start of feeding operations, water will be metered into the melter at a controlled rate prior to starting the ADS pumps. The water will serve to "freeze" the surface of the glass, establish a cold melt surface, and allow the ADS pumps to operate without causing excessive pressure fluctuations. Starting feeding with water has the added benefit of eliminating the carryover of solids that would have occurred during feed startup. The rate and total volume of water added will be measured, displayed, and logged.

The rate of feeding is controlled by manually adjusting a single feed-rate set point. However, it is anticipated that the plenum temperatures measured in each of the three zones may be different, even with a uniform feed rate to each zone. This imbalance may lead to differences in cold cap thickness or coverage across the melter surface, which in turn may result in more feed entrainment or glass temperature instabilities. To compensate for these potential temperature differences, the rate of feeding to the outer zones (zones 1 and 3) is capable of being varied independently from the common set point by some incremental amount. Plenum temperatures in these zones will provide the feedback necessary to control the feed rate.

The ADS feed pump logic is programmed to automatically flush the feed line and nozzle every 4 hours and whenever feeding is terminated (including interlock feed trips). This step is necessary because accumulated feed in the nozzle can cause blockages.

From the control interface, feed is started with at least one feed pump in each zone. The feed rate will be adjusted to maintain the plenum between 300°C and 600°C. Adjustments are made based on plenum temperature trends collected over 1/2-hour to 1-hour intervals.

When the operator terminates feed flow to a pump, a water flush is then performed to clear the feed line, and a screen flush is performed to clear the pump. During feeding, a feed line flush for each pump will be activated approximately every 4 hours. When melter feed is terminated due to a safety interlock, the flush cycle is inhibited and cannot be performed until the interlock is reset.

Monitoring of the feed pump operation is required. Due to the slug flow nature of pump operation, no direct measurement of feed slurry flow rate can be made. The theoretical feed rate of each pump is determined by counting the number of pump strokes since each stroke volume is identical and the volume of the stroke is known. Also, trending the motive air pressure air pressure provides the status of the ADS pump. The restricting orifice on the operating air supply causes this pressure to dip dramatically each time the feed line is blown clear at the end of the pump stroke. If the feed nozzle or lines are clogged, the magnitude of the pressure will be reduced. To ensure even feeding of the melter, online trending of the operating air pressure for the six pumps must be available to the operators. In addition, a pump failure alarm must be generated if the operating air pressure does not drop below a threshold value for several feed strokes in order to notify the operator of a potential feed line clog.

The basis for and control of waste transfer from the MFVs to the melters in the SD is not specific. Control of the feed is only stated in very general terms. The SFS also does not provide any control logic.

Apparently, this will primarily be under operator control primarily based on plenum temperature measurements. Even though the SD indicates "the PCJ system determines the cycle time for the ADS pumps in each melter zone," this logic for the PCJ system does not appear to have been developed.

- *How is the melter plenum temperature and offgas flow to the Submerged Bed Scrubber controlled?*

  During slurry feeding, the melter plenum will be in the range of 300°C to 600°C. This temperature range is controlled by the feed rate to the melter. Adjustments are made based on plenum temperature trends collected over 1/2-hour to 1-hour intervals.

  Offgas flow is not directly controlled. Primary offgas system pressure balancing is accomplished by controlling: (1) Film cooler and melter air inbleed; (2) adjusting flow control butterfly valves downstream of the WESP before the HEPA filters; and (3) adjusting the exhauster/blower speed down stream of the HEPA filters.

- *How is a LAW waste feed batch qualified for transfer from MFV?*

  The basis for the glass former additions to the MFPVs is the samples taken upstream in the CRVs. This sample and the correct additions in the MFPVs are the controls for proper composition in the MPVs.

- *How is temperature controlled and monitored?*

  The LFP SD (24590-LAW-3YD-LFP-00001, Rev. 1) describes melter temperature control in general terms. Adjusting melter feed rate and increasing bubbler flow rate shall be used to control melter plenum temperature during slurry feeding to optimize throughput and stabilize melter operation (WIPSD, Section 8.2.2, item 2). The melt pool temperature is adjusted by automatically controlling the power supplied to melter electrodes based on a glass temperature feedback control algorithm [SD].

  Temporary lid-mounted heaters shall be used to create the initial molten glass pool at melter startup. The following is from the SD:

  > The LAW melter can be divided into 3 equally divided zones: a middle zone, an east zone, and a west zone. Each of the 3 zones has the same free surface area of molten glass and is heated by a pair of electrodes. Single-phase alternating current is passed through the pairs of electrodes.
  >
  > Thermocouple assemblies will be installed in each of the 18 bubbler assembly thermowells. Each thermocouple assembly will consist of 1 plenum and 2 glass pool thermocouples for a total of 18 plenum and 36 glass pool thermocouples. The glass pool has 10 thermocouples in Zone 1, 16 in Zone 2, and 10 in Zone 3. Redundancy of the thermocouple indication within the melter is required to ensure accurate glass pool temperature. The average overall glass pool temperature is indicated in the plant control system and can be used as the feedback signal by the plant control system for automatic temperature control. By necessity, during start up the melter temperature will be controlled manually. During commissioning runs, at the discretion of operators, the melter can be controlled manually. Any temperature set point change is constrained to a ramp rate of 50°C/h to limit thermal shock to the refractory. Glass temperature is monitored and logged during operations to help identify required melter operating adjustments.
  >
  > Joule heating is controlled based on the average temperature of melt pool thermocouples. One leg of each of the 18 bubbler assemblies serves as a thermowell with 3 thermocouples located at approximately 3 inches, 20 inches and 60 inches above the melter floor. The 2 lower thermocouples in each thermowell measure glass pool temperature while the upper thermocouple (60 inches) measures the plenum temperature.

This following paragraph is from the WIPSD:

> The glass in the melters is heated by passing electrical current through the molten glass. The resistance of the molten glass to electrical current flow provides the source of Joule heating. The melt pool temperature is adjusted by automatically controlling the power supplied to melter electrodes based on a glass temperature feedback control algorithm. A bulk temperature value is estimated based on averaging the readings of several thermocouples located throughout the glass pool. The upper glass melt temperature limit is required to maximize the life of the melters and the lower limit supports vitrification of melter feed slurry. Melt pool bubblers are used to increase production rates and help maintain consistent glass temperatures throughout the melters to avoid excessive hot or cold regions.

- *How is temperature of the pour spout controlled and monitored?*

Glass discharge is initiated by operator action. A low glass level reading will alert operators to terminate glass discharge. A high container level will indicate that it is time to stop glass discharge. Glass melt level is determined via pneumatic probes into the melt pool and a reference probe in the plenum head space. There are two observation methods for container level: an infrared camera that provides thermal imaging and a visible light camera (CCTV) for direct observation of the container. To prevent container overfill, a load cell on the container support will send a signal at a predetermined weight to stop the airlift process.

An auxiliary heater is attached around the pour spout of the discharge chamber. The operator manually plugs it to a power source, but only if the spout becomes obstructed with glass. Temperature indications are available for the pour spout.

Control of the gas injection rate to the air lance is needed to control the glass flow rate. The air lance is also connected to a differential pressure transmitter that is referenced to the plenum, which may act as a backup means of level detection.

