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

DESIGN OVERSIGHT REPORT

REVIEW OF BECHTEL NATIONAL, INC. WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) LOW-ACTIVITY WASTE (LAW) FACILITY INSTRUMENTATION AND CONTROL (I&C) SYSTEM HARDWARE LAYOUT DESIGN

February 2008

DESIGN OVERSIGHT: D-08-DESIGN-063

Team Lead: _____
Mark L. Ramsay, SSO Engineer
WTP Engineering Division

EXECUTIVE SUMMARY

In February 2008, an oversight assessment was performed on the design of selected process systems within the Waste Treatment and Immobilization Plant (WTP) Project Low-Activity Waste (LAW) Facility, with focus on instrumentation and control (I&C) equipment layout. The purpose of the assessment was to evaluate the adequacy of the WTP Contractor's LAW Facility I&C design product deliverable in meeting applicable high-level requirements from the WTP Contract and contract documents and lower-level requirements from industry standards and contractor design guides, procedures, specifications, etc.

The main objectives of the assessment were to:

- Verify that selected systems and elements in the LAW Facility I&C hardware layout are consistent with applicable functional and design requirements specified in contract documents and implementing codes and standards.
- Confirm that the Contractor's I&C design and procurement documentation for the LAW Facility is consistent throughout and is in accordance with design guides, procedures, and specifications.

This assessment focused on I&C hardware and equipment extending from primary process control loop devices and transmitters to field network controller enclosures. WTP custom software was not evaluated.

The assessment mainly involved document reviews and a few interviews as necessary for clarification. The documentation was reviewed against lines of inquiry and a set of requirements obtained from contract documents. The documentation included system descriptions, various types of drawings, datasheets, calculations, equipment lists, instrument databases, industry standards, specifications, and design guides.

Results and Conclusion

The LAW I&C design as evaluated from the design media listed above meets high-level requirements as provided in contract documents. The design appears to be consistent with numerous specifications and design guides detailing requirements for instrument procurement and installation. Equipment procurement requirements appear to adequately implement industry standards. Design drawings are consistent throughout and are sufficiently detailed for both system-level configuration management and instrument/equipment installation.

No findings or follow-up items were identified in this assessment. Recommendations for the Office of River Protection with respect to future assessments are presented in Section 5.0 of this report.

TABLE OF CONTENTS

TERMS AND ABBREVIATIONS

ABB	Asea Brown Bavari (Company providing control system platform)
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BOD	*Basis of Design*
COTS	Commercial-Off-The-Shelf
DOE	U.S. Department of Energy
EIA	Electronic Industries Association
FF	Foundation Fieldbus
FNJ	Facility Network Infrastructure
HSE	High Speed Ethernet
I/O	input/output
I&C	instrumentation and control
ICN	Integrated Control Network
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
ITS	important-to-safety
LAW	Low-Activity Waste [Facility]
LCP	LAW Concentrate Receipt Process System
LFH	LAW Container Finishing Handling System
LFP	LAW Melter Feed Process System
LMH	LAW Melter Handling System
LMP	LAW Melter Process System
LOI	line of inquiry
LOP	LAW Primary Offgas Process System
LPH	LAW Container Pour Handling System
LRH	LAW Container Receipt Handling System
LVP	LAW Secondary Offgas/Vessel Vent Process System
Mbps	megabits per second
MHD	mechanical handling drawing
ORD	*Operations Requirements Document*
ORP	Office of River Protection
OSI	Open Systems Interconnectivity
PB	Profibus DP
P&ID	piping and instrumentation diagram
PPJ	LAW Programmable Protection System
RTD	resistance temperature device
SBD	system block diagram
SD	system description
SRD	*Safety Requirements Document*
SQA	Software Quality Assurance
TIA	Telecommunications Industry Association
UPE	uninterruptible power equipment
UPS	uninterruptible power supply
WED	WTP Engineering Division
WTP	Waste Treatment and Immobilization Plant

1.0 INTRODUCTION

In February 2008, the Waste Treatment and Immobilization Plant (WTP) Engineering Division (WED) conducted an assessment to evaluate the adequacy of the WTP Contractor's Low-Activity Waste (LAW) Facility instrumentation and control (I&C) design product deliverable in meeting applicable high-level requirements from the WTP Contract and contract documents such as the *Basis of Design* (BOD), *Safety Requirements Document* (SRD), and *Operations Requirements Document* (ORD). The I&C design product deliverable was also evaluated in how it meets lower-level requirements from industry standards and contractor design guides, procedures, specifications, etc. The assessment described herein reviewed portions of selected process systems within the LAW Facility with focus on I&C equipment layout.

The assessment was conducted in accordance with the requirements and guidelines of Office of River Protection (ORP) desk instruction, ORP DI 220.1, "Conduct of Design Oversight." (Note: During the course of this assessment, the referenced desk instruction was superseded by DI 5.1, "Conduct of Design Oversight." The change did not impact this assessment.)

2.0 BACKGROUND

The I&C design and equipment layout for the LAW Facility has progressed to a point where instrument equipment installations will begin this calendar year (2008). While the U.S. Department of Energy (DOE) has maintained general cognizance of the LAW design progress throughout its evolution, a formal assessment has not yet been conducted to evaluate the adequacy the LAW I&C design product in meeting requirements. Therefore, given the design progress and the nearness of the commencement of construction activities, it was necessary at this time to perform a critical assessment of selected aspects of the LAW I&C design.

3.0 OBJECTIVES, SCOPE, AND APPROACH

3.1 Objectives

The main objectives in this assessment were as follows:

- Verify that selected systems and elements in the LAW Facility I&C hardware layout are consistent with applicable functional and design requirements specified in contract documents and implementing codes and standards.
- Confirm that the WTP Contractor's I&C design and procurement documentation for the LAW facility is consistent throughout and is in accordance with design guides, procedures, and specifications.

3.2 Scope

This assessment reviewed aspects of the LAW I&C design with respect to the following systems:

- LAW Concentrate Receipt Process System (LCP)
- LAW Melter Feed Process System (LFP)
- LAW Melter Process System (LMP)

- LAW Primary Offgas Process System (LOP)
- LAW Secondary Offgas/Vessel Vent Process System (LVP)
- LAW Container Finishing Handling System (LFH)
- LAW Container Pour Handling System (LPH)
- LAW Container Receipt Handling System (LRH)
- LAW Programmable Protection System (PPJ)*
- LAW Network Infrastructure System (FNJ)*
- LAW Melter Handling System (LMH)*

*The LMH (originally scheduled to be considered) was not evaluated because it did not have any I&C features to review. The PPJ and FNJ (not originally planned for) were considered only briefly.

It was not the intent of this assessment to perform an exhaustive or comprehensive review of any of the systems listed. Rather, selected aspects of each system were sampled and reviewed (some more than others) in order to gain a broad perspective.

This assessment mainly focused on I&C equipment extending from primary process control loop devices (sensors and switches) to field network controller enclosures. Equipment included final control elements (valves, pumps, etc.), transmitters, wiring and cabling equipment, remote input/output (I/O) modules, network communication devices such as controllers, fieldbus communication devices, and support equipment. WTP custom software was not evaluated in this review, but the Contractor's configuration program for Commercial-Off-The-Shelf (COTS) configurable firmware or software was briefly considered.

3.3 Approach

The approach taken in the assessment mainly involved document reviews and a few interviews as necessary for clarification. The documentation reviewed included system descriptions (SD), drawings (piping and instrument drawings [P&ID], mechanical handling drawings [MHD], system block diagrams [SBD], instrument location drawings, etc.), datasheets, equipment lists, instrument databases, industry standards, specifications, and design guides. In order to meet the objectives listed in Section 3.1, the LAW I&C design documentation was evaluated against the lines of inquiry (LOI) listed below. (These LOIs are the same as those listed in the assessment plan but are discussed here in a different order.)

3.3.1 Lines of Inquiry (LOI)

LOI Regarding Design Media and Requirements

- LOI #1: Is the design media substantially complete and readily available for evaluation?
- LOI #2: Do the design documents convey a complete and consistent body of information adequate for plant operations as well as instrument installation?
- LOI #3: For sampled systems, are the P&IDs consistent with the Systems Descriptions and other associated design media?
- LOI #4: Does the design, as reflected in the design media, meet high-level project requirements in documents such as the WTP Contract, BOD, ORD, and SRD?

- LOI #5: Is the I&C design consistent with BNI design guides and specifications?
- LOI #6: Does the I&C design and hardware layout reflect implementation of industry standards and acceptable practices?

LOI Regarding Instruments

- LOI #7: Do the instruments appear to have a necessary and sufficient function within the plant operation and control scheme?
- LOI #8: Are instruments suitable for the intended application and process environment?
- LOI #9: Were instrument calibration and maintenance considerations adequately factored into the design?
- LOI #10: Does BNI have an effective process for verifying that a given vendor is providing an instrument that meets the requirements identified on datasheets?
- LOI #11: Are instruments adequately detailed in terms of type, attributes, properties, location, and installation?
- LOI #12: Are instruments appropriately stored until time of installation and does BNI have a program from managing instruments after installation?
- LOI #13: Does BNI have a process for accommodating instrument configurable firmware/software upgrades?

4.0 RESULTS

Since the LOIs listed in Section 3.3 were established mainly to address the objectives in Section 3.1, the assessment results as described in this section will be discussed according to LOI.

The documents reviewed in this assessment are generally listed in Section 6.0 and specifically listed in tables in Appendix C. Detailed document review summaries are provided in Appendix A. High-level design requirements considered in this review are tabulated in Appendix B. A copy of the assessment plan is provided in Appendix D.

4.1 LOI Discussions Regarding Design Media and Requirements

LOIs numbered 1 through 6 essentially address both assessment objectives. Responses to these LOI address adequacy of design media with respect to design documentation consistency and adequacy for construction; meeting high-level requirements in contract documents; and meeting lower-level requirements from design guides, specifications, and industry standards.

LOI #1: Is the design media substantially complete and readily available for evaluation?

Discussion: Most of the documents necessary to perform this assessment were readily available through the Contractor's document database, *DocSearch.* In most cases, the documentation was complete and (except in a few cases) the documents had numeric rather than alpha revisions. In a few instances when documents were not available, Contractor personnel provided the documents. By these provisions, the following general Contract requirement was met:

> "DOE shall have access to all Contractor-developed design documents and information, paper and electronic files." *WTP Contract, Section C.6, Standard 3: Design (c)*

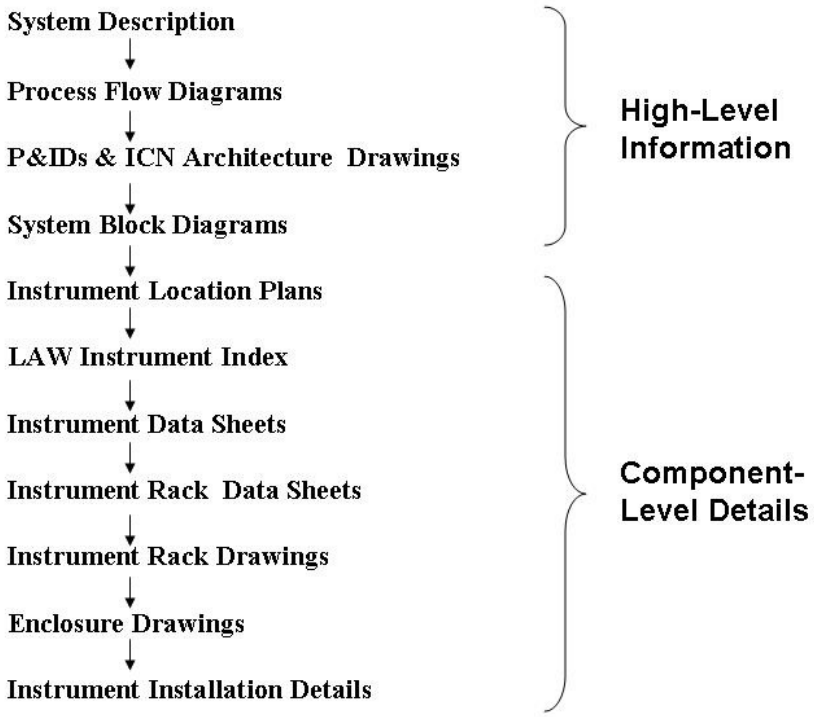
The completeness of the documentation appeared to be consistent with LAW I&C design status being at least 80% complete in most areas, with some areas being 100% complete. These percentages were provided by the Contractor in response to a request for project status, made in the assessment plan.

LOI #2: Do the design documents convey a complete and consistent body of information adequate for plant operations personnel as well as instrument installation?

Discussion: The intent behind this LOI was to ascertain that documents were sufficient and detailed enough for equipment/system installation and ultimately useful for plant configuration management.

It was verified that the available documentation provided adequate design detail on a system level as well as a component level for both equipment installation and for plant configuration management. There was a consistent flow of information from a high-level system perspective to lower-level details for component installation. The design information flow down as verified by various document reviews is depicted below.

Instrument and Control Design Information Flow



It was also verified that the Contractor maintains these document types in accordance with a controlled document numbering scheme identified in 24590-WTP-DNT-PADC-02-001, *WTP Document Numbering Tables and Codes*.

With respect to I&C construction preparation and readiness, the procedure, 24590-WTP-G04B-00047, *Engineering Deliverables to Construction and Startup/Commissioning,* was reviewed. This document establishes the engineering deliverables and data content requirements to Construction and Startup/Commissioning. As verified, this procedure drives the production of instrument installation reports (essentially database index reports). These reports, in conjunction with the instrument database, appear to provide a thorough listing of required instrument-specific information and details for construction. A sample report was reviewed and includes several dozen data fields required for each instrument. Many of the fields provide drawing references as listed below:

- Reference P&ID
- Location drawing
- Reference SBD
- Instrument datasheet
- Electrical connection detail drawing
- Heat trace detail drawing
- Pneumatic connection detail drawing
- Process connection detail drawing
- Support installation detail drawing
- Miscellaneous material detail drawings

Many of these drawings were reviewed in this assessment and found to be acceptable in terms of detail and intended purpose. See Appendix A for document review summaries.

P&IDs, SBDs and instrument datasheets provide clear designations and information to define and distinguish safety system components and quality requirements. This is in compliance with BOD requirement 9 as listed in Appendix B of this report.

Construction and installation of I&C equipment is also driven by specification, 24590-WTP-3PS-JQ08-T0001, *Engineering Specification for Construction and Installation of Controls and Instrumentation*. As verified, this document provides a thorough set of construction requirements for all aspects of I&C equipment installation. Moreover, the specification draws upon the documents listed above. Provision is also made in the specification that where conflicts occur between design drawings, vendor drawings, and/or datasheets, they are to be brought to the attention of Resident/Design Engineering for resolution.

Most of the drawings that were reviewed appeared to be accurate and informative. In a few cases, there were minor inconsistencies between documents (mislabeling, incomplete drawings and datasheets, etc.). However, through interviews it was made clear that many of the work activities are being performed in parallel in order to better utilize limited resources; and since the design is still ongoing, the parallel work approach sometimes results in disconnects and time lags between document updates and revisions that would normally pickup and correct such inconsistencies.

No findings or follow-up items were identified relevant to this LOI. However, a future assessment should verify the adequacy and consistency of construction packages. Also, when construction gets underway, assessments should be performed against specification 24590-WTP-3PS-JQ08-T0001 discussed above. See recommendations in Section 5.0.

LOI #3: For sampled systems, are the P&IDs consistent with the Systems Descriptions and other associated design media?