Discharge chamber heating:

All heaters and their respective power supplies are available for all modes of operation. If less than 8 of 12 heaters are available per discharge chamber, discharge operations may continue. However, the cause for the inoperability of the heater or heaters should be determined to ensure that there is not a common mode failure that could threaten the other heaters.

Glass discharging:

1. Airlift is available for operation.
2. Melter level is at normal operating range of >30 inches.
3. Discharge chamber temperature is within range (50°C less than melt pool set point).
4. Discharge viewing pour stream CCTV system is operational.
5. Canister position and level detection systems are available.

6. Only one discharge chamber per melter is pouring glass.

- *What are the operating temperature ranges?*

  The glass temperature will be maintained at approximately 1150°C. The operating range will be 1150 ± 25°C.

  The LMP operating range values are identified here.

  Glass pool temperature 1150 ± 25°C

  Discharge chamber temperature 1100 ± 25°C

  Plenum temperature (manually controlled through 300°C to 600°C slurry feeding)

- *How are melter cooling jackets controlled and monitored?*

  [from SD] Cooling panels surrounding the glass tank limit the extent of glass leakage and migration by cooling the refractories and causing glass to "freeze". The glass melt viscosity increases sharply as the temperature drops; for example, it could be 100 poise at 1150°C and 10,000 poise at 700°C. At such a high viscosity, the glass is unable to flow or further penetrate outward through the refractory package. With pristine refractory, there is a 600°C isotherm within the K-3 refractory on the north, east, and west walls, and the floor to prevent glass penetration into the AZS refractory. Cooling of the glass contact refractory package will also reduce the rate of corrosion of the interior refractory by the glass melt.

  All melter surfaces that could significantly heat the shielding annulus and the outer shielding are water-cooled. This feature minimizes heat loading to the C5 ventilation system which ventilates the shielding annulus. The melter cooling is designed such that most external shielded surfaces of the melter lid will not exceed 95°F to facilitate contact maintenance and reduce heat loads to the melter gallery C3 HVAC system.

  Additional cooling circuits are also provided for the six feed nozzles. All cooling circuits have a design pressure rating of 150 psig.

  The temperature measurements and flow control systems are shown on the P&IDs, such as 24590-LAW-M6-LMP-00003.

- *What is the cooling capacity of the melter cooling jackets?*

  The melter cooling is designed such that most external shielded surfaces of the melter lid will not exceed 95°C. There are several cooling circuits around the melter. Cooling circuits are also provided for the six feed nozzles.

- *How is melter pressure controlled and monitored?*

  High plenum pressure will activate interlocks, adjust offgas exhauster speed, and maintain cold cap coverage (via plenum temperature control).

  Offgas exhauster speed, maintain[ing] cold cap coverage (via plenum temperature control), and shut[ting] down feed to melter in the event of positive offgas pressure [shall be used to] control plenum pressures of melters more negative than melter cave pressure to ensure vapors flow through offgas system for treatment (WIPSD, Section 8.2.2, item 6).

[From SD] To maintain an unobstructed flowpath from each melter to the ventilation exhaust stack and to maintain an adequate flow rate, the LAW melter offgas system must fulfill the following functional requirements:

- The offgas high efficiency particulate air (HEPA) filter differential pressure interlocks must stop feed to the melter upon an activating signal from the differential pressure instrumentation across the first bank of HEPA filters.

To prevent flow restriction or overload of the melter offgas flowpath and subsequent pressure rise in the melter, the following functional requirements must be met:

- The melter plenum pressure interlocks must stop feed to the melter on receiving an actuation signal from the melter plenum pressure instrumentation whenever its associated melter is operating.

Primary offgas system pressure balancing is accomplished by controlling: (1) film cooler and melter air inbleed; (2) adjusting flow control butterfly valves downstream of the WESP before the HEPA filters; and (3) adjusting the exhauster/blower speed down stream of the HEPA filters.

- *What is the operating pressure ranges?*

  The plenum vacuum is nominally -5 inch H_2O (reference to shield annulus). Offgas flow is not directly controlled. Primary offgas system pressure balancing is accomplished by controlling: (1) film cooler and melter air inbleed; (2) adjusting flow control butterfly valves downstream of the WESP before the HEPA filters; and (3) adjusting the exhauster/blower speed down stream of the HEPA filters.

- *What flow rate is required for transfer from MFV to the Melter?*

  See item under MFV.

- *How is the glass flow rate monitored and controlled?*

  Each melter has two heated discharge chambers mounted on the melter's south wall. The glass is discharged by an air lift system. Glass discharge rates in the range of 1,000 to 2,000 kg/hr are needed to allow the glass to flow uniformly to the periphery of the container.

  Experiments on the LAW pilot melter showed that glass discharge rates in the range of 1,000 to 2,000 kg/h4 (roughly 25 to 50 MTG/d) are needed to allow the glass to flow uniformly to the periphery of the container. Note that average glass production rate is 625 kg/h (15 MTG/d). Changes in the melt pool level need to be limited during pouring cycles to minimize thermal shock of glass contact refractory at the slurry-glass interface. Glass level for the LAW melter is 30 ±1.5 inches. It is desirable to hold the level variation to less than ±1.5 inch to keep thermal cycling to a minimum. Assuming 2,300 kg/m^3 bulk density for the bubbled glass melt (specific gravity of 2.3); 1 inch of level in the melter is 580 kg of glass.

A container fill requires pouring approximately 6,000 kg. Because of the restriction in melt level change, it is necessary to execute multiple pours to fill a container. It will take four cycles over a 10-hour period at a glass production rate of 15 MTG/d.

The discharge airlift gas supply (0 to 3 scfm) is clean, dry instrument air. Pressure and flow control instruments are installed to prevent glass splatter or pressurization of the discharge chamber.

A positive means of stopping gas flow to the airlift lances is provided to minimize dripping. Argon at approximately 0.2 scfh is bubbled through the glass in the riser using the airlift lance. This strips oxygen from the melt thus lowering the tendency for redox-induced foaming (dioxide [O_2] release caused by localized temperature excursions). The argon purge may also limit corrosion of the airlift lance and extend its life.

Injection of air from the airlifting operation may cause the glass to absorb some oxygen. Therefore, once glass leaves the glass pool during the discharge cycle, reheating of the glass is to be avoided because this could cause foaming. Temperatures in the discharge risers are thus incrementally lower than in the glass pool, and thermal gradients through the discharge system are designed to prevent reheating of the glass.

The discharge chambers, troughs, and trough tips are to be maintained at nominally 1100°C, or 50°C less than the glass pool set point (nominally 1150°C). This ensures that glass viscosity is in the correct range to allow the pour stream to travel to the bottom of an empty canister and to flow out to the canister periphery while not reheating the glass above the glass pool temperature, thus ensuring that glass foaming does not occur during discharge.

Glass discharges off the tip of the discharge trough so that the pour stream flows down the center of the pour spout and container opening and does not contact cooler surfaces below, where the glass could stick and form a plug. Each pour spout is fitted with a visible light camera (or CCTV) to view the glass melt pour stream. In the event that a glass plug is formed at the bottom of the discharge chamber, there is an auxiliary heater around the bottom opening of the discharge chamber that can be energized to melt the plug.

- *What are the primary concerns with waste feed chemistry (e.g. Na ....)?*

  The primary components of interest are cesium-137, sodium (Na), and sulfate. These components are sampled and controlled in upstream vessels.