Discussion: System descriptions (SD) were reviewed and verified that appropriate reference is made to associated system P&IDs. Also, instrument components discussed in the SDs could be readily identified on referenced P&IDs.

It was also verified that instruments shown on P&IDs have unique equipment identification and specific datasheets and each instrument datasheet refers back to the P&ID where the instrument is used. See Instrument Datasheets Document Review Summary (A7) in Appendix A.

Process control system SBDs are based upon and developed from P&IDs and each SBD references the associated P&IDs. SBDs were reviewed against P&IDs and found to be consistent. See SBD Document Review Summary (A2) in Appendix A.

The observations above indicate compliance with Contract requirements 1, 2, and 4 as listed in Appendix B of this report.

No findings or follow-up items were identified relevant to this LOI.

LOI #4: Does the design, as reflected in the design media, meet high level project requirements in documents such as the WTP Contract, BOD, ORD, and SRD?

Discussion: Requirements for this assessment were identified from the referenced contract documents and are stated as questions and tabulated in Appendix B along with source document references. In addition, the table indicates briefly whether the requirement was met and how compliance was determined or verified. In most cases, requirements verification is referenced to the document review summaries in presented in Appendix A of this report. The summaries tend to be specific to the high level requirements.

Based upon the large volume of documentation reviewed, the LAW I&C hardware design and layout appears to implement the tabulated high level requirements.

No findings or follow-up items were identified relevant to this LOI.

LOI #5: Is the I&C design consistent with BNI design guides and specifications?

Discussion: Plant-wide design guides were reviewed and found to be consistent with the BOD. The guides clearly add technical clarification to the design process and are generally considered as a source for detailed requirements. The guides also point to equipment specifications, particularly in 24590-WTP-GPG-J-014, *Control Systems Design Process Guide*.

The Control Systems Interface guide identifies specific equipment types and components within the Asea Brown Bavari, Inc. (ABB) hardware platform. Details are presented that cover the fieldbus technologies, Profibus DP (PB) and Foundation Fieldbus (FF). PB and FF devices and cabling is evident in the design based on review of SBDs, datasheets, and enclosure general arrangement drawings. The guides, Profibus Testing Design Guide and 24590-WTP-GPG-J-004, *Guidelines for Design of a Foundation Fieldbus H1 Segment*, add further clarification consistent with the I&C design.

The guide for System Block Diagrams is fully implemented as evident from review of SBDs.

The guide for Control Valve Sizing appears to be closely followed as is evident from review of valve calculations.

To the extent that the guides were reviewed, there was not seen anything in the LAW I&C design that appeared to be inconsistent with the design guides.

A host of I&C equipment specifications were briefly looked at. Several are discussed in the document review summaries in Appendix A. A listing of specifications is provided in the appendices of 24590-WTP-GPG-J-014, *Control Systems Design Process Guide*. The specifications appear to be comprehensive in identifying industry standards and requirements. With respect to the LAW I&C design, all major components appear to be covered under at least one specification. Several of the specifications have two versions, one version for safety class/quality level procurement, the other version for non-safety class/commercial procurement. Installation of instruments is also covered under a specification. While some of the specifications are broad in scope, many are very specific to instrument types, valves, and enclosures. Where there is a conflict between the specifications and instrument datasheets, the datasheets take precedence. It is primarily at the datasheet level that the LAW I&C design most clearly appears to be consistent with specification details.

No findings or follow-up items were identified relevant to this LOI.

LOI #6: Does the I&C design and hardware layout reflect implementation of industry standards and acceptable practices?

Discussion:

Industry Standards: Major industry standards applicable to the LAW I&C design are listed primarily in Section 9 of the BOD. The SRD also includes implementing standards for meeting safety criterion. As expected, industry standards listed in procurement specifications typically go beyond those listed in the contract requirements documents.

In this assessment, a few key standards were briefly considered with respect to implementation.

- Institute of Electrical and Electronics Engineers (IEEE) 802.3, *Information Technology* – Telecommunications and Information Exchange between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

  IEEE 802.3 is a collection of IEEE standards defining the physical layer (electrical wiring characteristics), and the media access control sublayer of the data link layer, of wired Ethernet. Ethernet is a local area network technology that accommodates physical connections between computer devices, switches, routers, etc., by various types of copper or fiber optic cable. Ethernet technology is employed within the WTP for the Integrated Control Network (ICN) and specifically for High Speed Ethernet (HSE) communications associated with FF. Several control system interface devices used within the LAW I&C communications equipment are required to be Ethernet compliant. Ethernet devices come with vender certification, which necessarily means implementation of the IEEE 802.3 standard.

- American National Standards Institute/Instrument Society of America (ANSI/ISA) S50.02, *Fieldbus Standard for Use in Industrial Control Systems*

  This standard is an open systems standard upon which FF technology for H1 circuits (31.25 bits/sec) is based. The standard is specific to the physical layer (wiring)

associated with the Open System Interconnectivity (OSI) model used in network communications. Instrument transmitters or devices manufactured for specific operation within FF networks must comply with this standard. Devices that satisfy the test requirements under FF certification are therefore compliant with ANSI/ISA S50.02. Transmitters are indicated as FF compliant in instrument datasheets associated with the LAW I&C design.

- Telecommunications Industry Association/Electronic Industries Association (TIA/EIA)-485-A, *Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*

  This standard is also an OSI model physical layer electrical specification for two-wire multipoint serial connection. TIA/EIA-485-A is used within the WTP Project with respect to shielded twisted pair wiring for components such as those operating within Profibus networks wherein data is transmitted at a typical rate of 12Mbps over an RS-485 circuit.

- ANSI/ISA – 75.01.01 – 2002, *Flow Equations for Sizing Control Valves*

  This standard is fully implemented in the software used for control valve calculations. See Instrument valves review summary (A5, Instrument Valves [Calculations and Specifications]) in Appendix A. The software used in the calculations is verified in software quality assurance verification documents. Within the verification documents, hand calculations are performed using the valve sizing formulas just as they are listed in the referenced standard.

- ANSI/ISA S5.1, *Instrumentation Symbols and Identification*
- ANSI/ISA S5.3, *Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer System*s

  The implementation of these standards is clearly evident in P&IDs and particularly in the P&ID Symbols and Legend drawings.

- ISA S5.4, *Instrument Loop Diagrams*

  While instrument loop diagrams, for the most part are not widely used on the project due to network instrumentation, in some cases the diagrams are necessary. 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems*, Section 11.2.7, requires vendors and suppliers in specific instances to provide loop diagrams that meet the content requirements outlined in Figure 3 of the referenced ISA standard. For the LAW I&C design, loop diagrams for LPH system loops (LPH-ZS-7105, LPH-ZS-7108, and LPH-JZ-7001) were reviewed and verified that they implement the requirements of the referenced standard.

- ISA 20, *Specific Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves*

  This standard is implemented in the forms used for instrument datasheets. See Instrument Datasheets Review Summary (A7) in Appendix A.

- National Electrical Manufacturers Association (NEMA) ICS 6, *Enclosures for Industrial Controls and Systems*
- NEMA 250, *Enclosures for Electrical Equipment*

  Housing cabinets used for the LAW I&C equipment and systems are typically called out in project specifications and other project documents as NEMA 12 enclosures. A NEMA 12 enclosure is specifically defined in the NEMA 250 standard. The NEMA ICS 6 standard provides requirements to enclosure manufacturers regarding the construction of industrial enclosures and refers to NEMA 250 for the test methods and criteria by which to certify an enclosure to a particular rating (i.e., NEMA 12). WTP standard enclosure general arrangement drawings specify NEMA 12 enclosures and site the specification where NEMA standards are to be met in the fabrication and the specification states requirements from the NEMA standards.

- DIN 43760, *References Nickel Precision*
- DIN IEC 751, *Reference Platinum*

  These are European industrial standards that are called out in 24590-WTP-GPG-J-014, *Control Systems Design Process Guide* (Section 8.5.2). They are specific to resistance temperature devices (RTD), which are used in temperature measurement. Implementation of these standards was verified by review of instrument datasheets (Form 13) for platinum RTDs.

Acceptable Practices: A very effective industry practice utilized by the Contractor is the development of SBDs. These drawings convey the control system design and cabling scheme and have proven to be useful for communicating information to system engineers for advancing the I&C design. SBDs are discussed further in Appendix A (Document Review Summary A2).

No findings or follow-up items were identified relevant to this LOI.

4.2 LOI Discussions Regarding Instruments

LOIs numbered 7 through 13 mainly address instrument functionality, application, calibration and maintenance, description details, procurement, storage, and software upgrades.

LOI #7: Do the instruments appear to have a necessary and sufficient function within the plant operation and control scheme?

SDs and P&IDs as listed in the references were reviewed for the LCP, LFP, and LOP.

For the LCP, Table 6-3 in the SD was verified as listing the specific functions of *Major Process Control Valves*, and Table 6-4 of the SD presents the functions of the *Major Process Instrumentation.*

For the LFP, Table 6-3 in the SD was verified as listing the system *Control Devices,* and Table 6-4 presents the associated *Instrumentation.*

For the LOP, Table 6-2 in the SD was verified as listing the system *Control Devices,* and Table 6-3 presents the associated *Instrumentation.*

Valves, pumps, equipment, and instruments shown in the tables are uniquely labeled and have specific functionality for the unique and necessary contribution the devices provide in the control

scheme. For example, each control device that depends on an electric motor has a dedicated current level indicator; and each process vessel has dedicated instruments for temperature, pressure, level, and density. Redundant instruments are only apparent in level instrumentation for some process vessels. While the reason for the redundancy is not clear in the SDs that were reviewed, allowance is made for redundancy "where it is appropriate".

LOI #8: Are instruments suitable for the intended application and process environment?

General guidelines for instrument application with respect to process environment are provided in 24590-WTP-GPG-J-014, *Control Systems Design Process Guide*. Environmental conditions of ambient temperature, humidity, radiation, and contamination are addressed. Specifications for instruments provide the range of environmental conditions within which particular types of instruments are to function. Instrument datasheets indicate the type of device, its location, application, and the process environment respectively. For the datasheets reviewed, there was consistency between the specifications and the data on the sheets relative to environmental conditions. For example, in the specification for vortex flowmeters, the temperature range specification for internal plant conditions is from 59°F to 113°F and the radiological conditions are specified for an instantaneous dose rate of less than 10 mrad/hr, with a time integrated dose of 876 R over a 10-year period. These are precisely the conditions indicated on the vortex datasheets (Form 103). The same is true for other specifications and datasheets reviewed.

No findings or follow-up items were identified relevant to this LOI

LOI #9: Were instrument calibration and maintenance considerations adequately factored into the design?

According to interviews with Contractor engineering personnel, calibration of smart devices is generally automatic after installation and can be monitored and adjusted through the ICN. For design consideration, calibration of non-microprocessor based devices was estimated to be performed at least twice per year. To accommodate manual calibration activities, engineering design considered service type, zone, and location for instrument access. Valves are also designed in the plant for isolation and bypass associated with equipment replacement and maintenance. For safety maintenance, double block and bleed is implemented.

No findings or follow-up items were identified relevant to this LOI.

LOI #10: Are instruments adequately detailed in terms of type, attributes, properties, location, and installation?

The specific details for each LAW instrument are provided on instrument datasheets. Instrument datasheets make up a substantial portion of the I&C documents required by the Contract. The formulation and maintenance of instrument datasheets is in compliance with Contract requirement 8 as listed in Appendix B.

The instrument datasheets reviewed in this assessment are listed in the references and a Document Review Summary of Instrument Datasheets (A7) is provided in Appendix A.

As found in this review, the datasheets clearly indicate the type of instrument and the attributes/ properties and requirements of the instrument in order to function within defined process conditions. The instrument datasheets also indicate the process service line in which the instrument is to function.

The Contractor also maintains a detailed instrument database that, along with the process service line number, indicates the room location and the rack or bulge where the instrument is installed. This was verified by review of the LAW Facility Instrument Index.

Instrument location drawings were also reviewed that verify instruments and instrument racks and bulges are adequately detailed in terms of location.

Typical instrument installation drawings are also maintained that provide details with respect to mounting, piping, and wiring associated with instruments. These drawings are discussed further in Appendix A (Document Review Summary A4).

No findings or follow-up items were identified relevant to this LOI.

LOI #11: Does BNI have an effective process for verifying that a given vendor is providing an instrument that meets the requirements identified on datasheets?

Based on interviews, the Contractor establishes a partnering arrangement to ensure that instruments satisfy datasheet requirements. The partnering arrangement starts with developing instrument template datasheets (specific to type but not to component) and obtaining review and agreement from vendors that the template information is correct and that the instrument requirements can be met or otherwise adjusted. Incorporation of specification requirements are part of this process. When agreement is obtained on what may be provided on the template datasheets, unique component-specific datasheets are then developed with vendor review.

No findings or follow-up items were identified relevant to this LOI

LOI #12: Are instruments appropriately stored until time of installation and does BNI have a program from managing instruments after installation?

The Contractor procedure, 24590-WTP-GPP-GCB-00100, *Field Material Management,* states, "Material equipment and components are to be stored in accordance with purchase order requirements, manufacturer's specification, material acceptance plan requirements, or direction from Field Engineering or C&T Maintenance to ensure the material is properly controlled and protected." According to interviews with Contractor staff, indoor storage requirements for instruments are provided in instrument Material Requisitions (specifications) and are specific to standardized storage levels A, B, or C. These storage levels are defined in 24590-WTP-GPP-GCB-00100 and are taken directly from American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-2, *Quality Assurance Requirements for Nuclear Facility Applications*. The same environmental requirements for instrument storage are to be maintained after instrument installation within the facility in which the instruments were installed.

According to interviews, instruments that have been procured for the LAW Facility and are awaiting installation are being stored in at least three locations, each location providing the required storage conditions. These locations and the instruments being stored were not observed in this assessment. In a future assessment the instrument storage arrangements should be observed and verified that they meet requirements. See recommendations in Section 5.0.

No findings or follow-up items were identified relevant to this LOI.

LOI #13: Does BNI have a process for accommodating instrument configurable firmware/software upgrades?

Software was not specifically reviewed or considered in this assessment. However, since most, if not all, of the smart instruments (i.e., microprocessor based transmitters) typically come with onboard programming features, it was of interest in this assessment to understand how the Contractor manages device upgrades associated with device programming functions.

The Contractor has established a Software Quality Assurance (SQA) program to meet requirements defined in Policy Q-03.2, "Software Quality," of the Quality Assurance Manual (24590-WTP-QAM-QA-01-001). Of the suite of procedures comprising the SQA program, 24590-WTP-GPP-IT-014, *Acquired Software Packaged with Equipment*, describes the life cycle documentation process that must be followed for managing software that comes packaged with plant equipment. Guidance for using this procedure is provided in the document, 24590-WTP-GPG-ENG-090, *Guidance for Management of Acquired Software Packaged with Equipment*. Another procedure is followed for installed software, 24590-WTP-GPP-MGT-027, *Plant Installed Software Baseline Change Control* that controls changes or upgrades to software approved on the "Plant Installed Software Baseline." The configured software and firmware types of items to be controlled and maintained are listed in Appendix 1, Section 5.0, of 24590-WTP-GPP-IT-014. Appendix 1 of the procedure is a sample life cycle document template.

According to interviews with Contractor personnel, the process described above accommodates upgrades to components that network to the ICN. This would include electronic items such as General Station Description (GSD) files for Profibus DP devices and Device Description (DD) files for FF devices. These types of files are provided by vendors and are necessary for device programming.

Implementation of the process described above should be evaluated in a future assessment that that focuses on software development and configuration management. See recommendations in Section 5.0.

No findings or follow-up items were identified relevant to this LOI.

5.0 RECOMMENDATIONS

The following recommendations deal with actions to be taken by ORP personnel in future oversight reviews or assessments.

- Verify the adequacy and consistency of construction packages associated with instrument installation activities once such activities commence. Installation is estimated to begin in first quarter of fiscal year 2009. Instrument installation and construction activities should also be reviewed specifically against 24590-WTP-3PS-JQ08-T0001, *Engineering Specification for Construction and Installation of Controls and Instrumentation*.
- Future assessment activity should observe instrument storage facilities to verify that they meet storage (environmental) requirements. Also, after instruments are installed, observation should be made that required environmental conditions are maintained.

- Future assessment activity should evaluate the Contractor's software quality assurance program to ensure acquired software for packaged equipment is properly managed in accordance with requirements.
- The Contractor does not plan to maintain the configuration of SBDs after the design has been completed, unlike other contract-required documents (i.e., P&IDs). Consequently, valuable design configuration information could be lost. It is recommended that DOE look carefully at the value of SBDs with respect to facility turnover. SBDs will likely prove to be beneficial with respect to WTP configuration management and therefore should be maintained.

6.0 REFERENCES

Due to the large volume of documentation reviewed in this assessment, the document references are generally listed below as table headings. Specific documents within each table are provided in Appendix C.

Table C-1 System Descriptions
Table C-2 Piping and Instrument Drawings
Table C-3 Mechanical Handling Diagrams
Table C-4 System Block Diagrams (SBD) and Control Sys. Architecture Diagrams
Table C-5 Instrument Datasheets
Table C-6 Equipment Installation Drawings
Table C-7 Equipment Datasheets
Table C-8 Specifications, Guides, Calculations and Procedures
Table C-9 Instrument Location Plans and General Arrangements
Table C-10 High Level Requirements Sources
Table C-11 Electrical Drawings

Appendix A. Document Review Summaries

The document review summaries are presented as listed below:

- A1- Control System Architecture Drawings
- A2- System Block Diagrams
- A3- Equipment Datasheets
- A4- Equipment Installation Drawings
- A5- Instrument Valves (Calculations and Specifications)
- A6- Instrument Database (INtools)
- A7- Instrument Datasheets
- A8- Instrument Location Drawings

In these summaries, reference will be made to specific documents listed in the tables in Appendix C.

A1 – Control System Architecture Diagrams

References 53 through 58 in Table C-4 comprise the Integrated Control Network (ICN) Architecture Diagrams reviewed in this assessment. These drawings provide a general layout of the Low-Activity Waste (LAW) Facility control system. They present the basic connectivity between major control equipment items including, controllers, Foundation Fieldbus (FF) linking devices, operator consoles, systems servers and network switches. Enclosure listings and fieldbus segments for FF and Profibus DP (PB) are also identified in the diagrams. The focus of review for these drawings was with respect to controllers and linking devices associated with select PCJ and MHJ systems in meeting requirements stated in 24590-WTP-3PS-JD01-T0001, *Engineering Specification for Plant Wide Control Systems (Integrated Control Network).* With respect to the numbered sections in the specification where requirements are stated, the following observations were noted:

- The network architecture drawings depict dedicated controllers for the various plant systems indicating independence of plant control systems in accordance with 3.1.1 of the specification.
- The architecture drawings indicate that FF and High Speed Ethernet (HSE) protocols are employed in the design, in compliance with 3.1.1 of the specification. This also indicates compliance with *Basis of Design* (BOD) requirement 12 as listed in Appendix B.
- Servers as shown on the architecture drawings are provided to support Object Linking and Embedding for Process Control (OPC) protocol in accordance with 3.1.1.1 of the specification.
- Control and monitoring is provided from the LAW Facility control room via operator workstations and at Local Operator Interfaces located at facility cave faces, in compliance to 3.1.1.7 and 3.1.1.9 of the specification.
- Based on observed network addresses on the architecture diagrams, redundant controllers are provided in compliance with 3.1.1.10 of the specification.

The drawings were also found to be consistent with LAW Facility system block diagrams (SBD) with respect to controller designations, room locations, and network segment identification.

Also as verified by observation, FF and PB segment identification is unique to each segment and is listed and controlled within a database established and maintained by the Contractor.

A2 – System Block Diagrams

The main purpose for SBDs is to provide information to the Contractor's Electrical and Control and Instrumentation (C&I) design groups. SBDs conceptualize the control system configuration. They identify required equipment, controllers, remote input/output (I/O) assemblies, field tagged devices, panels, cabinets, instrument racks, junction boxes, FF spurblocks, instrument jumpers, cabling and tubing routings.

SBDs are developed in accordance with design guide, 24590-WTP-GPG-J-006, *System Block Diagrams.* The SBDs listed in Table C-4 were evaluated against criteria in the design guide and found to be consistent with required content and format.

The SBD design guide also provides a listing of required cable types. The cabling designations shown on the SBDs were consistent with those listed in the guide. In the cases observed, cables were shielded in compliance with BOD requirement 27 as listed in Appendix B. Cable types are also stipulated in 24590-WTP-3PS-JQ07-T0001, *Engineering Specification for Instrumentation for Package Systems*, which is consistent with the SBD guide.

SBDs are developed from plant system piping and instrumentation diagrams (P&ID), ventilation and instrument diagrams (V&ID) and mechanical handling drawings (MHD). Many of the SBDs were checked against associated system P&IDs and were found to be consistent.

Since SBDs also indicate room locations for various equipment elements, major components such as racks, enclosures, spurblocks and junction boxes were checked against associated instrument location plans (Table C-9) and found to be consistent.

As observed from the process control SBDs, primary elements are located on or near process vessels and the associated transmitters are in nearby rooms (also checked against instrument location drawings). Radar tubes are used for level monitoring and pneumatic lines are used for density and pressure measurements, which have their respective signal lines connected to transmitters located in rooms near the process vessels. This indicates that instruments are generally located as close to the point of measurement as is practical, demonstrating compliance to BOD requirement 21 as listed in Appendix B.

As verified, the SBDs indicate that FF and PB cabling is used throughout the instrumentation and control (I&C) hardware layout. FF cabling interconnections are through spurblocks, which are identified on the SBDs. These observations verify compliance to BOD requirements 12 and 26 in Appendix B. Also, since many of the instruments depicted on the SBDs are analog devices that are connected via FF cabling, the analog signals transmitted are therefore by fieldbus in compliance with BOD requirement 23 in Appendix B.

As verified, the SBDs show the cabling between instruments located on racks and interface control equipment located within controller enclosures, linking device enclosures, and remote I/O enclosures. This is in compliance to BOD requirement 22 in Appendix B.

The SBDs indicate fiber optic cabling to enclosures that make up the Facility Network Infrastructure System (FNJ) in compliance with BOD requirement 25 in Appendix B.

The SBDs were also checked against several uninterruptible power equipment (UPE) panel schedules (Table C-11) to verify that enclosures listed on the SBDs were provided uninterruptible power. For the LAW I&C enclosures assessed, 120 V power is in fact provided from UPE panels, compliant with BOD requirement 28 in Appendix B.

Review of Programmable Protection System (PPJ) SBDs

Important-to-safety (ITS) UPE power was also verified as being provided to PPJ enclosures shown on PPJ SBDs as compared with uninterruptible power supply (UPS) panel schedules. As verified from ITS UPE single line drawings (Table C-11), UPS power supplied to safety instrumented systems in the LAW Facility is separate and independent from power provided to normal plant control systems. This is in compliance with BOD requirement 29 in Appendix B.

SBDs (59 through 68 in Table C-4) for the PPJ were briefly reviewed against BOD and SRD requirements. A few observations were noted as explained below.

As generally observed from the referenced drawings, ITS temperature, pressure, and level monitoring devices are provided in the LAW Primary Offgas Process System (LOP), LAW Secondary Offgas/Vessel Vent Process System (LVP), and LAW Melter Feed Process System (LFP) to monitor and sense process parameters. Transmitters provide signaling to dedicated PPJ controllers. ITS valves receive control and actuation from the controller enclosures. While software was not observed, it is evident that safety instrumented hardware is provided. These observations indicate compliance to SRD requirements 41 and 42 as listed in Appendix B of this report.

With respect to drawing 24590-LAW-J1-PPJ-00001:

- The ITS on/off valve, YV-1008, is provided a control signal from PPJ enclosure (00015) through the current/pneumatic (I/P) converter device, YY-1008B, and a monitoring signal is provided back to the ICN through the P/I device, YY-1008A, to a PCJ remote I/O enclosure (shown on 24590-LAW-J1-LOP-00001). Independence of circuits is evident since electrical signals for PCJ monitoring extend from YY1008A to LOP-JB-02068 then to PCJ-RIO-2008. Whereas PPJ control signals extend from PPJ-ENCL-00015 through PPJ-JB-00006 to YY1008B then to the valve. This scheme indicates that the ITS valve status is monitored by the ICN without affecting the actual operation or control of the ITS valve. A similar arrangement is also shown for ITS valves, YV-2008, YV-1140, and YV-2140. Since these valves are associated with the LOP, the referenced PPJ SBD refers to the associated LOP SBDs.

Flow control valves 1129 and 2129 are completely independent and provisions are not planned for PCJ monitoring.

These few cases indicate the following:

- The ITS valves are independent and isolated from the normal control system (the ICN) even though in some cases monitoring is provided to the ICN.
- The valves are dedicated to the PPJ. This is indicated by the line type shown on the drawings as well as by the identified cabling.
- PPJ control is provided through dedicated cables to the valves by logic controllers that are housed in dedicated PPJ enclosures.

These observations demonstrate compliance to BOD requirements 33 through 36 as listed in Appendix B.

While SBDs are not required documents for the Waste Treatment and Immobilization Plant (WTP) design, they are an industry-accepted practice and provide a very effective means for communicating plant control system information. The listed SBDs meet requirements and adequately serve their intended purpose.

During interviews with Contractor engineering personnel, it was communicated that while SBDs have been very effective in advancing the I&C design, they have been more costly than originally estimated in terms of development and configuration management. The Contractor does not plan to maintain the configuration of SBDs after the design has been completed, unlike other contract-required documents (i.e., P&IDs). Consequently, valuable design configuration information could be lost. It is recommended that U.S. Department of Energy (DOE) look carefully at the value of SBDs with respect to facility turnover as these drawings may prove beneficial for WTP configuration management. See Recommendations in Section 5.0 of this report.

A3 – Equipment Datasheets

The Contractor uses a standardized methodology for outlaying control system interface equipment. This methodology incorporates equipment datasheets for control system interface components and typical general arrangement drawings for enclosures and racks. The enclosures and racks contain the equipment listed on the equipment datasheets. Equipment datasheets for the different enclosures and racks are listed in Table C-6 and enclosure and rack general arrangement drawings are listed in Table C-7.

Key features of the equipment datasheets were verified as follows:

- Each datasheet references typical control system interface equipment components consistent with the employment of standardized hardware and a common control system platform. This complies with BOD requirements 10 and 11 as listed in Appendix B. This equipment is also consistent with components listed in 24590-WTP-3PS-JD01-T0001, *Engineering Specification for Plant Wide Control Systems (Integrated Control Network)* and especially in the Guide: *Control Systems Interfaces*.
- Each datasheet references the quantities of control system components and the typical enclosure general arrangement drawing(s) by which the equipment is to be installed.
- The datasheets clearly call out devices that are Foundation Fieldbus components (linking devices for H1 segments) and Profibus components (I/O modules), demonstrating compliance with BOD requirement 12 in Appendix B.
- As is evident from the number of rack datasheets reviewed and the rack installation drawings, instrument transmitters are mostly located on racks in compliance with BOD requirement 30 in Appendix B.

Rack Datasheets indicate the following:

- Unique rack identification number
- Lists equipment tag numbers identifying instruments (mainly transmitters and FF valves) FF spurblocks, and junction boxes
- Refers to standard rack drawings and details specifying the rack position for the instrument and the installation details
- Refers to the instrument datasheet where instrument requirements are provided
- Identifies quality level and seismic category or each instrument
- Identifies other drawings for wiring details

The datasheets for the different enclosures include the following information:

- Unique enclosure identification number
- Specifies National Electrical Manufacturers Association (NEMA) 12 type enclosure
- Identifies quality level and seismic category for the enclosure
- Environmental temperature range

RIO Enclosure Datasheets indicate the following:

- Lists the quantities and types of modules for discrete and analog I/O points
- Specifies module position within the enclosure and the wiring detail referenced to a standard drawing
- Identifies unique identification for associated fiber optic converters

Controller Enclosure Datasheets indicate the following:

- Identifies the controller type
- Identifies communication modules, quantity and type (FF and PB typically)
- Identifies the communication segment
- Identifies fiber optic converters
- Identifies FF linking devices
- Refers to the typical enclosure drawing by which the devices are to be installed.

Linking Device Enclosure Datasheets indicate the following:

- Identifies the linking device modules and the FF segments associated with each module
- Identifies segment
- Identifies fiber optic converters
- Refers to the typical enclosure drawing by which the devices are to be installed.

As verified, equipment datasheets appear to be useful for procurement and installation, and are consistent with requirements and specifications.

No findings or follow-up items were identified regarding equipment datasheets.

A4 – Equipment Installation Drawings

Detailed general arrangement drawings provide specific direction and requirements for installation of equipment and instruments within enclosures and racks. The general arrangement drawings particularly for racks also reference standard instrument mounting details.

Three general types of enclosure drawings were reviewed in this assessment. These include drawings for controller enclosures, remote I/O (RIO) enclosures, and FF linking device enclosures. The various types of equipment/components and their typical general layout are depicted on the general arrangement drawings.

The equipment installation drawings reviewed in this assessment are listed in Table C-7. The drawings are also necessarily referenced on associated equipment datasheets.

As reviewed and verified, the enclosure general arrangement drawings provide appropriate hardware layout details for controller enclosures, FF linking device enclosures, and RIO enclosures. The drawings are standardized for configuration control, uniformity for equipment installation, and equipment commonality. The drawings include typical material listings that identify controllers, interface modules, power supplies, I/O modules, FF linking devices, Ethernet switches, fiber optic equipment and other support devices. The listed equipment is consistent with specifications and guides listed as references 1, 5, 7, 8, 16, and 18 in Table C-8. The referenced specifications provide system equipment requirements and the referenced guides provide details specific to system components.

In order to meet the requirements in the referenced specifications and guides, the Contractor has selected the Asea Brown Bavari (ABB) Industrial^{IT} control system as the primary control platform for the WTP Project. The design guides provide details concerning the components that make up the ABB platform. As verified, the equipment identified in the material listings of the enclosure drawings is consistent with the design guides and with typical ABB system hardware components.

As verified, the interface control equipment includes standard devices that form a part of ABB's AC800M controller and S800 I/O series of modules and components. This use of standardized component hardware on a common control system platform meets BOD requirements 10 and 11 as listed in Appendix B.

The material lists identify interface devices to communicate with FF and PB instrumentation, consistent with BOD requirement 12.

As verified from RIO enclosure drawings and from specific vendor literature (not identified in the references), the S800 series of I/O module equipment complies with requirements as follows and is based on vendor data obtained for I/O as listed below.

The analog devices accommodate 4-20 mA signals consistent with BOD requirement 23 in Appendix B. The units also accommodate at least 12 bits of resolution (~.024% of 16 mA span) and are capable of driving resistive loads up to and exceeding 600 ohms. Moreover, the units are short circuit proof. These latter features reveal compliance to detailed requirements in 24590-WTP-3PS-JD01-T0001, *Engineering Specification for Plant Wide Control Systems (Integrated Control Network).*

Discrete I/O signals are 24 V dc Consistent with BOD requirement 24 in Appendix B.