- *How is chemistry controlled and monitored?*

  The concentrations of these and other components are measured and controlled in the LFP – the primary sampling point is the CRV and the primary feed adjustment point is the MFPV.

- *What is used to control and monitor glass level in the melter?*

  Glass pool level (manually controlled) 30 ± 1.5 inch.

Measurement of melter glass level will be used throughout melter operations to control the starting and stopping of melter glass discharge operations as well as to determine the onset of melter foaming. Melter glass level is one of the key parameters used in evaluating melter performance since the level of glass in the melter affects its operation. Changes in glass level will change the glass pool resistance and the glass discharge flow rates.

The melter glass level detector functions using three pneumatic probes. The operative principle is based on fluid statics. Two probes of different lengths are immersed in the glass pool, and one probe is in the plenum. The pressure reading from the longest probe is used to calculate glass level. This pressure reading, in combination with the reading of the shorter of the two glass pool probes, yields density. The plenum probe provides a reference pressure value used in the latter two calculations and also provides an independent measure of plenum pressure. These probes are installed in a level detector assembly that passes through the melter lid. The level probe extends to within a few inches of the floor of the melter, and the density probe terminates 10 inches above the level probe.

Each of the level detector probes is gas-purged. The reference probe is purged to prevent the accumulation of solids during feeding operations. The glass pool probes are purged to maintain the tube in a gas-filled condition so that static pressure can be measured. The reference probe is only purged with air because it terminates above the glass pool. The level and density probes are purged with argon. Argon is used for these probes to limit oxidation of the metal probe. Low gas flow rates (0.2 to 0.4 scfh) minimize error due to frictional line losses.

The level of the glass in the melter is determined using the measured differential pressure between the level probe and the density probe and the density probe and the plenum probe. A backup indication of melter level can be obtained from the riser air lances. Measuring the differential pressure between these air lances and the standby reference will indicate the level when airlift operations are not in progress.

Melter plenum pressure is determined by measuring the differential pressure between the plenum probe and the shielding annulus pressure. A second plenum pressure tap is used in the event that the primary tap is clogged. This second tap is located on the standby offgas port. There is a third pressure tap with independent pressure instrumentation that can activate important-to-safety (ITS) trip interlocks.

The level detector probes are designed to be fabricated from 3/4 inch schedule 160 alloy 690. The tips of the probes will be machined with a crown to reduce erosion of the metal by the rising gas bubbles.

Melter glass level is controlled by feed addition and glass pouring.

- *What is used to control and monitor glass viscosity in the melter?*

per the SD: Viscosity range is 10-150 poise at 100°C

Viscosity is controlled by the recipe for glass former additions. The concentrations of these components and others are measured and controlled in the LFP – the primary sampling point is the CRV and the primary feed adjustment point is the MFPV.

- *What other glass properties are monitored/controlled?*

  Electrical conductivity, 0-1 to 0.7 siemens per cm at 1100-1200°C

  per the SD: Liquidous temperature, 950 – 1050°C

  Mixing is accomplished by a checkerboard array of bubblers.

Following is from the SD:

The bubbler controls must provide for continuous monitoring and recording of key bubbler operating parameters. These key parameters are: (1) mass flow of air, (2) bubbler air supply back pressure, (3) glass melt pool temperatures, and (4) glass melt density.

Each of the 18 bubblers must be supplied with a separate injection mass flow controller. The flow rate will be displayed to operators at the control room and archived. The mass flow rate will range from 0.1 to 1.5 scfm.

Pressure transmitters monitor the air supply pressure of each bubbler downstream of the mass flow controller. The pressure range is expected to be between 1 and 10 psig.

Glass pool parameters that need to be monitored are melt pool temperature and density. Uniformity of the glass pool temperature is an indication of mixing performance of the bubblers. The melter glass density indicates the extent of bubble entrainment in the glass. More bubbles result in lower bulk density, which may be an indication of excessive air flow to the bubblers or excessive melter feeding.

Melter operational control is primarily by the operators monitoring instrument data rather than automated control.

Review of the process control strategy for the LAW melter revealed no significant issues. The melter control system is based on successful operation of similar pilot and production scale melters at other sites. All required instrumentation was included on the P&IDs.

Primary Offgas

- ***Film coolers** – Rob Gilbert*

  The WIPSD, SD, SFS, and 24590-LAW-M6-LOP-00001, *P&ID – LAW Primary Offgas Process System Melter 1*, were reviewed to address the LOI.

  - *What process controls are used to manage melter offgas in the film cooler?*
    - Plant service air is supplied to the film cooler to cool melter offgas below its sticky point and maintain offgas velocity at greater than 50 ft/sec. Plant service air addition rate is adjusted to control melter vacuum within the normal control setpoint. This is accomplished by controlling the plant service

air addition rate to the film cooler. A standby film cooler has plant service air addition to prevent plugging during operation. If the melter vacuum is reduced below the normal setpoint, the standby offgas system is opened to the SBS by opening of a butterfly valve. If pressure continues to rise above the high setpoint then a relief valve opens and vents offgas through the standby film cooler to the process cell.

- *How is temperature, pressure drop, and the flow rate of air monitored?*
  - Temperature is monitored in the lines between the film cooler and SBS using thermocouples. This function is described in the SFS and the instruments are shown on the P&ID.
  - Pressure is monitored in the melter plenum and in line between the film cooler and SBS.
  - Flow rate is not monitored but can only be inferred from the plant service air addition to the melter, bubbler air addition, and calculated volatilization of melter feed. Typically, approximately 75% of flow is established by control air, film cooler additions, and air inleakage. Therefore, velocity will be reasonably constant with fluctuation due to fedding and cold cap stability (24590-LAW-M4C-LOP-00001, *LAW Melter Offgas System Design Basis Flowsheets*).
- *Is there a film cooler cleaner?*
  - A film cooler cleaner is not described in the WIPSD, SD, or SFS. Discussions with BNI confirmed that there is no film cooler cleaner on the LAW melters. BNI stated data from the pilot melter in Columbia, Maryland, indicated that there was not need for the film cooler cleaning for LAW vitrification.
- *How will it be controlled/operated?* Not applicable.
- *How is offgas velocity monitored?*
  - As discussed above, offgas velocity is not monitored but can be projected based on feed and plant service air added to the melter. Calculation 24590-LAW-M6C-LOP-00002, *LAW Primary and Secondary Offgas Line Sizing Calculation*, provides line velocity from flows and will be updated with the flows from 24590-LAW-M4C-LOP-00001, *LAW Melter Offgas System Design Basis Flowsheets* during system confirmation.

Based on the above the approach to control the film cooler appeared viable. All required instrumentation was included on the P&ID.

- ***Submerged Bed Scrubbers (SBS)- Rob Gilbert***

  The WIPSD, SD, SFS, and P&ID were reviewed to address the LOI.