I/O Device Type	ABB#	Features (from ABB specifications)
Analog Input Module	AI810	8 channels, single-ended, 0(4)-20mA, 0(2)-10V, 12 bits
Analog Input Module	AI820	Differential Inputs, 4 channels, 0(1)-5V, ±0(2)-10V, ±0(4)-20mA, 12 bits + sign
Digital Input Module	DI810	16 channels, 2 groups of 8 channels, 24V, current sink
Analog Output Module	AO810	8 channels, common return, 0(4)-20mA, 14 bits, 859Ω load (short-circuit proof)
Analog Output Module	AO820	Isolated output, 4 channels, separate returns, measuring range: ±0(2)-10V, ±0(4)-20mA, resolution :12 bits + sign, load: ≤500ohms (current) or ≥2kΩ (voltage), short circuit proof
Digital Output Module	DO810	16 channels, 2 groups of 8 channels, 24V, max 0.5A dc, transistor, current source, short-circuit-proof
Digital Output Module	DO820	8 channels, separate returns, 5-250V, max 3A ac/dc, relay (NO)
Incremental Pulse Counter Module	DP820	2 channels, separate returns, 0.25Hz-1.5MHz, signal voltage: 5 or 24V dc

The enclosure general arrangement drawings also show enclosures to be steel, NEMA 12 rated. This is consistent with requirements identified particularly in the enclosure specifications.

A brief review of rack general arrangement drawings indicates consistency between equipment datasheets and instrument installation details. With respect to the volume and varied types of instruments, these drawings appear to be very necessary for uniform/standardized equipment outfitting by vendors and rack fabricators.

No findings or follow-up items were identified regarding equipment installation drawings.

A5 – Instrument Valves

Specifications

In terms of high-level requirements, the contract documents say relatively little concerning valve requirements. The BOD calls out valve-specific industry standards such as American National Standards Institute/Instrument Society of America (ANSI/ISA) S75, *Series On Control Valves*, yet specific application of these standards is not discussed. Chapter 15 of 24590-WTP-GPG-J-014, *Control Systems Design Process Guide,* discusses the types of valves and actuators to be used in the WTP design. The guide also points to several specifications dealing with valves and actuators. These are listed as references 9 through 14 in Appendix C, Table C-8, and cover control valves, on/off instrument valves, high-temperature offgas service valves, and actuators for on/off valves.

Brief review of the standards yielded the following observations:

- The specifications are written to cover requirements for quality level and commercial grade procurements.

- Specifications for ITS valves and actuators are labeled as "QL" documents and include Institute of Electrical and Electronics Engineers (IEEE) Standard 323, for qualifying the equipment.
- The ANSI/ISA S75, *Series On Control Valves*, are employed in the control valve specifications.
- The specifications appear to implement appropriate industry standards in terms of type and application. Several of the standards are among those listed in the BOD.
- The specifications require provisions for FF communications.
- As reviewed against the valve and actuator discussion in 24590-WTP-GPG-J-014, *Control Systems Design Process Guide*, the specifications appear to be consistent particularly in regard to control features, fail safe state, and specifying other support components such as position switches for valve position feedback and airsets for valve control and actuation.

Calculations

Calculations for instrument control valves are performed to determine appropriate control valve style, body size, and trim size for the control valves. This review verified that a calculation is performed for each control valve. Based on review of the Contractor's documentation, the following general observations were made:

- The calculations utilize the sizing method per ANSI/ISA-75.01.01-2002, *Flow Equations for Sizing Control Valves*.
- Each calculation uses one of three software routines depending on the type of process fluid it will control:
  - "Valve Sizing – Liquid Service." This routine has been verified and validated according to 24590-WTP-VV-ENG-03-001, *Control Valve Sizing for Liquid Service –QAS Routine.*
  - "Valve Sizing – Gas Service." This routine has been verified and validated according to 24590-WTP-VV-ENG-03-002, *Control Valve Sizing for Gas Service –QAS Routine.*
  - "Valve Sizing – Steam Service." This routine has been verified and validated according to 24590-WTP-VV-ENG-03-003, *Control Valve Sizing for Steam Service – QAS Routine.*

These software routines and the verification and validation (V&V) documents are listed in Table C-8.

- The control valve calculation software routines were also verified as residing under configuration management control according to software quality assurance requirements and procedures.
- The calculations are driven by, and are consistent with, BNI design procedure, 24590-WTP-3DP-G04B-00037, *Engineering Calculations*, and guide, 24590-WTP-GPG-J-016, *Control Valve Sizing*.

- The calculations include appropriate data tables to support the sizing results and conclusions.

No findings or follow-up items were identified regarding valve and actuator specifications and calculations.

A6 – Instrument Database (INtools)

The Contractor manages and maintains an instrument database through the *INtools Database*. According to the project guide/instruction 24590-WTP-GPG-J-018, *INtools Database,* INtools is a software tool that the Contractor's C&I group uses to collect, organize, and manage the data necessary to support the I&C work processes for the WTP Project. INtools contains a record for every instrument tag, component number, and instrument cable number used on the project as well as other information. The data within INtools is used to generate instrument index reports for project personnel and datasheets to support procurement activities.

Sample pages of an index report were reviewed and the information in the data fields was consistent with instrument datasheets and referenced P&IDs. In addition, the index report provides location information for each instrument.

This instrument index complies with Contact requirement 8 as listed in Appendix B).

No findings or follow-up items were identified with respect to the Contractor's instrument database.

A7 – Instrument Datasheets

Instrument datasheets are composed from standardized forms. This ensures that consistent information is provided for each instrument type. According to interviews, the WTP forms are based upon template forms provided by standard, ISA 20, *Specific Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.* The ISA forms have been modified to suit the WTP Project data needs. A few examples are as follows: Form 1 is specific to control valves with fieldbus interface; Form 85 is specific to radar level transmitters for fieldbus interface; Form 129 is for actuated on/off valves with Foundation Fieldbus interface, and so on. Form 132 is for actuated on/off valves (non-fieldbus) and is very similar to ISA Form S20-50 of the referenced standard. Form numbers are included in Table C-5.

The instrument datasheets were verified that they met Contract requirements 2 through 5 as listed in Appendix B.

The datasheets also include fields that provide safety classification and quality level information, complying with BOD requirement 9 in Appendix B.

The datasheets indicate a standardized approach for instrument types; complying with BOD requirement 10 in Appendix B. For example the same Foxboro model of temperature transmitter (Form 50) devices are used in the LCP, LOP, and LVP. This is similarly true for pressure transmitters (Form 49).

The datasheets also indicate utilization of typical equipment on a common I&C platform, namely FF; complying with BOD requirements 11 and 12 in Appendix B.

Based on the sampled datasheets reviewed for flow measurement, the techniques employed are consistent with those listed in the BOD, complying with requirement 16 in Appendix B.

Based on the sampled datasheets reviewed for level measurement, radar level detection is consistent with the level measurement techniques listed in the BOD, complying with requirement 17 in Appendix B.

Based on the datasheets reviewed for pressure measurement, the techniques employed are consistent with those listed in the BOD, complying with requirement 18 in Appendix B.

Based on review of the datasheets for temperature measurement, 100 ohm platinum resistance temperature devices (RTD) are used and temperature transmitters utilize fieldbus technology; complying with BOD requirement 19 in Appendix B.

Density measurement, based on review of Form 164 datasheets, is by means of strain gauges (for hydrostatic head) and differential pressure transmitters. This methodology is consistent with techniques in the BOD, complying with requirement 20 in Appendix B.

No findings or follow-up items were identified with respect to instrument datasheets.

A8 – Instrument Location Plans

As verified by the instrument location drawings and general arrangement drawings listed in Table C-9, instruments associated with the focus systems for this assessment are located within R5/C5 spaces, R3/C3 spaces, and non-radiation spaces. Instruments in R5/C5 spaces, (primarily process vessel cells) appear to be minimal, generally involving primary sensing elements and valves required at the process vessels. Transmitters, instrument racks, enclosures, and panels are not installed in R5/C5 areas. This is altogether in keeping with the control design objective to minimize instrument installed in areas of high radiation and/or contamination as stated in 24590-WTP-GPG-J-014, *Control Systems Design Process Guide*. This also complies with BOD (and *Operations Requirements Document* [ORD]) requirement 13 as listed in Appendix B.

Based on review of the drawings, instruments, mainly transmitters and valves, are largely located on racks (or bulges), and appear to be in suitable areas (environmentally) within a large space for safe and convenient access from main level floors. Also as reviewed from rack instrument installation drawings, transmitters are positioned on racks with good line of site and access. Standalone transmitters also appear to be located in open areas, with convenient access. Based on these observations, ORD requirements 31 and 37 appear to be met with respect to the LAW Facility instrumentation for process systems.

No findings or follow-up items were identified with respect to instrument location.

Appendix B. HIGH LEVEL REQUIREMENTS MATRIX

#	Requirement	Reference	Met	Verification
1	Do selected System Descriptions (SD) include sufficient references to plant P&IDs and Process Datasheets?	Contract, Std. 3, (c)(1)	Yes	Section 10 (*Applicable Documents*) of the SDs (listed in Table C-1) were observed and referenced P&IDs or MHDs and Process Datasheets were verified. Also, see discussion under LOI #3.
2	Do sampled datasheets include equipment or instrument identification numbers?	Contract, Std. 3, (c)(2) and (c)(3)	Yes	The instrument datasheets listed in Table C-4 were reviewed. Each datasheet is labeled with specific identification numbers. See general discussion under LOI #3 and the Instrument Datasheets Document Review Summary (A7) in Appendix A.
3	Do sampled datasheets include equipment/instrument name and/or description?	Contract, Std. 3, (c)(2) and (c)(3)	Yes	The instrument datasheets listed in Table C-5 were reviewed. Each datasheet is specific to one instrument and provides a name and description. See Instrument Datasheets Document Review Summary (A7) in Appendix A.
4	Do sampled datasheets for equipment/instrument reference the P&ID where the equipment or instrument is shown?	Contract, Std. 3, (c)(2) and (c)(3)	Yes	The instrument datasheets listed in Table C-5 were reviewed. The datasheets reference the P&ID where the instrument is used and P&IDs were also checked. See general discussion under LOI #3 and the Instrument Datasheets Document Review Summary (A7) in Appendix A.
5	Do sample datasheets provide capacity and operation parameters and materials of construction?	Contract, Std. 3, (c)(2)	Yes	The instrument datasheets listed in Table C-5 were reviewed. The datasheets are standardized and include data fields where operation and capacity parameters and materials of construction are presented. See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
6	Do calculations for control valve sizing provide the appropriate technical basis?	Contract, Std. 3, (c)(4)	Yes	The control valve calculations listed in Table C-8 were reviewed. The calculations follow a standardized process that defines input information, calculation methodology, and verifiable results. See Instrument Valves Document Review Summary (A5) in Appendix A.

#	Requirement	Reference	Met	Verification
7	Do P&IDs identify appropriate instrument requirements and simplified control system information?	Contract, Std. 3, (c)(10)	Yes	The P&IDs listed in Table C-2 were reviewed and adequately indicate the instruments required for process monitoring and control.
8	Does the suite of Instrument and Control (I&C) documents provided for the LAW design include control system specifications, datasheets, and instrument databases?	Contract, Std. 3, (c)(11)	Yes	See general discussion under LOI #2. Specifications are listed in Table C-8, Datasheets are listed in Tables C-5 and C-7, and INtools is the Contractor's instrument database.
9	Do the I&C documents include features that address process safety and process control for product quality?	Contract, Std 3, (c)(11)	Yes	See general discussion under LOI #2. The datasheets listed Tables C-5 and C-7 in particular identify required safety and quality features.
10	Does the LAW I&C design employ standardized hardware?	BOD 9.2	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A3, A4, and A6.
11	Is the LAW Facility instrumentation and controller hardware specified to a common platform to the extent practicable?	BOD 9.2.1	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A3, A4, and A6.
12	Does the I&C design for the LAW Facility utilize Foundation Fieldbus (FF) and Profibus DP industrial network technologies to the extent practical?	BOD 9.4.1	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A1, A2, A3 and A4.
13	Does the I&C design for the LAW Facility appear to minimize the number of instruments installed in R5/C5 areas?	BOD 9.4.2 ORD 11.16	Yes	See the Instrument Location Drawings Document Review Summary (A8) in Appendix A.
14	Where instruments are located in R3/C3 areas of the LAW facility, were as low as reasonably achievable (ALARA) requirements considered and are components designed for decontamination?	BOD 9.4.2	NA	This requirement was not evaluated in this assessment.
15	Where final control elements are located in active areas within the LAW Facility, were the elements designed to allow removal for maintenance?	BOD 9.4.2	NA	Not evaluated in this assessment.
16	Is flow measurement within the LAW Facility implemented by appropriate techniques?	BOD 9.4.3	Yes	See the Instrument Datasheets Document Review Summary (A7) in Appendix A.

#	Requirement	Reference	Met	Verification
17	Is Level measurement within the LAW Facility implemented by listed techniques?	BOD 9.4.4	Yes	See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
18	Is pressure measurement by means of electronic pressure and DP transmitters with consideration to radiation environment?	BOD 9.4.5	Yes	See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
19	Is temperature measurement within the LAW Facility by means of either Resistance Temperature Detectors (100 ohm platinum) or thermocouples (the latter for high temperature applications) with 2-wire (4-20mA) or fieldbus transmitters?	BOD 9.4.6	Yes	See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
20	Is density measurement with the LAW Facility implemented by listed techniques?	BOD 9.4.7	Yes	See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
21	Are transmitters, transducers, and process switches within the LAW Facility located as close to the point of measurement as can be achieved (to extent practicable)?	BOD 9.5.1	Yes	See the Instrument Location Drawing Document Review Summary (A8) in Appendix A.
22	Is interface control equipment located in suitable enclosures, panels, or racks as listed?	BOD 9.5.1	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
23	Are analog transmission signals within the LAW Facility mainly by Fieldbus except in some cases where 4-20 mA current signals have to be utilized?	BOD 9.5.3.1	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A2 and A4.
24	Are discrete I/O signals 24 V DC and are actuation signals to valves with limit switches by means of Fieldbus or remote I/O equipment?	BOD 9.5.3.2	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A3 and A4.
25	For data highways within the LAW Facility are fiber-optic systems used where practical?	BOD 9.5.3.3	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
26	Does the LAW I&C design use Foundation Fieldbus and Profibus DP communication cable to the extent practical?	BOD 9.5.3.4	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.

#	Requirement	Reference	Met	Verification
27	Are all signal cables within the LAW I&C design shielded with their shields connected to ground at the panel end only?	BOD 9.5.3.4	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
28	Are the ICN control systems within the LAW Facility powered from 120 V UPS systems?	BOD 9.5.4	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
29	Are power supply systems for Safety Instrumented Systems (SIS) within the LAW Facility separate from power supplies for the normal power control instrumentation?	BOD 9.5.4	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
30	Are instrument transmitters within the LAW I&C system located on racks to the extent practical?	BOD 9.5.6	Yes	Remarks pertaining to meeting this requirement are provided in the following Document Review Summaries in Appendix A: A3 and A4.
31	Are transmitters and instrument racks within the LAW Facility located in suitable areas with appropriate access for maintenance?	BOD 9.5.6	Yes	See the Instrument Location Drawings Document Review Summary (A8) in Appendix A.
32	Is the instrumentation within the LAW Facility appropriately managed and maintained in a database?	BOD 9.8	Yes	See the Instrument Database (INtools) Document Review Summary (A6) in Appendix A.
33	Are SISs within the LAW I&C design independent and isolated from the normal control system except for providing status information?	BOD 9.10	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
34	Do SISs with the LAW design have dedicated sensors and final control elements?	BOD 9.10	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
35	Do SISs with the LAW design have dedicated processing and logic circuitry housed in dedicated enclosures?	BOD 9.10	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
36	Do SISs within the LAW Facility have dedicated cabling?	BOD 9.10	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
37	Are instruments in the LAW Facility positioned to give clear line of sight and safe accessibility?	ORD 11.16	Yes	See the Instrument Location Drawings Document Review Summary (A8) in Appendix A.