  - *What process controls are used to manage solutions and melter offgas in the SBS?*

- The WIPSD, SD, SFS, and 24590-LAW-M6-LOP-00001, *P&ID – LAW Primary Offgas Process System Melter 1*, were reviewed to address the LOI.
- The SBS is controlled by maintaining temperature of solutions in the SBS and SBS condensate vessel and maintaining vessel level. Pressure drop across the SBS is also monitored to provide input to overall primary offgas system pressure balancing. Primary offgas system pressure balancing is accomplished by controlling: (1) film cooler and melter air inbleed; (2) adjusting flow control butterfly valves downstream of the WESP before the HEPA filters; and 3) adjusting the exhauster/blower speed down stream of the HEPA filters.

o *How are SBS temperature, pressure drop, solution level and recirculation controlled?*

- SBS temperature is controlled by cooling the vessel with a cooling jacket and two submerged cooling coils. SBS condensate is also recirculated with the SBS condensate vessel. The SBS condensate vessel also has a cooling jacket which contributes to SBS cooling. The LOP/LVP SD (24590-LAW03YD-LOP-00001) identified a nominal temperature of 120°F. A thermocouple is included in the SBS vessel and a thermocouple is included in the recirculation line from the SBS condensate vessel to monitor temperature. Flow control valves are included in the return lines for the chilled water return. These features were present on 24590-LAW-M6-LOP-00001, *P&ID – LAW Primary Offgas Process System Melter 1.*

  Pressure drop was described as being monitored in the SFS. Review of the P&ID showed the presence of pressure instrumentation before and after the SBS.

  Solution level in the SBS vessel is maintained by continuously overflowing the vessel to the SBS condensate vessel. Condensate is re-circulated back to the SBS vessel to facilitate mixing. Based on level instrumentation in the condensate vessel and time, the SD indicated condensate and solids are transferred to RLD-VSL-00005 at a frequency projected to occur every 24 to 48 hours.

  Recirculation between the SBS vessel and SBS condensate vessel occurs continuously at a rate of about 80 gal/min when the system is operational per the SD. Two pumps to serve this function are included in the P&ID.

o *How is the cooling jacket controlled?* (addressed above)

o *When is the SBS condensate removed/purged?* (addressed above)

o *How are vessel level, specific gravity, and temperature monitored?*

- Density is monitored in the recirculation line between the SBS and condensate vessels. No criteria are specified for this information. Vessel level and temperature control are discussed above.

- *Is there a SBS bypass?*
  - There are two lines from the melter to the SBS (primary and standby) and a vent to the C5 cell that opens upon high pressure. Offgas can be routed through the SBS servicing the alternate primary offgas train through an interconnection between the standby film coolers.
  - The SBS condensate vessel (LOP-VSL-00001) is passively vented to the SBS (LOP-SCB-00001). The assessors asked if a flammable gas concentration could be created in the SBS condensate vessel from release of gas entrained in the SBS. The Contractor responded providing the following:

    "The volatile and semi-volatile organics are normally only present in minor amounts - less than 2700 micro grams per liter). The fluids in the SBS condensate vessel will be in equilibrium with the fluid in the SBS because of continuous recirculation. Based upon Henry's Law, there should not be build up of flammable gases. For example, acetone (most likely a laboratory contaminant) at 2700 micro grams per liter, with a Henry's law constant of 10.25 mol/liter atm - concentration in the gas is less than 5 ppm. Values for concentrations in the SBS solutions are from the following reports: Table 4.9, 24590-101-TSA-W000-0009-111-01, Integrated Off-gas System Tests on the DM1200 Melter with RPP-WTP LAW Sub-LAW Envelope C1 Simulants; Table 4.10, 24590-101-TSA-W000-0009-111-02, Final Report - Integrated Off-gas System Tests on the DM1200 Melter with RPP-WTP LAW Sub-Envelope A1 Simulants."

Based on the above, the approach to control the SBS appeared viable. All required instrumentation was included on the P&ID.

- ***Wet Electrostatic Precipitators (WESP)** – Ricky Bang*

Reference:

24590-WTP-3YD-50-00002, *WTP Integrated Processing Strategy Description*, Rev, 0, July 12, 2004

24590-LAW-3YD-LOP-00001, *System Description for LAW Primary Offgas Process (LOP) and LAW Secondary Offgas/Vessel Vent Process (LVP) Systems*, Rev. 1, March 23, 2005

24590-LAW-M6-LOP-00001, *P&ID – LAW Primary Offgas Process System Melter 1*, Rev. 4, November 9, 2006

24590-LAW-M6-LOP-00002, *P&ID – LAW Primary Offgas Process System Melter 2*, Rev. 4, November 9, 2006

24590-LAW-3PS-LOP-T0001, *Software Functional Specification for LAW Primary Offgas Process (LOP) System*, Rev. A, December 12, 2003

24590-QL-POA-MKE0-00001-07-12, *Calculations - LAW WESP - Efficiency Calculations for LAW WESP, "C03-2790-CALC-01," REV. 000*, Rev. 00A, November 5, 2003

24590-QL-POA-MKE0-00001-20-00001, *Operations & Maintenance Manual for LAW WESP Vessels*, not in database

- *What process controls are used to manage solutions and melter offgas in the WESP?*
  - The offgas inlet pressure is monitored. There is no actual control of flow to the WESP. The WESP receives all the flow that comes from the SBS. The SBS removed water vapor through condensation and particulates from the flow from the film cooler. The film cooler flow is from melter inleakage as a result of the melter plenum pressure to be maintained negative in order to direct offgas to the offgas system. Offgas flow from WESP is controlled by modulating valve LOP-FV-1140 based on control air flow monitored by FT-1140 to the primary offgas film cooler.
  - Process air is added through the electrical ducting to keep the conductors clean and dry. The air is heated by WESP purge air heaters. Process air flow to the WESP is controlled by modulating valve LOP-FV-1150, and air temperature by adjusting power to heater LOP-HTR-00001 based on differential between offgas and process air supply temperatures.
  - The inlet water spay ensures that the inlet stream is saturated to allow the WESP to operate wet - this reduces buildup time on the walls. The WESP is cleaned by flushing the system with demineralized water from the top nozzles. Flush water and inlet spray water flow is controlled by adjusting LOP-V-34060 and LOP-V-10760, respectively, and monitoring the water pressure PI-1099 from the demineralized water manifold. Flush water supply to the WESP is stopped whenever a high condensate level is detected.
- *How is the WESP controlled (voltage, etc.)?*
  - A high voltage transformer/rectifier supplies power to the electrodes. Voltage is maintained based on feedback from the spark rate sensor. This control loop automatically adjusts voltage to minimize the spark rate while keeping the voltage to as high a value as possible. Typical voltage is in the range of 30,000 to 50,000V.
  - The voltage, current, power, hand switch, and the multi-variable alarm elements monitor the WESP power supply. A change in current would be an indicator of WESP efficiency.
  - There are three vendor documents that describe the WESP control functions -24590-QL-POA-MKE0-00001-22-00001, *Electrical Operating Functional Description for Wet Electrostatic Precipitator LAW 1 & 2* (this document includes the operating manual) and 24590-QL-POA-MKE0-00001-16-00001 and -00002, *Description - Control System Operating Parameters Description for the Wet Electrostatic Precipitator LAW* 1 and 2, respectively. Also, there are the following control logic diagrams available: 24590-QL-POA-MKE0-00001-06-00040, 41, 42, and 43. See Section 5 of 24590-QL-POA-MKE0-00001-22-00001 for a discussion of current and efficiency.
- *Is the pressure drop monitored?*

- Differential pressure across the WESP is calculated from the monitored offgas inlet and outlet pressures.

o *Will the WESP be washed offline?*
- The tubes in the WESP will not remain energized when water is flushed into the system. The operator will flush the WESP periodically. The frequency will be determined through operation and trending of the current / voltages. The SFS 24590-LAW-3PS-LOP-T0001 notes these controls as on hold pending WESP vendor information on control logic. The life cycle document for acquired software packaged with LAW WESP referenced 24590-QL-POA-MKE0-00001-16-00001, Description - Control System Operating Parameters Description for the Wet Electrostatic Precipitator LAW 1, which states: "To initiate a wash cycle the operator disables the T/R set through the remote stop/start switch (HS-1071B)." The plan is to have the operator periodically flush the unit instead of software controlled flush based upon buildup.
- 24590-QL-POA-MKE0-00001-20-00001, Operations & Maintenance Manual for LAW WESP Vessels, is a vendor manual that provides information on washing and powering down the WESPs, including the frequency.
- Failure of an electrode can be detected by monitoring the current from the WESP and by the rate of loading on the HEPA filters.
- Loss of power or electrode failure results in lowered equipment efficiency, causing a more rapid HEPA loading. To correct the problem, the melter is idled until power is restored. The maintenance bypass is used until electrode repairs are made on the WESP. If decreased efficiency is not significant, maintenance is performed at the next melter change out.
- If maintenance of a WESP is required during the lifetime of the melter, a maintenance bypass line is provided from the standby offgas line on the corresponding melter to the standby line on the other melter. The bypass line is only opened when both melters are idled. To isolate the SBS/WESP after the melter is idled, the bypass isolation valve is opened and the isolation valve downstream of the WESP is closed. The valve on the WESP drain is also closed.
- Equipment and tankage will be drained or decontaminated. Following radiological safety assessment, manned access may be allowed in the wet process cell. At this time, equipment is inspected and non-routine maintenance or repairs are conducted (e.g., WESP electrodes/conductors, or ultrasonic testing of tank walls to detect erosion/corrosion)
- The WESP transformer/rectifier and local control panel/operator interface are located outside the process cell. This enables contact maintenance on the transformer and control system.

o *Is there a backup or bypass when the WESP is offline?*
- There is a bypass valve to the primary offgas process system of the second melter located after the film coolers.

o *How is the WESP treatment efficiency determined?*
- Addressed above

- 24590-WTP-RPT-ENV-01-008, Radioactive Air Emissions Notice of Construction Permit Application for the Hanford Tank Waste Treatment and Immobilization Plant, references CCN 112294, "WTP Radionuclide Constituents Air Emissions Estimates to Support the 2005 Update to the RAD NOC Permit," which lists decontamination factors ranging from 11 to 80 (90.9 % to 98.75%) removal for radionuclide particulates. Equipment specification is 99.5% overall and 99% for 0.3 micrometer particulates, which is more conservative to ensure the permit limits are met. Solids removal performance requirements are listed in 24590-WTP-3PS-MKE0-T0001, Engineering Specification for Wet Electrostatic Precipitators, Appendix B.
- The WESP was designed with sufficient tube area and power density to attain the specified efficiency (24590-QL-POA-MKE0-00001-07-12, Calculations - LAW WESP - Efficiency Calculations for LAW WESP, "C03-2790-CALC-01," REV. 000).

- *How will WESP functionality be determined during operations?*
  - Addressed above
- *What happens if there is loss of process air or a failure of the purge air heaters?*
  - The power to the WESP is interlocked to the air flow and to the air temperature, so the WESP would stop. This would result in an alarm to the operator, which would stop feed to the melter in a control manner. The period between loss of WESP and feed cap burn off would lead to some increase loading on the HEPA.

Based on the above, the approach to control the WESP appeared viable. All required instrumentation was included on the P&ID.

Secondary Offgas

- ***High Efficiency Particulate Air (HEPA) filters*** *- Ricky Bang*

References:

24590-WTP-3YD-50-00002, *WTP Integrated Processing Strategy Description*, Rev, 0, July 12, 2004

24590-LAW-3YD-LOP-00001, *System Description for LAW Primary Offgas Process (LOP) and LAW Secondary Offgas/Vessel Vent Process (LVP) Systems*, Rev. 1, March 23, 2005

24590-LAW-M6-LVP-00001, *P&ID-LAW Secondary Offgas/Vessel Vent Process System Melters Secondary Offgas*, Rev. 3, January 31, 2007

24590-LAW-M6-LVP-00004, *P&ID - LAW Melters Secondary Offgas Vessel Vent Process System Mercury Mitigation Equipment*, Rev. 1, January 31, 2007

- *What process controls are used to manage melter offgas in the HEPA filters?*
  - Offgas inlet temperature to the HEPA filters is controlled by the preceding electric heaters, and monitored at the preheater outlet. The calculation 24590-LAW-MEC-LVP-00004 shows the inlet temperature and temperature rise across the heaters for the various cases. The normal control is to provide a 20°C rise across the heaters with the ITS control ensuring a minimum of a 10°C rise across the heaters. The main purpose of the heaters to reduce the humidity of the offgas before it gets to the HEPA filters.
- *How is flow through the preheaters and HEPA filters controlled?*
  - The flow at the preheaters is not monitored, but both are sized to heat 100% of the flow. The HEPA filters have flow transmitters (FT-0112, 0114, 0115) which monitor flow (24590-LAW-M6-LVP-00001).
  - Filter train inlet and outlet pressure, and differential pressure are monitored. Pressure drop across each filter train is monitored to detect failed filters. During operation, a reduced pressure drop across HEPA filters in the primary housing or particulate/aerosol accumulation on HEPA filters in the secondary housing may indicate failure. The flow would be routed to the redundant filter train upon detection of failure. Failed filters are replaced to restore redundancy. In addition, there is a yearly test of filters.
- *How is a negative pressure in the system maintained?*
  - Vessel vent pressure is controlled via PV-0072 (P&ID M6-LVP-00001). The pressure control loop PT-0072 to PV-0072 on P&ID 24590-M6-LVP-00001 is set to maintain a negative pressure of 4 inch WC on the vessel vent side of the valve. The side of the valve closer to the preheaters is at approximately – 56 inch WC and normally does not fluctuate. PV-0072 opens/ closes as the vessel vent flow changes to maintain a drop across the valve of approximately 52 inch WC.
- *How is in-flow velocity monitored?*
  - The minimum in-flow velocity of 100 ft/min required in the vessel vent header is a design criteria. It is not controlled directly, but pressure is controlled via PV-0072 (P&ID M6-LVP-00001).
- *How is the preheater controlled?*
  - The inlet condition to the heater is saturated because of the liquid contact in the SBS. The HEPA pre-heaters are controlled to raise the temperature of the gas by some specified temperature rise. The temperature difference between the inlet and outlet is used, TY-0101 on M6-LVP-00001, to adjust power to the heaters.
  - Only temperature monitoring is provided because 100% relative humidity (RH) is assumed for the inlet stream, and the temperature is raised to ensure that the 70% RH limit on the HEPA filters is protected.

        - High differential temperature trip de-energizes the heaters. Low differential temperature trip closes valves LFP-YV-1208 and 2208.
    - *How is the temperature monitored in the preheater?*
        - Offgas inlet and outlet temperature are monitored by LVP-TT-0001Z and -0005Z. The temperature differential is monitored by TY-0101.
    - *Is pressure drop across the filters monitored?*
        - Filter differential pressure across the HEPA filter housing is monitored.
    - *Is the ability to isolate each bank of filters for testing available?*
        - The HEPA filter housings form two trains: a main train used in normal operations and an auxiliary train used as an installed back-up. Offgas flow can be routed to the redundant filter, such as in the event of a failed filter.