#	Requirement	Reference	Met	Verification
38	Are temperature elements in the LAW Facility installed in thermowells?	ORD 11.16	Yes	This is verified from Instrument Datasheets. See the Instrument Datasheets Document Review Summary (A7) in Appendix A.
39	Are valves in the LAW Facility positioned to allow access from the floor or permanent platform?	ORD 11.16	Yes	See the Instrument Location Drawings Document Review Summary (A8) in Appendix A.
40	Are instrument valves in the LAW Facility uniquely identified?	ORD 11.16	Yes	This is verified from Instrument Datasheets. See the Instrument Datasheets Document Review Summary (A7) in Appendix A.A7
41	Does the LAW I&C design employ equipment to sense accident conditions and to initiate the operation of Important to Safety (ITS) systems and components?	SRD Vol. II SC 4.3-1	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.
42	Does the LAW I&C design provide ITS equipment to monitor variables, control systems and components?	SRD Vol. II SC 4.3-4	Yes	See the System Block Diagram Document Review Summary (A2) in Appendix A.

Appendix C. Document Reference Tables

Table C-1. System Descriptions

#	Document Number	Document Title
1	24590-LAW-3YD-LCP-00001	SYSTEM DESCRIPTION FOR LAW CONCENTRATE RECEIPT PROCESS (LCP)
2	24590-LAW-3YD-LFH-00001	SYSTEM DESCRIPTION FOR LFH - LAW CONTAINER FINISHING HANDLING SYSTEM
3	24590-LAW-3YD-LFP-00001	SYSTEM DESCRIPTION FOR LOW-ACTIVITY WASTE MELTER FEED PROCESS SYSTEM (LFP)
4	24590-LAW-3YD-LMP-00001	SYSTEM DESCRIPTION FOR LAW MELTER PROCESS SYSTEM (LMP)
5	24590-LAW-3YD-LOP-00001	SYSTEM DESCRIPTION FOR LAW PRIMARY OFFGAS PROCESS (LOP) AND LAW SECONDARY OFFGAS/VESSEL VENT PROCESS (LVP) SYSTEMS
6	24590-LAW-3YD-LPH-00001	SYSTEM DESCRIPTION FOR LAW SYSTEM LPH CONTAINER POUR HANDLING SYSTEM
7	24590-LAW-3YD-LRH-00002	SYSTEM DESCRIPTION FOR CONTAINER RECEIPT HANDLING SYSTEM
8	24590-WTP-3YD-PPJ-00001	SYSTEM DESCRIPTION FOR PROGRAMMABLE PROTECTION SYSTEMS (PPJ)

Table C-2. Piping and Instrument Drawings

#	Document Number	Document Title
1	24590-LAW-M6-LCP-00001	P&ID - LAW CONCENTRATE RECEIPT PROCESS SYSTEM CONCENTRATE RECEIPT VESSEL LCP-VSL-00001
2	24590-LAW-M6-LCP-00002	P & ID - LAW CONCENTRATE RECEIPT PROCESS SYSTEM CONCENTRATE RECEIPT VESSEL LCP- VSL-00002
3	24590-LAW-M6-LFP-00001	P&ID-LAW MELTER FEED PROCESS SYSTEM MELTER 1 FEED PREPARATION AND FEED
4	24590-LAW-M6-LFP-00002	P & ID - LAW MELTER FEED PROCESS SYSTEM MELTER 1 ADS PUMPS
5	24590-LAW-M6-LFP-00003	P&ID-LAW MELTER FEED PROCESS SYSTEM MELTER 2 FEED PREPARATION AND FEED
6	24590-LAW-M6-LFP-00004	P & ID - LAW MELTER FEED PROCESS SYSTEM MELTER 2 ADS PUMPS
7	24590-LAW-M6-LFP-00007	P&ID - LAW MELTER FEED PROCESS SYSTEM ADS PUMP AND CONTROL RACK DETAILS MELTER 1
8	24590-LAW-M6-LFP-00008	P&ID - LAW MELTER FEED PROCESS SYSTEM ADS PUMP AND CONTROL RACK DETAILS MELTER 2
9	24590-LAW-M6-LMP-00001	P&ID-LAW MELTER PROCESS SYSTEM MELTER 1 AGITATION-ZONE 1 & ZONE 2
10	24590-LAW-M6-LMP-00002	P & ID - LAW MELTER PROCESS SYSTEM MELTER 1 AGITATION ZONE 3 & LEVEL DETECTION SYSTEM
12	24590-LAW-M6-LMP-00003	P&ID - LAW MELTER PROCESS SYSTEM MELTER 1 WALLS AND FLOOR PANELS COOLING SYSTEM

Table C-2. Piping and Instrument Drawings

#	Document Number	Document Title
13	24590-LAW-M6-LMP-00004	P&ID - LAW MELTER PROCESS SYSTEM MELTER 1 & 2 START-UP HEATERS
14	24590-LAW-M6-LMP-00008	P&ID - LAW MELTER PROCESS SYSTEM MELTER 1 DISCHARGE HEATERS, POWER CONTROLS (1-4) & AIR LIFT - EASTSIDE
15	24590-LAW-M6-LMP-00010	P&ID - LAW MELTER PROCESS SYSTEM MELTER 1 DISCHARGE HEATERS, POWER CONTROLS (1-4) & AIR LIFT - WESTSIDE
16	24590-LAW-M6-LMP-00032	P&ID-LAW MELTER PROCESS SYSTEM MELTER 2 AGITATION ZONE 3 & LEVEL DETECTION SYSTEM
17	24590-LAW-M6-LMP-00037	P&ID-LAW MELTER PROCESS SYSTEM MELTER 2 GLASS POURING AND MONITORING INSTRUMENTATION
18	24590-LAW-M6-LMP-00038	P&ID - LAW MELTER PROCESS SYSTEM MELTER 2 DISCHARGE HEATERS, POWER CONTROLS (1-4) & AIR LIFT - EASTSIDE
19	24590-LAW-M6-LMP-00040	P&ID - LAW MELTER PROCESS SYSTEM MELTER 2 DISCHARGE HEATERS, POWER CONTROLS (1-4) & AIR LIFT - WESTSIDE
20	24590-LAW-M6-LOP-00001	P&ID - LAW PRIMARY OFFGAS PROCESS SYSTEM MELTER 1
21	24590-LAW-M6-LOP-00002	P&ID-LAW PRIMARY OFFGAS PROCESS SYSTEM MELTER 2
22	24590-LAW-M6-LOP-00004	P&ID - LAW PRIMARY OFFGAS PROCESS SYSTEM MELTER 1 OFFGAS FILM COOLERS
23	24590-LAW-M6-LOP-00005	P&ID - LAW PRIMARY OFFGAS PROCESS SYSTEM MELTER 2 OFFGAS FILM COOLERS
24	24590-LAW-M6-LVP-00001	P&ID-LAW SECONDARY OFFGAS/VESSEL VENT PROCESS SYSTEM MELTERS SECONDARY OFFGAS
25	24590-LAW-M6-LVP-00002	P&ID - LAW SECONDARY OFFGAS/VESSEL VENT PROCESS SYSTEM AND STACK DISCHARGE MONITORING SYSTEM
26	24590-LAW-M6-LVP-00003	P&ID - LAW SECONDARY OFFGAS /VESSEL VENT PROCESS SYSTEM EQUIPMENT VENTS
27	24590-LAW-M6-LVP-00004	P&ID - LAW MELTERS SECONDARY OFFGAS VESSEL VENT PROCESS SYSTEM MERCURY MITIGATION EQUIPMENT
28	24590-LAW-M6-LVP-00005	P&ID-LAW MELTERS SECONDARY OFFGAS VESSEL VENT PROCESS SYSTEM SCR, VOC & AMMONIA DILUTION PACKAGES

Table C-3. Mechanical Handling Diagrams

#	Document Number	Document Title
1	24590-LAW-M7-LFH-00001001	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM FINISHING HANDLING SYSTEM
2	24590-LAW-M7-LFH-00001004	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM SOUTH LIDDING STATION
3	24590-LAW-M7-LFH-00001005	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM SOUTH DECONTAMINATION STATION
4	24590-LAW-M7-LFH-00001008	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM NORTH SAMPLING AND INERT FILL
5	24590-LAW-M7-LFH-00001012	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM NORTH EXPORT / MONITOR STATION
6	24590-LAW-M7-LFH-00001013	LAW VITRIFICATION SYSTEM LFH MECHANICAL HANDLING DIAGRAM LINE TRANSFER STATION

Table C-3. Mechanical Handling Diagrams

#	Document Number	Document Title
7	24590-LAW-M7-LPH-00001001	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
8	24590-LAW-M7-LPH-00001003	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
9	24590-LAW-M7-LPH-00001006	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
10	24590-LAW-M7-LPH-00001009	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
11	24590-LAW-M7-LPH-00001013	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
12	24590-LAW-M7-LPH-00001018	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
13	24590-LAW-M7-LPH-00001022	LAW VITRIFICATION SYSTEM LPH MECHANICAL HANDLING DIAGRAM CONTAINER POUR HANDLING SYSTEM
14	24590-LAW-M7-LRH-00001001	LAW VITRIFICATION SYSTEM LRH MECHANICAL HANDLING DIAGRAM CONTAINER RECEIPT HANDLING SYSTEM
15	24590-LAW-M7-LRH-00001002	LAW VITRIFICATION SYSTEM LRH MECHANICAL HANDLING DIAGRAM CONTAINER RECEIPT HANDLING SYSTEM
16	24590-LAW-M7-LRH-00001003	LAW VITRIFICATION SYSTEM LRH MECHANICAL HANDLING DIAGRAM CONTAINER RECEIPT HANDLING SYSTEM
17	24590-LAW-M7-LRH-00001004	LAW VITRIFICATION SYSTEM LRH MECHANICAL HANDLING DIAGRAM COMPONENT IDENTIFICATION TABULATION

Table C-4. System Block Diagrams & Control System Architecture Diagrams

#	Document Number	Document Title
1	24590-LAW-J1-LCP-00001	LAW VITRIFICATION SYSTEM LCP SYSTEM BLOCK DIAGRAM CONCENTRATE RECEIPT VESSEL LCP-VSL-00001 EL 3'-0" & 28'-0"
2	24590-LAW-J1-LCP-00002	LAW VITRIFICATION SYSTEM BLOCK DIAGRAM CONCENTRATE RECEIPT VESSEL LCP-VSL-00002 EL 3'-0" & 28'-0"
3	24590-LAW-J1-LFH-00005	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
4	24590-LAW-J1-LFH-00009	CANCELLED - LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM FIXATIVE STATION
5	24590-LAW-J1-LFH-00018	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
6	24590-LAW-J1-LFH-00019	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
7	24590-LAW-J1-LFH-00020	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
8	24590-LAW-J1-LFH-00021	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
9	24590-LAW-J1-LFH-00022	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM

Table C-4. System Block Diagrams & Control System Architecture Diagrams

#	Document Number	Document Title
10	24590-LAW-J1-LFH-00023	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
11	24590-LAW-J1-LFH-00024	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
12	24590-LAW-J1-LFH-00025	LAW VITRIFICATION MH SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISH HANDLING SYSTEM
13	24590-LAW-J1-LFH-00050	LAW VITRIFICATION SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISHING HANDLING SYSTEM INERT FILL HOPPER 1
14	24590-LAW-J1-LFH-00051	LAW VITRIFICATION SYSTEM LFH SYSTEM BLOCK DIAGRAM CONTAINER FINISHING HANDLING SYSTEM INERT FILL HOPPER 2
15	24590-LAW-J1-LFP-00001	LAW VITRIFICATION SYSTEM LFP SYSTEM BLOCK DIAGRAM FEED PREP AND FEED VESSEL LFP-VSL-00001/00002
16	24590-LAW-J1-LFP-00002	LAW VITRIFICATION SYSTEM LFP SYSTEM BLOCK DIAGRAM FEED PREP AND FEED VESSEL LFP-VSL-00003/00004
17	24590-LAW-J1-LFP-00004	LAW VITRIFICATION SYSTEM LFP SYSTEM BLOCK DIAGRAM MELTER 1 FEED 1 ADS PUMPS LFP-VSL-00002
18	24590-LAW-J1-LFP-00005	LAW VITRIFICATION SYSTEM LFP SYSTEM BLOCK DIAGRAM MELTER 2 FEED 2 ADS PUMPS LFP-VSL-00004
19	24590-LAW-J1-LMP-00004	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM JOULE HEATER/ELECTRODE COOLING T/C ASSY MELTER 1
20	24590-LAW-J1-LMP-00005	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE SYSTEM AND AIR LIFT/LEVEL MELTER 1
21	24590-LAW-J1-LMP-00006	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM MELTER 1 & 2 START-UP HEATERS
22	24590-LAW-J1-LMP-00007	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE HEATER POWER SUPPLY MELTER 1 WEST
23	24590-LAW-J1-LMP-00008	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM MELTER 1 AGITATION/BUBBLER
24	24590-LAW-J1-LMP-00010	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM LID, PLENUM & WALL COOLING MELTER 1
25	24590-LAW-J1-LMP-00011	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE HEATER POWER SUPPLY MELTER 1 EAST
26	24590-LAW-J1-LMP-00014	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM MELTER 1 POUR SPOUT INSTRUMENTS AND MISC
27	24590-LAW-J1-LMP-00020	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM JOULE HEATER/ELECTRODE COOLING T/C ASSY MELTER 2
28	24590-LAW-J1-LMP-00021	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE SYSTEM AND AIR LIFT/LEVEL MELTER 2
29	24590-LAW-J1-LMP-00023	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE HEATER POWER SUPPLY MELTER 2 WEST
30	24590-LAW-J1-LMP-00024	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM MELTER 2 AGITATOR/BUBBLER
31	24590-LAW-J1-LMP-00026	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM LID, PLENUM AND WALL COOLING MELTER 2
32	24590-LAW-J1-LMP-00027	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM DISCHARGE HEATER POWER SUPPLY MELTER 2 EAST