Based on the above, the approach to control the HEPA preheaters and filters appeared viable. All required instrumentation was included on the P&ID.

- ***Exhausters** - Ricky Bang*
    - *How are the exhausters controlled?*
        - There are speed, temperature, and pressure instrumentation for the exhausters (M6-LVP-00001). The flow to the stack is measured by FT-2113 on 24590-LAW-M6-LVP-00002. The exhauster speed is controlled by a pressure signal from a location upstream of the HEPA pre-heaters. Fan curves show the relationship between fan speed and how much upstream vacuum or downstream pressure is developed. The cascade effect of fan speed versus pressure throughout the offgas system was analyzed in the dynamic modeling done by a subcontractor. Also, data for the pressure profiles for min, norm, max conditions are available.
        - The pressure rise across the fans is measured by PDT-0133, 0134, and 0135 on 24590-LAW-M6-LVP-00001, the pressure is measured in front of the mercury adsorbers by PT-0025 on 24590-LAW-M6-LVP-00004, and flow is measured in front of the thermal catalytic oxidizer (TCO)/selective catalytic reducer (SCR) by FE-0506 on 24590-LAW-M6-LVP-00005 (Note - no other flows have been added to the exhausters and this point).
    - *How is pressure across the entire melter offgas system controlled?*
        - For the primary/LOP portion of the system, the primary pressure controls are the control air to the film cooler (PV-1105, with input from LMP-PDY-1410) (24590-LAW-M6-LOP-00004/24590-LAW-M6-LMP-00002) and the control valve after the WESP (FT/FV-1140) 24590-LAW-M6-LOP-00001, which gets feed back from the flow to PV-1105. The amount of melter control air can be adjusted to maintain the pressure in the melter plenum. The control valve downstream of the WESP on each primary offgas system is adjusted based on changes to the control air rate.

The main header pressure control for the secondary (LVP) portion is the fan speeds controlled by PT-0071 (24590-LAW-M6-LVP-00001). The fans are sized to provide enough pressure gain to exhaust through down steam equipment. There are also controls for upsets, such as the opening the lines to the secondary film cooler and the by-passes around equipment in the secondary system that meet the safety requirements to vent the system out of building

- *How is their performance monitored?*
  - Addressed above.

Based on the above, the approach to control the exhausters appeared viable. All required instrumentation was included on the P&ID.

- ***Carbon Beds**- Ricky Bang*
  - *What process controls are used to manage offgas in the carbon beds?*
    - There is no specific control for the flow to the carbon adsorbers, They get the full flow of the offgas from the exhausters at exit pressure of the exhausters.
    - Pressure is monitored throughout the offgas system to determine if a blockage or constriction is occurring. For example, at the skid there is PDT-0402 on M6-LVP-00004, which monitors the pressure differential across the bypass valve.
    - A CO or CO_2 concentration above normal levels indicates that a carbon bed fire is occurring. Upon detection of a high CO_X concentration, melter feed is interlocked to stop, bypass valve is interlocked to open, and isolation valves and are interlocked to close. Following detection of a high bed temperature, manual valves are opened to flood the bed with water and isolation valves are automatically closed on high bed level to prevent water from blocking the offgas system. The column would then be drained and the activated carbon replaced.
    - A high offgas temperature could initiate a carbon bed fire. Upon detection of a high offgas temperature, melter feed is interlocked to stop, bypass valve is interlocked to open, and isolations valves are interlocked to close. The high temperature could be caused by a malfunctioning HEPA filter preheater. The preheaters are de-energized upon detection of high differential temperature while the cause is determined and the condition is corrected.
  - *How is the performance of the adsorbers monitored?*

2.1.1. Offgas outlet mercury (Hg), hydrogen chloride (HCl), and hydrogen fluoride (HF) concentrations are monitored.

Based on the above, the approach to control the activated carbon bed adsorbers appeared viable. All required instrumentation was included on the P&ID.

- ***Thermal Catalytic Oxidation** – Rob Gilbert*

The WIPSD, SD, SFS, and 24590-LAW-M6-LVP-00005, *P&ID-LAW Melters Secondary Offgas Vessel Vent Process System SCR, VOC & Ammonia Dilution Packages*, were reviewed to address the LOI.

- *What process controls are used to manage offgas in the thermal catalytic oxidation units?*
  - The thermal catalytic oxidizer (TCO) is controlled by heating the offgas through the use of a regenerative heat exchanger and electric heaters. The required temperature was not specified in the WIPSD, SD, SFS, or P&ID. The nominal flow rate is 4,180 acfm at 216°F and 28 inch wg. The offgas flows across the catalyst (platinum based material) where approximately 95% of the volatile organics are destroyed. Sampling for volatile organic carbon (VOC) is performed downstream of the regenerative heat exchanger following selective catalytic reduction (SCR) and before the caustic scrubber. Temperature is monitored before and after the heaters and TCO. Pressure drop is monitored across the TCO.
- *How is the heater controlled?*
  - Temperature is monitored before and after the electric heater to establish required adjustments to power. No controls are provided on the regenerative heat exchanger.
- *Are there any additives?*
  - Only heat and the catalyst are used for the reaction.
- *How is catalyst fouling monitored?*
  - Catalyst fouling would be detected by high total organic carbon samples, low temperature rise through the thermal catalytic oxidization unit, or increased pressure drop for gross media fouling.
- *When does the catalyst need to be replaced?*
  - Catalyst replacement would be performed upon detection of degradation of performance primarily from sample analysis.
- *Are temperature, pressure drop monitored?*
  - Temperature and pressure drop are monitored. Instrumentation is included on the P&ID.
- Based on the above, the approach to control the TCO appeared viable. All required instrumentation was included on the P&ID.

• ***Selective Catalytic Reduction** – Rob Gilbert*

The WIPSD, SD, SFS, and 224590-LAW-M6-LVP-00005, *P&ID-LAW Melters Secondary Offgas Vessel Vent Process System SCR, VOC & Ammonia Dilution Packages*, were reviewed to address the LOI.

- *What process controls are used to manage offgas in the selective catalytic reduction units?*
  - The SCR is controlled by receiving heated offgas from the thermal catalytic oxidizer and mixing the offgas stream with ammonia mixed with air from the C3 vent system. Ammonia is added at a ratio of 0.095 with NO_X. The maximum ammonia consumption rate is 123 lb/hr and is controlled by an orifice sized for the pressure regulator on the ammonia supply. NO_X concentration is determined by instrumentation located just before the SCR and treatment effectiveness is monitored with instrumentation immediately following the SCR. Mixed ammonia/air injection rate is controlled by flow control valves from C3 air and ammonia feeding the mixing chamber LVP-MXR-00001. The control of these valves is based on NO_X and ammonia levels in the exit gas. The required temperature was not specified in the WIPSD, SD, SFS, or P&ID. Maximum ammonia slip concentration is 20 ppm. Areas containing ammonia lines are monitored to detect leaks.
- *How is catalyst fouling monitored?*
  - The catalyst is a titanium oxide based material deposited on a metal monolith held in frames, which are inserted through doors on the selective catalytic reduction unit. Catalyst fouling would be detected by high NO_X samples downstream of the SCR, low temperature rise through the SCR, or increased pressure drop for gross media fouling.
- *When does the catalyst need to be replaced?*
  - Catalyst replacement would be performed upon detection of degradation of performance primarily from sample analysis.
- *Are temperature, pressure drop and NOx monitored?*
  - Yes, see above discussion.
- *What are the Hazards associated with the ammonia and how are these mitigated?*
  - Specific controls have been specified to assure leak tightness of the secondary offgas system, which is at a slight positive pressure (58 in water column). The following summary of controls and requirements were provided in response to the assessors question:

    "24590-WTP-SED-ENS-03-002-03, section 4.4.3.4 requires offgas piping to be design to ASME B31.3 Process piping code and refers also to ASME Pressure Vessel Code, ASME AG-1 and ASME N509 for pressure boundaries. For the items down stream of the exhausters these requirement have been incorporated in the specifications as follows:

    - Mercury Adsorbers - 24590-WTP-3PS-MWK0-T0001, Engineering Specification for Activated Carbon Bed Absorbers, Section 2 for references to the codes and standards, section 3 for design of the pressure boundary and section 6 for pneumatic testing of the pressure boundary.

- TOC/SCR - 24590-WTP-3PS-MBTV-T0001 Engineering Specification for Thermal Catalytic Oxidizers/Reducers Section 2 for references to the codes and standards, section 3 for design of the pressure boundary and section 6 for pneumatic testing of the pressure boundary.
- Caustic Scrubber - 24590-LAW-3PS-MKAS-T0001 Engineering Specification for LAW Melter Offgas Caustic Scrubber, Section 2 for references to the codes and standards, section 3 for design of the pressure boundary per the MDS (24590-LAW-MKD-LVP-00011) and section 6 for testing of the pressure boundary."

▪ ORP will be performing an assessment of LAW HVAC and offgas system in early 2008. Controls for mitigating the positive pressure in the secondary offgas will be evaluated further in this assessment.

o Based on the above, the approach to control the SCR appeared viable. All required instrumentation was included on the P&ID.

- ***Caustic Scrubber*** *- Rob Gilbert*

The WIPSD, SD, SFS, and 24590-LAW-M6-LVP-00002, *P&ID - LAW Secondary Offgas/Vessel Vent Process System and Stack Discharge Monitoring System*, were reviewed to address the LOI.

o *What process controls are used to manage solutions and offgas in the caustic scrubber?*

▪ The caustic scrubber removes acid gases from the offgas stream using 5 molar NaOH. Off gas flows from the bottom of the caustic scrubber to the top counter current from the caustic solution. Caustic solution is pumped into the top of the caustic scrubber and flows counter to the offgas. The caustic solution drains from the caustic scrubber in to the caustic collection tank. The caustic collection tank has a 2-day holdup of caustic scrub solution. The caustic collection tank has level instrumentation, sampling capability, density measurement, temperature measurement, and flow measurement to the caustic scrubber. The tank is passively vented to the C2 vent exhaust intake.

The caustic scrubber normally operates with a pH of 9. If high halides are measured in the scrubber bottoms, pH is raised to 14. Process water is added to the caustic collection tank to maintain scrub solution level and dissolved solids below 10 w/o based on specific gravity. Scrubber bottoms are transferred to the PT Facility vessels RLD-VSL-00017a/b about every two days.

o *What process controls are used to manage solutions collected from the caustic scrubber?*

- The caustic collection tank level is maintained, pH is maintained, dissolved solids are maintained below 10 w/o, and halide content is monitored through sampling in RLD-VSL-00017a/b. Caustic solution is transferred to RLD-VSL-00017a/b about every 2 days.

o *Are pH, temperature, and caustic solution level monitored?*

- pH, level, and temperature are monitored.

o *How is the automatic recirculation flow controlled?*

- Caustic recirculation flow is controlled at 60 gal/min through a flow control valve.

o *When is the scrubber solution replenished/flushed?*

- Caustic scrubber solution is replenished at low level, high pH, high specific gravity, and approximately every 2 days.

o *Are there any composition/radionuclide limits for the stream to RLD-VSL-00017B?*

- RLD-VSL-00017a/b is sampled every 2 days to confirm composition and radionuclide criteria for transfer to the Effluent Treatment Facility are met in accordance with interface requirements. There are two methods to detect increased halides to the caustic scrubber, first instrumentation AE-0439 on the carbon bed exit, measure halides (24590-LAW-M6-LVP-00004). An upward trend would indicate that the guard beds are no longer performing their halide removal functions. Second, the sample of the RLD-VSL-00017a/b for halides, which per the ISARD (24590-WTP-PL-PR-04-0001), Pretreatment sample point 25, page B-39, occurs every 48 hours.

• The caustic collection vessel (LVP-TK-00001) is passively vented to a C2 vent discharge. The assessors asked if a flammable gas (ammonia for example) concentration could be created in the caustic collection vessel from release from the caustic solution. The Contractor responded providing the following:

> "The organics in the offgas system have been removed by the Carbon Bed/TCO before the caustic scrubber. Only ammonia from the SCR has the possibility of accumulating in the caustic collection tank. The ENS group is working on a paper on the release of a ammonia from the caustic collection tank. Based upon the ammonia slip rate from the TCO/SCR and the batch time and Henry's Law, the concentration of ammonia is estimated to be 0.054 mol/liter, the Henry's Law 57.4 mol/liter - atm - the concentration is 940 ppm - below the LFL of 16% the caustic scrubber normally operates between 9 and 10 pH. Ammonia pH is 11.6 at 1 mol/liter so the vapor concentration would approximately 17,500 ppm or 1.7% still below 16%."

o Based on the above, the approach to control the caustic scrubber appeared viable. All required instrumentation was included on the P&ID.

Appendix B. DESIGN PRODUCT OVERSIGHT PLAN

U.S. Department of Energy, Office of River Protection

DESIGN PRODUCT OVERSIGHT PLAN

WTP ENGINEERING DIVISION ASSESSMENT OF LOW-ACTIVITY WASTE (LAW) VITRIFICATION PROCESS CONTROL STRATEGY

November 2007

Design Oversight: D-07-DESIGN-054

Submitted by:

original signed by ______________________ Date ____________
R. A. Gilbert, Team Lead
WTP Engineering Division

Concurrence:

______________________ Date ____________
R. W. Griffith, Acting Director
WTP Engineering Division

______________________ Date ____________
John Eschenberg, Project Manager WTP

1.0 BACKGROUND, PURPOSE AND OBJECTIVES

1.1 Background

The Waste Treatment and Immobilization Plant (WTP) Engineering Division (WED) has responsibility for the design oversight of the WTP. The WTP is comprised of three primary processing facilities: Pretreatment, HLW Vitrification, and LAW Vitrification. WED plans to perform a series of three assessments to evaluate process control strategies for each of the primary process facilities.

WTP Process control strategies are documented in the WTP Integrated Processing Strategy Description and System Descriptions. The WTP Integrated Processing Strategy Description provides a single document that links process flowsheet and upper tier processing related requirements with selected monitoring and control approaches for normal operations of the primary waste processing facilities. System Descriptions provide an overview description of the system, including functions, requirements, design operating parameters and operational conditions and limits, and define the system technical basis and code requirements.

1.2 Purpose

This design oversight assessment will review the process control strategy and design associated with the LAW Vitrification facility.