Table C-4. System Block Diagrams & Control System Architecture Diagrams

#	Document Number	Document Title
33	24590-LAW-J1-LMP-00030	LAW VITRIFICATION SYSTEM LMP SYSTEM BLOCK DIAGRAM MELTER 2 POUR SPOUT INSTRUMENTS AND MISC
34	24590-LAW-J1-LOP-00001	LAW VITRIFICATION SYSTEM LOP SYSTEM BLOCK DIAGRAM PRIMARY OFFGAS MELTER 1 SBS/WESP
35	24590-LAW-J1-LOP-00002	LAW VITRIFICATION SYSTEM LOP SYSTEM BLOCK DIAGRAM PRIMARY OFFGAS MELTER 2 SBS/WESP
36	24590-LAW-J1-LOP-00004	LAW VITRIFICATION SYSTEM LOP SYSTEM BLOCK DIAGRAM PRIMARY OFFGAS MELTER 1 FILM COOLERS
37	24590-LAW-J1-LOP-00005	LAW VITRIFICATION SYSTEM LOP SYSTEM BLOCK DIAGRAM PRIMARY OFFGAS MELTER 2 FILM COOLERS
38	24590-LAW-J1-LRH-00001	LAW VITRIFICATION MH SYSTEM LRH SYSTEM BLOCK DIAGRAM CONTAINER RECEIPT HANDLING SYSTEM
39	24590-LAW-J1-LRH-00002	LAW VITRIFICATION MH SYSTEM LRH SYSTEM BLOCK DIAGRAM CONTAINER RECEIPT HANDLING SYSTEM
40	24590-LAW-J1-LVP-00001	LAW VITRIFICATION SYSTEM LVP SYSTEM BLOCK DIAGRAM SECONDARY OFFGAS SYSTEM
41	24590-LAW-J1-LVP-00002	LAW VITRIFICATION SYSTEM LVP SYSTEM BLOCK DIAGRAM SECONDARY OFFGAS SYSTEM
42	24590-LAW-J1-LVP-00003	LAW VITRIFICATION SYSTEM LVP SYSTEM BLOCK DIAGRAM SECONDARY OFFGAS SYSTEM
43	24590-LAW-J1-LVP-00006	LAW VITRIFICATION SYSTEM LVP SYSTEM BLOCK DIAGRAM SECONDARY OFFGAS CAUSTIC SCRUBBER
44	24590-LAW-J1-PCJ-00001	LAW VITRIFICATION SYSTEM PCJ SYSTEM BLOCK DIAGRAM PROCESS CONTROL SYSTEM NETWORK SH 1
45	24590-LAW-J1-PCJ-00002	LAW VITRIFICATION SYSTEM PCJ SYSTEM BLOCK DIAGRAM PROCESS CONTROL SYSTEM NETWORK SH. 2
46	24590-LAW-J1-PCJ-00009	LAW VITRIFICATION SYSTEM PCJ SYSTEM BLOCK DIAGRAM PROCESS CONTROL SYSTEM CONTROL ROOM
47	24590-LAW-J1-MHJ-00001	LAW VITRIFICATION SYSTEM MHJ SYSTEM BLOCK DIAGRAM CONTROLLER NETWORK
48	24590-LAW-J1-FNJ-00002	LAW-VITRIFICATION SYSTEM FNJ SYSTEM BLOCK DIAGRAM FACILITY NETWORK INFRASTRUCTURE EL -21'-0"
49	24590-LAW-J1-FNJ-00003	LAW VITRIFICATION SYSTEM FNJ SYSTEM BLOCK DIAGRAM FACILITY NETWORK INFRASTRUCTURE EL 3'-0"
50	24590-LAW-J1-FNJ-00004	LAW VITRIFICATION SYSTEM FNJ SYSTEM BLOCK DIAGRAM FACILITY NETWORK INFRASTRUCTURE EL 28'-0"
51	24590-LAW-J1-FNJ-00006	LAW VITRIFICATION SYSTEM FNJ SYSTEM BLOCK DIAGRAM LOCAL OPERATOR INTERFACE ELEVATION -21
52	24590-LAW-J1-FNJ-00007	LAW VITRIFICATION SYSTEM FNJ SYSTEM BLOCK DIAGRAM LOCAL OPERATOR INTERFACE
53	24590-LAW-JJ-PCJ-00001	RIVER PROTECTION PROJECT WASTE TREATMENT PLANT CONTROL SYSTEM ARCHITECTURE DIAGRAM - LAW
54	24590-LAW-JJ-PCJ-00002	LAW VITRIFICATION SYSTEM ICN CONTROL SYSTEM ARCHITECTURE DIAGRAM
55	24590-LAW-JJ-PCJ-00003	LAW VITRIFICATION SYSTEM ICN CONTROL SYSTEM ARCHITECTURE DIAGRAM

Table C-4. System Block Diagrams & Control System Architecture Diagrams

#	Document Number	Document Title
56	24590-LAW-JJ-PCJ-00004	LAW VITRIFICATION SYSTEM ICN CONTROL SYSTEM ARCHITECTURE DIAGRAM
57	24590-LAW-JJ-PCJ-00005	LAW VITRIFICATION SYSTEM ICN CONTROL SYSTEM ARCHITECTURE DIAGRAM
58	24590-LAW-JJ-PCJ-00006	LAW VITRIFICATION SYSTEM ICN CONTROL SYSTEM ARCHITECTURE DIAGRAM
59	24590-LAW-J1-PPJ-00001	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM "PRESSURE"
60	24590-LAW-J1-PPJ-00002	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM
61	24590-LAW-J1-PPJ-00003	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM
62	24590-LAW-J1-PPJ-00004	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM
63	24590-LAW-J1-PPJ-00005	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM CAUSTIC
64	24590-LAW-J1-PPJ-00006	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM OVERVIEW
65	24590-LAW-J1-PPJ-00007	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION EXHAUSTERS
66	24590-LAW-J1-PPJ-00008	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM MERCURY MITIGATION
67	24590-LAW-J1-PPJ-00009	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM HEPA
68	24590-LAW-J1-PPJ-00010	LAW VITRIFICATION SYSTEM PPJ SYSTEM BLOCK DIAGRAM PROG PROTECTION SYSTEM

Table C-5. Instrument Datasheets

#	Document Number	Document Title	Form
1	24590-LAW-JLD-LCP-00001	LCP-LT-0131 - RADAR LEVEL XMTR-FIELDBUS	85
2	24590-LAW-JPD-LCP-00003	LCP-PI-0212 - PRESS/DIFF PRESSURE GAUGE	8
3	24590-LAW-JPD-LCP-00006	LCP-PT-0255 - PRESSURE XMTR-FIELDBUS	49
4	24590-LAW-JPD-LCP-00012	LCP-DT-0144 - DIFF PRESS XMTR(DENS)-FIELDBUS	164
5	24590-LAW-JTD-LCP-00002	LCP-TT-0231 - TEMP XMTR/SWITCH-FIELDBUS	50
6	24590-LAW-JTD-LCP-00003	LCP-TE-0132 - RTD ELEMENT WITH WELL	13
7	24590-LAW-JTD-LCP-01320	LCP-TT-0132 - TEMP XMTR/SWITCH-FIELDBUS	50
8	24590-LAW-JVD-LCP-00004	LCP-YV-0107 - ACTUATED ON-OFF VALVE FF	129
9	24590-LAW-JVD-LCP-00021	LCP-YV-0207 - LCP-YY-0207 - LCP-ZSH-0207 - LCP-ZSL-0207 - ACTUATED ON/OFF VALVE FF	129
10	24590-LAW-JVD-LCP-00034	LCP-YV-0230 - ACTUATED ON-OFF VALVE FF	129
****	*****	*****	
11	24590-LAW-JFD-LFP-00043	LFP-FT-1204E - VORTEX/SWIRL METER-FIELDBUS	103
12	24590-LAW-JFD-LFP-00056	LFP-FT-2204F - VORTEX/SWIRL METER-FIELDBUS	103
13	24590-LAW-JLD-LFP-00003	LFP-VSL-00002 - INSTRUMENT DATASHEET RADAR LEVEL XMTR-FIELDBUS	85

Table C-5. Instrument Datasheets

#	Document Number	Document Title	Form
14	24590-LAW-JPD-LFP-00001	LFP-PI-1116 - PRESS/DIFF PRESSURE GAUGE	8
15	24590-LAW-JPD-LFP-00064	LFP-PT-2150 - PRESSURE XMTR-FIELDBUS	49
16	24590-LAW-JPD-LFP-00081	LFP-PT-2202 - INSTRUMENT DATASHEET PRESSURE XMTR-FIELDBUS	49
17	24590-LAW-JTD-LFP-00002	LFP-TT-1147 - TEMP XMTR/SWITCH-FIELDBUS	50
18	24590-LAW-JTD-LFP-00007	LFP-TE-2125 - RTD ELEMENT WITH WELL	13
19	24590-LAW-JVD-LFP-00017	LFP-PCV-1202E - INSTRUMENT DATASHEET PRESSURE REGULATOR	26
20	24590-LAW-JVD-LFP-00038	LFP-PCV-2203E - INSTRUMENT DATASHEET PRESSURE REGULATOR	26
21	24590-LAW-JVD-LFP-00201	LFP-FV-2201E - CONTROL VALVE-FIELDBUS	1
22	24590-LAW-JVD-LFP-00206	LFP-FV-2206E - CONTROL VALVE-FIELDBUS	1
23	24590-LAW-JVD-LFP-22053	LFP-YV-2205C - ACTUATED ON/OFF VALVE FF	129
****	*****	*****	
24	24590-LAW-JAD-LMP-25420	LMP-CT-2542 - PH/CONDUCTIVITY XMTR-FIELDBUS	135
25	24590-LAW-JAD-LMP-25421	LMP-CE-2542 - CONDUCTIVITY ELEMENT	100
26	24590-LAW-JFD-LMP-00043	LMP-FT-1224 - VORTEX/SWIRL METER-FIELDBUS	103
27	24590-LAW-JFD-LMP-00075	LMP-FI-1408 - ROTAMETER	6
28	24590-LAW-JFD-LMP-00080	LMP-FI-1475 - ROTAMETER IND/SWITCH/XMTR	158
29	24590-LAW-JFD-LMP-00210	LMP-FT-1051 - GAS MASS FLOW CONTROLLER/XMTR	128
30	24590-LAW-JFD-LMP-00236	LMP-FT-2333 - GAS MASS FLOW CONTROLLER/XMTR	128
31	24590-LAW-JPD-LMP-00001	LMP-LT-1053 - DIFF PRESS XMTR (LEVEL) FIELDBUS	59
32	24590-LAW-JPD-LMP-00004	LMP-LT-1403 - DIFF PRESS XMTR (LEVEL) FIELDBUS	59
33	24590-LAW-JPD-LMP-00006	LMP-LT-2053 DIFF PRESS XMTR (LEVEL) FIELDBUS	59
34	24590-LAW-JPD-LMP-00008	LMP-LT-2403 DIFF PRESS XMTR (LEVEL) FIELDBUS	59
35	24590-LAW-JPD-LMP-00010	LMP-LT-2405 - DIFF PRESS XMTR (LEVEL) FIELDBUS	59
36	24590-LAW-JPD-LMP-00036	LMP-PDT-2410 - DIFF PRESS XMTR-FIELDBUS	51
37	24590-LAW-JPD-LMP-00068	LMP-PT-1354 - PRESSURE XMTR-FIELDBUS	49
38	24590-LAW-JPD-LMP-00106	LMP-DT-1404 - DIFF PRESS XMTR(DENS)-FIELDBUS	164
39	24590-LAW-JPD-LMP-25160	LMP-PI-2516 - PRESS/DIFF PRESSURE GAUGE	8
40	24590-LAW-JTD-LMP-00050	LMP-TT-1267B - MULTIPOINT TEMP XMTR-FIELDBUS	Code 155
41	24590-LAW-JVD-LMP-00085	LMP-PCV-1423 - PRESSURE REGULATOR	26
42	24590-LAW-JVD-LMP-00086	LMP-PCV-1521 - PRESSURE REGULATOR	26
43	24590-LAW-JVD-LMP-00107	LMP-PCV-2423 - PRESSURE REGULATOR	26
44	24590-LAW-JVD-LMP-00108	LMP-PCV-2521 - PRESSURE REGULATOR	26
****	*****	*****	
45	24590-LAW-JFD-LOP-00002	LOP-FE-1049 - VENTURI TUBE	33
46	24590-LAW-JFD-LOP-00005	LOP-FE-2049 - VENTURI TUBE	33
47	24590-LAW-JFD-LOP-00017	LOP-FT-1108 - VORTEX/SWIRL METER-FIELDBUS	103
48	24590-LAW-JFD-LOP-00066	LOP-FT-1015 - CORIOLIS FLOWMETER-FIELDBUS	88
49	24590-LAW-JFD-LOP-00077	LOP-FI-2128 - INSTRUMENT DATASHEET ROTAMETER	6
50	24590-LAW-JFD-LOP-00083	LOP-F1-1228 - INSTRUMENT DATASHEET ROTAMETER	6
51	24590-LAW-JLD-LOP-00001	LOP-LT-1011 - RADAR LEVEL XMTR/SWITCH	146
52	24590-LAW-JLD-LOP-00007	LOP-LT-2018 - RADAR LEVEL XMTR-FIELDBUS	85

Table C-5. Instrument Datasheets

#	Document Number	Document Title	Form
53	24590-LAW-JPD-LOP-00001	LOP-PI-1023 - PRESS/DIFF PRESSURE GAUGE	8
54	24590-LAW-JPD-LOP-00008	LOP-PT-1065 - PRESSURE XMTR-FIELDBUS	49
55	24590-LAW-JPD-LOP-00014	LOP-PT-2072 - PRESSURE XMTR-FIELDBUS	49
56	24590-LAW-JPD-LOP-00016	LOP-FT-1049 - DIFF PRESS XMTR(FLOW)-FIELDBUS	58
57	24590-LAW-JPD-LOP-11330	LOP-PI-1133 - PRESS/DIFF PRESSURE GAUGE	8
58	24590-LAW-JTD-LOP-00007	LOP-TT-2013 - TEMP XMTR/SWITCH-FIELDBUS	50
59	24590-LAW-JTD-LOP-00013	LOP-TE-1013 - RTD ELEMENT W/WELL	13
60	24590-LAW-JTD-LOP-00016	LOP-TE-2013 - RTD ELEMENT W/WELL	13
61	24590-LAW-JVD-LOP-00015	LOP-FV-2113 - CONTROL VALVE FIELDBUS	1
62	24590-LAW-JVD-LOP-00017	LOP -TV -2013A - CONTROL VALVE-FIELDBUS	1
63	24590-LAW-JVD-LOP-00023	LOP -TV -1015 - CONTROL VALVE-FIELDBUS	1
64	24590-LAW-JVD-LOP-00025	LOP -TV -2015 - CONTROL VALVE-FIELDBUS	1
65	24590-LAW-JVD-LOP-00036	LOP-YV-2035 - LOP-YY-2035 - LOP-ZSH-2035 - LOP-ZSL-2035 - ACTUATED ON/OFF VALVE FF	129
70	24590-LAW-JVD-LOP-00092	LOP-YV-2008 - ACTUATED ON/OFF VALVE	132
71	24590-LAW-JVD-LOP-10500	LOP-FV-1050 - CONTROL VALVE-FIELDBUS	1
72	24590-LAW-JVD-LOP-20500	LOP-FV-2050 - CONTROL VALVE-FIELDBUS	1
****	*****	*****	
73	24590-LAW-JFD-LVP-00001	LVP-FT-0065 - CORIOLIS FLOWMETER - FIELDBUS	88
74	24590-LAW-JLD-LVP-00003	LVP-LT-0090 - RADAR LEVEL XMTR-FIELDBUS	85
75	24590-LAW-JPD-LVP-00003	LVP-PDT-0011 - DIFF PRESS XMTR-FIELDBUS	51
76	24590-LAW-JPD-LVP-00022	LVP-PDT-0083 - DIFF PRESSURE TRANSMITTER	152
77	24590-LAW-JTD-LVP-00014	LAW-LVP-PW-00043-N11F-18 - RTD ELEMENT W/WELL	13
78	24590-LAW-JTD-LVP-01010	LVP-TT-0101 - TEMP XMTR/SWITCH-FIELDBUS	50
79	24590-LAW-JTD-LVP-01041	LVP-TE-0104 – RTD ELEMENT W/WELL	13
80	24590-LAW-JVD-LVP-00650	LVP-DV-0065 - CONTROL VALVE-FIELDBUS	1

Table C-6. Equipment Installation Drawings

#	Document Number	Document Title
1	24590-WTP-J9-50-00001	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYP SINGLE CABINET LAYOUT
2	24590-WTP-J9-50-00002	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYP DUAL CABINET LAYOUT (EXT)
3	24590-WTP-J9-50-00003	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYP DUAL CABINET LAYOUT (INT)
4	24590-WTP-J9-50-00004	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYP 120VAC/24VDC TERM STRIP
5	24590-WTP-J9-50-00005	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYP DISCRETE/ANALOG TERMS
6	24590-WTP-J9-50-00006	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL 120VAC WIRING
7	24590-WTP-J9-50-00007	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL 24VDC WIRING DUAL ENCLOSURE

Table C-6. Equipment Installation Drawings

#	Document Number	Document Title
8	24590-WTP-J9-50-00008	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL DISCRETE I/O WIRING
9	24590-WTP-J9-50-00009	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL ANALOG I/O WIRING
10	24590-WTP-J9-50-00010	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT MISC DETAILS
11	24590-WTP-J9-50-00011	CONTROLS & INSTRUMENTATION 2 FT FIELD INSTRUMENT RACK GENERAL ARRANGEMENT
12	24590-WTP-J9-50-00012	CONTROLS & INSTRUMENTATION 4 FT FIELD INSTRUMENT RACK GENERAL ARRANGEMENT
13	24590-WTP-J9-50-00029	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK JUNCTION BOX INSTALLATION DETAILS
14	24590-WTP-J9-50-00030	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK JUNCTION BOX TERMINAL BLOCK INSTALLATION DETAILS
15	24590-WTP-J9-50-00037	CONTROLS & INSTRUMENTATION ADS PUMP RACKS GENERAL ARRANGEMENT LFP-RK-00007 & LFP-RK-00008
16	24590-WTP-J9-50-00039	RPP-WTP VITRIFICATION TELECOMMUNICATIONS FLOOR MOUNTED ENCLOSURE GENERAL ARRANGEMENT
17	24590-WTP-J9-50-00050001	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK DETAIL DRAWING INDEX AND FABRICATION DETAILS
18	24590-WTP-J9-50-00050003	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK FABRICATION DETAILS
19	24590-WTP-J9-50-00050004	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK FABRICATION DETAILS
20	24590-WTP-J9-50-00050007	CONTROLS & INSTRUMENTATION FIELD INSTRUMENT RACK FABRICATION DETAILS
21	24590-WTP-J9-50-00050008	CONTROLS AND INSTRUMENTATION FIELD INSTRUMENT RACK FABRICATION DETAILS
22	24590-WTP-J9-50-00052001	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK DETAIL DRAWING INDEX AND FABRICATION DETAILS
23	24590-WTP-J9-50-00052002	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK FABRICATION DETAILS
24	24590-WTP-J9-50-00052004	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK FABRICATION DETAILS
25	24590-WTP-J9-50-00052008	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK FABRICATION DETAILS
26	24590-WTP-J9-50-00053	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK JUNCTION BOX INSTALLATION DETAILS
27	24590-WTP-J9-50-00055	CONTROLS & INSTRUMENTATION QL - FIELD INSTRUMENT RACK JUNCTION BOX TERMINAL BLOCK INSTALLATION DETAILS
28	24590-WTP-J9-50-00057	CONTROLS & INSTRUMENTATION QL - 4 FT FIELD INSTRUMENT RACK GENERAL ARRANGEMENT SEISMIC III & SEISMIC IV
29	24590-WTP-J9-50-00060	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL 24VDC WIRING SINGLE ENCLOSURE

Table C-6. Equipment Installation Drawings

#	Document Number	Document Title
30	24590-WTP-J9-50-00066	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT 24VDC SECONDARY TERM STRIP WITH EXTRA POWER SUPPLY
31	24590-WTP-J9-50-00067	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL 120VAC WIRING WITH EXTRA POWER SUPPLY
32	24590-WTP-J9-50-00068	CONTROLS & INSTRUMENTATION RIO ENCLOSURE GENERAL ARRANGEMENT TYPICAL 24VDC WIRING WITH EXTRA POWER SUPPLY
33	24590-CM-POA-JD01-00001-05-13	CONTROLLER CABINET LAYOUT TYP-ENCL-00000 ABB Drawing
34	24590-LAW-J9-50-00004	LAW VITRIFICATION FLOOR/WALL PENETRATION INSTRUMENT TUBING PENETRATION SCHEDULE EL. 28'-0"
35	24590-LAW-J9-50-00005	LAW VITRIFICATION FLOOR/WALL PENETRATION INSTRUMENT TUBING PENETRATION SCHEDULE EL.28'-0"
36	24590-LAW-J9-LMP-00003	LAW VITRIFICATION SYSTEM LMP GENERAL ARRANGEMENT MELTER INSTRUMENT RACK LMP-RK-00040/41 SECT A & B
37	24590-LAW-J9-LMP-00004	LAW VITRIFICATION SYS LMP GENERAL ARRANGEMENT MELTER INSTRUMENT RACK TUBING SCHEMATIC LMP-RK-00040/41 SECT A & B
38	24590-LAW-J9-LMP-00005	LAW VITRIFICATION SYSTEM LMP MELTER INSTRUMENT RACK GENERAL ARRANGEMENT LMP-RK-00040 41 SECT C
39	24590-LAW-J9-LMP-00006	LAW VITRIFICATION SYSTEM LMP GENERAL ARRANGEMENT MELTER SERVICE RACK LMP-RK-00040 41 SEGMENT C TUBING SCHEMATIC
40	24590-LAW-J9-LMP-00007	LAW VITRIFICATION SYSTEM LMP GENERAL ARRANGEMENT MELTER INSTRUMENT RACK LMP-RK-00040/41 SECT D
41	24590-LAW-J9-LMP-00008	LAW VITRIFICATION SYSTEM LMP MELTER INSTRUMENT RACK TUBING SCHEMATIC LMP-RK-00040/41 SECT D
42	24590-LAW-J8-20-00003	LAW VITRIFICATION INSTR INSTALLATION DETAIL RADAR ANTENNA ASSEMBLY 3

Table C-7. Equipment Datasheets

#	Document Number	Document Title
1	24590-LAW-J9D-LCP-00001	LCP-ENCL-00001 - ENCLOSURE GENERAL ARRANGEMENT - LAW LINKING DEVICE DATASHEET - PROCESS CONTROL SYS LCP-ENCL-00001
2	24590-LAW-J9D-LCP-00002	24590-LAW-JX-LCP-ENCL-00002 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET PROCESS CONTROL SYS LCP-ENCL-00002
3	24590-LAW-J9D-LCP-00301	LCP-RK-00001 - LAW VITRIFICATION SYSTEM LCP INSTRUMENT RACK LCP-RK-000001 GENERAL ARRANGEMENT DATASHEET
4	24590-LAW-J9D-LCP-00302	LCP-RK-00002 - LAW VITRIFICATION SYSTEM LCP INSTRUMENT RACK LCP-RK-00002 GENERAL ARRANGEMENT DATASHEET

Table C-7. Equipment Datasheets

#	Document Number	Document Title
5	24590-LAW-J9D-LFH-00001	24590-LAW-JX-LFH-ENCL-00001 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00001
6	24590-LAW-J9D-LFH-00002	24590-LAW-JX-LFH-ENCL-00010 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00010
7	24590-LAW-J9D-LFH-00003	24590-LAW-JX-LFH-ENCL-00002 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00002
8	24590-LAW-J9D-LFH-00004	LFH-ENCL-00013 - ENCLOSURE GENERAL ARRANGEMENT LAW LINKING DEVICE DATASHEET PROCESS CONTROL SYS LFH-ENCL-00013
9	24590-LAW-J9D-LFH-00101	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00004
10	24590-LAW-J9D-LFH-00102	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00005
11	24590-LAW-J9D-LFH-00103	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00008
12	24590-LAW-J9D-LFH-00104	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00009
13	24590-LAW-J9D-LFH-00105	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LFH-ENCL-00006
14	24590-LAW-J9D-LFP-00002	LFP-ENCL-00002 - ENCLOSURE GENERAL ARRANGEMENT LAW LINKING DEVICE DATASHEET PROCESS CONTROL SYS
15	24590-LAW-J9D-LFP-00102	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET PROCESS CONTROL SYS LFP-ENCL-00007
16	24590-LAW-J9D-LFP-00301	LFP-RK-00007A - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00007A GENERAL ARRANGEMENT DATASHEET
16	24590-LAW-J9D-LFP-00302	LFP-RK-00007B - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00007B GENERAL ARRANGEMENT DATASHEET
18	24590-LAW-J9D-LFP-00303	LFP-RK-00007C - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00007C GENERAL ARRANGEMENT DATASHEET
19	24590-LAW-J9D-LFP-00304	LFP-RK-00008A - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00008A GENERAL ARRANGEMENT DATASHEET
20	24590-LAW-J9D-LFP-00305	LFP-RK-00008B - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00008B GENERAL ARRANGEMENT DATASHEET
21	24590-LAW-J9D-LFP-00306	LFP-RK-00008C - LAW VITRIFICATION SYSTEM LFP INSTRUMENT RACK LFP-RK-00008C GENERAL ARRANGEMENT DATASHEET
22	24590-LAW-J9D-LMP-00026	24590-LAW-JX-LMP-ENCL-00011 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET PROCESS CONTROL SYS LMP-ENCL-00011

Table C-7. Equipment Datasheets

#	Document Number	Document Title
23	24590-LAW-J9D-LMP-00027	LMP-ENCL-00012 - ENCLOSURE GENERAL ARRANGEMENT LAW LINKING DEVICE DATASHEET PROCESS CONTROL SYS
24	24590-LAW-J9D-LMP-00029	24590-LAW-JX-LMP-ENCL-00015 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET PROCESS CONTROL SYS LMP-ENCL-00015
25	24590-LAW-J9D-LMP-00030	LMP-ENCL-00016 - ENCLOSURE GENERAL ARRANGEMENT LAW LINKING DEVICE DATASHEET PROCESS CONTROL SYS LMP-ENCL-00016
26	24590-LAW-J9D-LMP-00101	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET PROCESS CONTROL SYS LMP-ENCL-00013
27	24590-LAW-J9D-LMP-00102	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET PROCESS CONTROL SYS LMP-ENCL-00017
28	24590-LAW-J9D-LMP-00301	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00040A GENERAL ARRANGEMENT DATASHEET
29	24590-LAW-J9D-LMP-00302	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00040B GENERAL ARRANGEMENT DATASHEET
30	24590-LAW-J9D-LMP-00303	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00040C GENERAL ARRANGEMENT DATASHEET
31	24590-LAW-J9D-LMP-00304	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00040D GENERAL ARRANGEMENT DATASHEET
32	24590-LAW-J9D-LMP-00305	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00041A GENERAL ARRANGEMENT DATASHEET
33	24590-LAW-J9D-LMP-00306	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00041B GENERAL ARRANGEMENT DATASHEET
34	24590-LAW-J9D-LMP-00307	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00041C GENERAL ARRANGEMENT DATASHEET
35	24590-LAW-J9D-LMP-00308	LAW VITRIFICATION SYSTEM LMP INSTRUMENT RACK LMP-RK-00041D GENERAL ARRANGEMENT DATASHEET
36	24590-LAW-J9D-LOP-00001	LOP-ENCL-00001 - ENCLOSURE GENERAL ARRANGEMENT LAW LINKING DEVICE DATASHEET PROCESS CONTROL SYS LOP-ENCL-00001
36	24590-LAW-J9D-LOP-00005	LAW VITRIFICATION SYSTEM INSTRUMENT RACK LOP-RK-20008 GENERAL ARRANGEMENT DATASHEET
38	24590-LAW-J9D-LPH-00001	24590-LAW-JX-LPH-ENCL-00008 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00008
39	24590-LAW-J9D-LPH-00002	24590-LAW-JX-LPH-ENCL-00010 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00010
40	24590-LAW-J9D-LPH-00101	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00001
41	24590-LAW-J9D-LPH-00102	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00002
42	24590-LAW-J9D-LPH-00103	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00003
43	24590-LAW-J9D-LPH-00104	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LPH-ENCL-00004

Table C-7. Equipment Datasheets

#	Document Number	Document Title
44	24590-LAW-J9D-LRH-00001	24590-LAW-JX-LRH-ENCL-00001 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET MH CONTROL SYS LRH-ENCL-00001
45	24590-LAW-J9D-LRH-00101	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LRH-ENCL-00003
46	24590-LAW-J9D-LRH-00102	ENCLOSURE GENERAL ARRANGEMENT LAW RIO ENCLOSURE DATASHEET MH CONTROL SYS LRH-ENCL-00004
47	24590-LAW-J9D-LVP-00001	24590-LAW-JX-LVP-ENCL-00001 - ENCLOSURE GENERAL ARRANGEMENT LAW CONTROLLER ENCLOSURE DATASHEET PROCESS CONTROL SYS LVP-ENCL-00001
48	24590-LAW-J9D-LVP-00301	LVP-RK-00001 - LAW VITRIFICATION SYSTEM LVP INSTRUMENT RACK LVP-RK-00001 GENERAL ARRANGEMENT DATASHEET
49	24590-LAW-J9D-LVP-00303	LVP-RK-00003 - LAW VITRIFICATION SYSTEM LVP INSTRUMENT RACK LVP-RK-00003 GENERAL ARRANGEMENT DATASHEET

Table C-8. Specifications, Guides, Calculations, and Procedures

#	Document Number	Document Title
1	24590-WTP-3PS-JD01-T0001	ENGINEERING SPECIFICATION FOR PLANT WIDE CONTROL SYSTEMS (INTEGRATED CONTROL NETWORK)
2	24590-WTP-3PS-JD031-T00021	ENGINEERING SPECIFICATION FOR PROGRAMMABLE PROTECTION SYSTEM
3	24590-WTP-3PS-JF12-T0001	ENGINEERING SPECIFICATION FOR VORTEX FLOWMETERS
4	24590-WTP-3PS-JL10-T0001	ENGINEERING SPECIFICATION FOR RADAR LEVEL MEASUREMENT
5	24590-WTP-3PS-JQ07-T0001	ENGINEERING SPECIFICATION FOR INSTRUMENTATION FOR PACKAGE SYSTEMS
6	24590-WTP-3PS-JQ08-T0001	ENGINEERING SPECIFICATION FOR CONSTRUCTION AND INSTALLATION OF CONTROLS AND INSTRUMENTATION
7	24590-WTP-3PS-JXXE-T0002	ENGINEERING SPECIFICATION FOR C&I ENCLOSURES, PANELS, CABINETS, AND RACKS
8	24590-WTP-3PS-JXXE-T0003	ENGINEERING SPECIFICATION FOR COMMERCIAL C&I ENCLOSURES, PANELS, CABINETS, AND RACKS
9	24590-WTP-3PS-JV01-T0001	ENGINEERING SPECIFICATION FOR CONTROL VALVES (**CM**)
10	24590-WTP-3PS-JV01-T0002	ENGINEERING SPECIFICATION FOR HIGH TEMPERATURE OFFGAS SERVICE VALVES (**CM**)
11	24590-WTP-3PS-JV01-T0003	ENGINEERING SPECIFICATION FOR CONTROL VALVES (**QL**)
12	24590-WTP-3PS-JV09-T0001	ENGINEERING SPECIFICATION FOR ON/OFF INSTRUMENT VALVES (**CM**)
13	24590-WTP-3PS-JV15-T0001	ENGINEERING SPECIFICATION FOR ACTUATORS FOR ON/OFF VALVES (**QL**)
14	24590-WTP-3PS-JV15-T0002	ENGINEERING SPECIFICATION FOR ACTUATORS FOR ON/OFF VALVES (**CM**)
15	24590-WTP-GPG-J-004	GUIDELINES FOR DESIGN OF A FOUNDATION FIELDBUS H1 SEGMENT
16	24590-WTP-GPG-J-005	CONTROL SYSTEMS INTERFACES
17	24590-WTP-GPG-J-006	SYSTEM BLOCK DIAGRAMS

Table C-8. Specifications, Guides, Calculations, and Procedures

#	Document Number	Document Title
18	24590-WTP-GPG-J-013	DESIGN GUIDE FOR PROGRAMMABLE PROTECTION SYSTEMS
19	24590-WTP-GPG-J-014	CONTROL SYSTEMS DESIGN PROCESS GUIDE
20	24590-WTP-GPG-J-016	CONTROL VALVE SIZING
21	24590-LAW-JVC-LOP-00001	CONTROL VALVE CALCULATION TAG NO. LAW-LOP-FV-1050
22	24590-LAW-JVC-LOP-00006	CONTROL VALVE CALCULATION TAG NO. LAW-LOP-FV-2050
23	24590-LAW-JVC-LOP-00650	CONTROL VALVE CALCULATION TAG NO. LAW-LVP-DV-0065
24	24590-WTP-VV-ENG-03-001	CONTROL VALVE SIZING FOR LIQUID SERVICE –QAS ROUTINE
25	24590-WTP-VV-ENG-03-002	CONTROL VALVE SIZING FOR GAS SERVICE –QAS ROUTINE
26	24590-WTP-VV-ENG-03-003	CONTROL VALVE SIZING FOR STEAM SERVICE –QAS ROUTINE
27	24590-WTP-G04B-00047	ENGINEERING DELIVERABLES TO CONSTRUCTION AND STARTUP/COMMISSIONING
28	24590-WTP-GPP-GCB-00100	FIELD MATERIAL MANAGEMENT
29	24590-WTP-GPP-IT-014	ACQUIRED SOFTWARE PACKAGED WITH EQUIPMENT
30	24590-WTP-GPP-MGT-027	PLANT INSTALLED SOFTWARE BASELINE CHANGE CONTROL
31	24590-WTP-GPG-ENG-090	GUIDANCE FOR MANAGEMENT OF ACQUIRED SOFTWARE PACKAGED WITH EQUIPMENT

Table C-9. Instrument Location Drawings and General Arrangements

#	Document Number	Document Title
1	24590-LAW-P1-P01T-00002	LAW VITRIFICATION BUILDING GENERAL ARRANGEMENT PLAN AT EL. 3’-0”
2	24590-LAW-P1-P01T-00003	LAW VITRIFICATION BUILDING GENERAL ARRANGEMENT PLAN AT EL. 22’-0”
3	24590-LAW-P1-P01T-00004	LAW VITRIFICATION BUILDING GENERAL ARRANGEMENT PLAN AT EL. 28’-0”
4	24590-LAW-J2-20-00004	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 3' - 0"
5	24590-LAW-J2-20-00005	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 3' - 0"
6	24590-LAW-J2-20-00006	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 3' - 0"
7	24590-LAW-J2-20-00008	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 3' - 0"
8	24590-LAW-J2-20-00010	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 3' - 0"
9	24590-LAW-J2-20-00013	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL 22 FT - 0 IN
10	24590-LAW-J2-20-00014	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL 22 FT - 0 IN
11	24590-LAW-J2-20-00201	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 28 FT - 0 IN
12	24590-LAW-J2-20-00202	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 28 FT - 0 IN
13	24590-LAW-J2-20-00206	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 28 FT - 0 IN

Table C-9. Instrument Location Drawings and General Arrangements

#	Document Number	Document Title
14	24590-LAW-J2-20-00207	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 28 FT - 0 IN
15	24590-LAW-J2-20-00208	LAW VITRIFICATION BUILDING C&I PROCESS INSTRUMENT LOCATION PLAN EL. 28 FT - 0 IN

Table C-10. High Level Requirements Sources

#	Document Number	Document Title
1	DE-AC27-01RL14136	WASTE TREATMENT AND IMMOBILIZATION PLANT CONTRACT
2	24590-WTP-DB-ENG-01-001	BASIS OF DESIGN
3	24590-WTP-RPT-OP-01-001	OPERATIONS REQUIREMENTS DOCUMENT
4	24590-WTP-SRD-ESH-01-001-02	SAFETY REQUIREMENTS DOCUMENT VOLUME II

Table C-11. Electrical Drawings

#	Document Number	Document Title
1	24590-LAW-E1-UPE-00003	LAW VITRIFICATION BUILDING ELECTRICAL ITS UPS UPE-UPS-20301 SINGLE LINE DIAGRAM
2	24590-LAW-E1-UPE-00004	LAW VITRIFICATION BUILDING ELECTRICAL ITS UPS UPE-UPS-20302 SINGLE LINE DIAGRAM
3	24590-LAW-E8-UPE-00001	LAW VITRIFICATION BUILDING ELECTRICAL 209-120V PANEL SCHEDULE UPE-PNL-20041
4	24590-LAW-E8-UPE-00002	LAW VITRIFICATION BUILDING ELECTRICAL 208-120V PANEL SCHEDULE UPE-PNL-20042
5	24590-LAW-E8-UPE-00003	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20043
6	24590-LAW-E8-UPE-00005	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20045
7	24590-LAW-E8-UPE-00006	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20046
8	24590-LAW-E8-UPE-00101	LAW VITRIFICATION BUILDING ELECTRICAL 208/120V PANEL SCHEDULE UPE-PNL-20141
9	24590-LAW-E8-UPE-00103	LAW VITRIFICATION BUILDING ELECTRICAL 208/120V PANEL SCHEDULE UPE-PNL-20143
10	24590-LAW-E8-UPE-00203	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20241
11	24590-LAW-E8-UPE-00204	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20242
12	24590-LAW-E8-UPE-00205	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20243
13	24590-LAW-E8-UPE-00206	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20244
14	24590-LAW-E8-UPE-00301	LAW VITRIFICATION BUILDING ITS UPS 480V PANEL SCHEDULE UPE-PNL-20301

Table C-11. Electrical Drawings

#	Document Number	Document Title
15	24590-LAW-E8-UPE-00302	LAW VITRIFICATION BUILDING ITS UPS 480V PANEL SCHEDULE UPE-PNL-20302
16	24590-LAW-E8-UPE-00303	LAW VITRIFICATION BUILDING ITS UPS 480V PANEL SCHEDULE UPE-PNL-20303
17	24590-LAW-E8-UPE-00304	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20341
18	24590-LAW-E8-UPE-00305	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20342
19	24590-LAW-E8-UPE-00307	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20344
20	24590-LAW-E8-UPE-00308	LAW VITRIFICATION BUILDING **ITS** UPS 208/120V PANEL SCHEDULE UPE-PNL-20350
21	24590-LAW-E8-UPE-00309	UPE-PNL-20351 **ITS** UPS 208/120V DISTRIBUTION PANEL BLOCK DIAGRAM
22	24590-LAW-E8-UPE-20201	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120 PANEL SCHEDULE UPE-PNL-20201
23	24590-LAW-E8-UPE-20202	LAW VITRIFICATION BUILDING NON-ITS UPS 208/120V PANEL SCHEDULE UPE-PNL-20202

Appendix D. ASSESSMENT PLAN

DESIGN PRODUCT OVERSIGHT PLAN

REVIEW OF THE WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) LOW-ACTIVITY WASTE (LAW) FACILITY INSTRUMENTATION AND CONTROL (I&C) SYSTEM HARDWARE LAYOUT DESIGN

February 2008

Design Oversight: D-08-DESIGN-063

Team Lead: Mark L. Ramsay

Reviewers: Mark L. Ramsay
Paul Hirschman

Submitted by

Team Lead: __original signed by_____ Date _____
Mark L. Ramsay, Electrical SSO
Waste Treatment and Immobilization Plant Engineering Division

Concurrence

WTP Engineering Division Director: _____ Date _____
James H. Wicks, Director

Approved

Assistant Manager Waste Treatment Plant: _____ Date _____
John R. Eschenberg, Project Manager

1.0 BACKGROUND, PURPOSE, AND OBJECTIVES

1.1 Background

The U.S. Department of Energy, Office of River Protection's mission is to retrieve and treat Hanford Site 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). In order to meet the requirements of WTP contract, DE-AC27-01RV14136, BNI (the Contractor) has established a process to deliver a technically defensible design that meets requirements. As the DOE owner, the ORP has responsibility to perform design and construction oversight of the WTP. The oversight process involves an objective measurement of the acceptability of BNI design products relative to established design criteria, and desired performance requirements.

1.2 Purpose

The purpose of this review is to evaluate the adequacy of the Contractor's Low-Activity Waste (LAW) Facility instrumentation and control (I&C) design product deliverable in meeting applicable requirements stemming from contract documents, such as the Basis of Design (BOD), Safety Requirements Document (SRD), Preliminary Safety Assessment Report, Operations Requirements Document (ORD), and lower-level requirements that are more detailed and technical in nature.

1.3 Objectives

The following are specific objectives of this assessment:

1. Verify that selected systems and elements in the LAW Facility I&C hardware layout are consistent with applicable functional and design requirements specified in Contract documents and implementing codes and standards.
2. Confirm that the Contractor's I&C design and procurement documentation for the LAW Facility is consistent throughout and is in accordance with design guides, procedures, and specifications.

2.0 SCOPE

This assessment will evaluate I&C aspects of selected systems within the LAW Facility. The systems to be evaluated include those listed below and may include others as time allows:

- LAW Concentrate Receipt Process System (LCP)
- LAW Melter Feed Process System (LFP)
- LAW Melter Process System (LMP)
- LAW Primary Offgas Process System (LOP)
- LAW Secondary Offgas/Vessel Vent Process System (LVP)
- LAW Container Finishing Handling System (LFH)
- LAW Container Pour Handling System (LPH)
- LAW Container Receipt Handling System (LRH)

- LAW Melter Handling System (LMH)

The main focus of this assessment will be on I&C equipment extending from primary process control loop devices, sensors, and switches to field network controller enclosures. Equipment will also include final control elements (valves, pumps, etc.), transmitters, wiring and cabling equipment, remote input/output (I/O) modules, and network communication devices such as controllers, fieldbus communication devices, and support equipment. WTP custom software will not be evaluated in this review; however, in some cases commercial-off-the-shelf (COTS) configurable firmware or software may be looked at.

Work activities will mainly involve review of design documents such as system descriptions, drawings (piping and instrumentation diagrams [P&ID], process flow diagrams, system block diagrams, instrument location drawings, etc.), datasheets, specifications, equipment lists, instrument databases, design guides, and procedures.

The final work product will be a report that addresses the adequacy of the I&C design with respect to the lines of inquiry listed below.

General Lines of Inquiry:

- Is the design media substantially complete and readily available for evaluation?
- For sampled systems, are the P&IDs consistent with the systems descriptions and other associated design media?
- Do the design documents convey a complete and consistent body of information adequate for plant operations as well as instrument installation?
- Do the instruments appear to have a necessary and sufficient function within the plant operation and control scheme?
- Are instruments adequately detailed in terms of type, attributes, properties, location, and installation?
- Does the design, as reflected in the design media, meet high-level project requirements in documents such as the BOD, SRD, and ORD?
- Does the I&C design and hardware layout reflect implementation of industry standards and acceptable practices?
- Are instruments suitable for the intended application and process environment?
- Were instrument calibration and maintenance considerations adequately factored into the design?
- Is the I&C design consistent with BNI design guidance documents, procedures, and specifications?
- Does BNI have an effective process for verifying that a given vendor is providing an instrument that meets the requirements identified on datasheets?
- Are instruments appropriately stored until time of installation and does BNI have a program from managing instruments after installation?

- Does BNI have a process for accommodating instrument configurable firmware/software upgrades?

3.0 PREPARATION

1. Identify the Contractor Points of Contact for this oversight design review.
2. Establish specific scope and deliverables of the LAW I&C design to be reviewed. Table 1 lists information requested from the Contractor in order to initiate this oversight review. The information requested may be presented at, or shortly following, the entrance meeting.
3. Review applicable requirements source documents (BOD, SRD, ORD, Safety Envelope Document (SED), etc.) and identify key industry codes and standards expected to be implemented in the LAW Facility electrical distribution design.
4. Review the Contractor's available database (DocSearch), identify documents to be reviewed, and obtain background information as necessary regarding revision status.
5. Prepare additional lines of inquiry as necessary and provide to the Contractor.

Table 1 – Initial Information Requirements

1.	Points of contact and responsible engineers for the design areas identified in Section 2. Include phone numbers and company e-mail addresses.
2.	List of design procedures, guides, instructions, templates, etc. used in the design process.
3.	List of key specifications for the LAW I&C design
3.	Reasonable percentage estimate of how complete the LAW I&C design is and what areas or aspects of the design are yet to be completed.
4.	Baseline Level 4 schedule for I&C equipment installations.
5.	Brief description of LAW Facility I&C design issues (if any) that directly or indirectly may affect the design. Also, list or describe design trends (if any) that may impact the LAW I&C hardware layout and design.
6.	Brief status of LAW I&C equipment procurements. Status procurements in terms of bulk commodities, major equipment and long lead items and list the quality assurance designations (commercial or quality) for the procurements.

4.0 ASSESSMENT

The assessors will evaluate the selected design elements in the LAW Facility I&C hardware layout and design. Where issues are identified, they will be discussed with the Contractor and their resolution mutually agreed to. Identified issues and path forward for resolution will be documented in the final report and, as necessary, will be tracked until closure.

5.0 REPORTING

The Assessment Team Lead will periodically brief ORP management and provide the Contractor POC the opportunity for a daily briefing as necessary during the assessment. The Team Lead, with assistance from the team, will prepare a final assessment report that summarizes review activities, results, conclusions, and recommendations.

6.0 SCHEDULE OF ACTIVITIES

Table 2 summarizes the schedule of this assessment.

7.0 DOCUMENTATION

The final assessment report shall contain the sections and content as summarized in ORP DI 220.1, "Conduct of Design Oversight." The open issues identified in this oversight shall be listed in the final report. Each open issue will be assigned an item number and will be tracked to resolution and closure through the ORP Consolidated Action Reporting System (CARS). The identified issues shall also be tracked to closure by the Contractor through a Correspondence Control Number (CCN) assigned to the report transmittal from ORP to Contractor.

8.0 CLOSURE

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

Table 2 – Schedule

Activity Description	Responsibility	Complete By
Develop Design Oversight Plan.	Lead Reviewer	01/30/2008
Provide written notification to Contractor of the planned oversight review and include as an attachment the Design Oversight Plan	Lead Reviewer	01/30/2008
Entrance meeting with Contractor personnel to discuss oversight review objectives, scope, schedule, and information requested in Table 1.	Reviewers	02/19/2008
Obtain information items from Contractor.	Reviewers	02/20/2008
Review Contractor design documentation, conduct interviews, and perform facility walkdowns as necessary.	Reviewers	02/26/2008
Preliminary out-briefing	Reviewers	02/27/2008
Prepare Draft Design Oversight Report.	Lead Reviewer	03/03/2008
Resolve comments and issue Final Report, and close out with Contractor.	Lead Reviewer	03/10/2008