1.3 Objectives

The following are specific objectives of this assessment:

- Review the LAW Vitrification process control strategy documented in the WTP Integrated Processing Strategy Description and System Descriptions.
- Review LAW Process Flow Diagrams (PFD) and Piping and Instrumentation Diagrams (P&ID) to verify features required for the process control strategy are included in WTP design.
- Assess the effectiveness of the process control strategy.
  - Determine if the process control strategy will meet Contract and interface requirements.
  - Determine if the process control strategy will support plant throughput requirements.

2.0 Process

This oversight shall be conducted within the guidelines of ORP M220.1 and the WED Desk Instruction DI 220.1 Rev. 1 as revised January 13, 2006, "Conduct of Design Oversight."

2.1 Scope

This assessment will include review of the WTP Integrated Processing Strategy Description, System Descriptions, PFDs and P&IDs associated with the LAW facility.

The team will be comprised of four members of ORP WED:

- R. Gilbert
- R. Bang
- K. Thomas
- L. McClure

2.2 Preparation

1. Identify Contractor Point of Contact for Review

2. Confirm with Contractor staff that documentation being reviewed is the most current approved revision.

3. Prepare detailed lines of inquiry.

2.3 Assessment

The assessors will review the requested documentation to assess each of the objectives identified in Section 1.3 of this plan. Based on this assessment, specific lines of inquiry for use in discussion and interviews will be prepared. Notes will be retained identifying the document title and number reviewed and results of the review for use in preparing assessment notes which will be written by each team member as input to the report.

De-brief ORP and Contractor management periodically as required. The team lead will prepare a draft report that summarizes the activities, the results and conclusions of the review. Issue the Draft Design Oversight Report for ORP management and Contractor review and comment. The final report will resolve comments received on the draft report.

3.0 SCHEDULE OF ACTIVITIES

Table 1 summarizes the schedule of this assessment

4.0 DOCUMENTATION

The final report of this task shall contain the sections and content as summarized in ORP DI 220.1 Rev. 1 draft as revised March, 2006, "Conduct of Design Oversight."

Conclusions from this assessment shall be documented in the final report. Issues shall be assigned an item number for tracking in the Consolidated Action Reporting System (CARS). The final report will be transmitted to the Contractor.

5.0 CLOSURE

The Team Lead, with concurrence of the Director, shall confirm that the items from this oversight, if any, are adequately resolved.

Table 1 – Initial Information Requirements

1.	Point of contact for the assessment
2.	The latest revisions of the WTP Integrated Processing Strategy Description
3.	The latest revision of the LAW Vitrification PFDs and P&IDs
4.	The latest revision of LAW Vitrification System Descriptions

Table 2 – Schedule

Activity Description	Responsibility	Complete By
Develop Design Oversight Plan.	Gilbert	10/5/07
Provide Design Oversight Plan to Contractor.	Gilbert	10/12/07
Identify Point of Contact (POC).	WTP	10/19/07
Obtain Contractor documentation defined in Table 1 above to support review and provide to team members.	Gilbert WTP POC	10/23/07
Qualify Team members.	Gilbert/Griffith	11/5/07
Kick-off meeting with Contractor to outline objectives, scope, schedule, and establish points of contact.	WTP POC Gilbert	11/5/07
Review documents from Contractor and provide oversight strategy, lines of inquiry, and interview requests to team lead.	Team	11/5/07
Review Contractor documents, participate in relevant Contractor internal meetings and meet with Contractor as required.	Team	11/16/07
Complete Design Oversight Notes.	Team	11/16/07
ORP and Contractor Exit Briefing.	Gilbert WTP POC	11/23/07
Draft Report	Gilbert	11/23/07
Resolve Comments and place Final Report into concurrence including factual accuracy review with Contractor.	Gilbert	12/3/07
Approve Final Report	ORP	12/7/07

Task# ORP-WTP-2008-0011

E-STARS[R] Report
Task Detail Report
01/15/2008 0332

TASK INFORMATION			
Task#	ORP-WTP-2008-0011		
Subject	(Concur 08-WTP-010) DESIGN OVERSIGHT OF LOW-ACTIVITY WASTE (LAW) VITRIFICATION PROCESS CONTROL STRATEGY		
Parent Task#		**Status**	CLOSED 01/15/2008
Reference		**Due**	
Originator	Licht, Sarah (Licht, Sarah)	**Priority**	High
Originator Phone	(509) 376-6611	**Category**	None
Origination Date	01/10/2008 0906	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	Hard copy of the correspondence is being routed for concurrence. Once you have reviewed the correspondence, please approve or disapprove via E-STARS and route to the next person on the list. Thank you. bcc: MGR RDG file WTP OFF file WTP RGD file T. M. Williams, AMD J. R. Eschenberg, WTP R. A. Gilbert, WTP J. H. Wicks, WTP		

ROUTING LISTS

1	Route List	Inactive
	• Gilbert, Rob A - Review - Concur - 01/10/2008 0955 *Instructions:*	
	• Wicks, James H - Review - Cancelled - 01/15/2008 1532 *Instructions:*	
	• Eschenberg, John R - Approve - Approved - 01/15/2008 1254 *Instructions:*	

ATTACHMENTS

Attachments	1. 08-WTP-010.RAG.Attach.D-07-design-054 Report Rev d redline (2).doc 2. 08-WTP-010.RAG.Simmons.doc

COLLABORATION

COMMENTS

RECEIVED
JAN 15 2008
DOE-ORP/ORPCC

Task# ORP-WTP-2008-0011
No Comments
TASK DUE DATE HISTORY
No Due Date History
SUB TASK HISTORY
No Subtasks

-- end of report --

Task# ORP-WTP-2008-0011

E-STARS[R] Report
Task Detail Report
01/10/2008 0908

TASK INFORMATION

Task#	ORP-WTP-2008-0011		
Subject	(Concur 08-WTP-010) DESIGN OVERSIGHT OF LOW-ACTIVITY WASTE (LAW) VITRIFICATION PROCESS CONTROL STRATEGY		
Parent Task#		**Status**	Open
Reference		**Due**	
Originator	Licht, Sarah (Licht, Sarah)	**Priority**	High
Originator Phone	(509) 376-6611	**Category**	None
Origination Date	01/10/2008 0906	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	Hard copy of the correspondence is being routed for concurrence. Once you have reviewed the correspondence, please approve or disapprove via E-STARS and route to the next person on the list. Thank you. bcc: MGR RDG file WTP OFF file WTP RGD file T. M. Williams, AMD J. R. Eschenberg, WTP R. A. Gilbert, WTP J. H. Wicks, WTP		

ROUTING LISTS

1	Route List	Active
	• Gilbert, Rob A - Review - Awaiting Response - Due Date *Instructions:* RAG 1/10/08	
	• Wicks, James H - Review - Awaiting Response - Due Date *Instructions:* JW 10 Jan 2008	
Rec'd 1/11/08	• Eschenberg, John R - Approve - Awaiting Response - Due Date *Instructions:* 1/15/08	

ATTACHMENTS

Attachments	1. 08-WTP-010.RAG.Attach.D-07-design-054 Report Rev d redline (2).doc 2. 08-WTP-010.RAG.Simmons.doc

COLLABORATION

COMMENTS

Task# ORP-WTP-2008-0011

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --