Prototype System for Detecting Interactions between Current Plant Configuration States and Component Manipulations Directed by In-Use Procedures

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EXECUTIVE SUMMARY

This research effort is a part of the Light Water Reactor Sustainability (LWRS) Program, which is a research and development (R&D) program sponsored by the Department of Energy. The LWRS Program is performed in close collaboration with industry R&D programs that provide the technical foundations for licensing and managing the long-term, safe, and economical operation of current nuclear power plants (NPPs). The LWRS Program serves to help the United States (U.S.) nuclear industry adopt new technologies and engineering solutions that facilitate the continued safe operation of these NPPs and the extension of their current operating licenses.

The Outage Risk Management Improvement Pilot Project seeks to improve the management of nuclear power plant outages. This is done through the development of tools to assist in evaluating pending activities against requirements to detect undesired interactions. Significant efforts are expended to manage the nuclear risk of an outage. The utilities conduct pre-outage risk assessments, based on a very detailed review of the outage schedule, to identify where combinations of outage work and out of service equipment would result in degraded conditions with respect to nuclear safety or regulatory compliance. Probabilistic risk assessment studies are conducted to quantify incremental core damage frequency as a result of the outage activities and system unavailability. These studies are usually presented to site and fleet management, the site plant operational review committee, and the NPP's independent Nuclear Safety Review Board for concurrence that the outage is planned safely and that reasonable measures have been taken to reduce the added risk of conducting the outage.

During the outage, the plant configuration is monitored continuously to ensure that it conforms to the approved safety plan. Deviations must be assessed and approved by management committees and, in some cases, the plant operational review committee. In virtually all outage meetings and job briefings, the current nuclear safety status of the plant is communicated, including information on the specific equipment necessary to meet the requirements of the nuclear safety plan. In addition, the operations and outage organizations implement several layers of physical and administrative barriers to prevent unintended interaction with the systems and equipment credited for nuclear safety.

In spite of all these efforts, nuclear safety challenges still occur too frequently during outages. While some of these are due to failures of equipment credited for safety, the majority occur because of human error. These typically involve some form of interaction between work activities and plant configuration changes. Some of them are very subtle and are extremely challenging to detect in advance. Nevertheless, they are not acceptable and represent clear opportunities to improve nuclear safety during outages. This project will develop tools and strategies to minimize these interactions.

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ACKNOWLEDGMENTS

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FIGURES

TABLES

ACRONYMS

ADV   Atmospheric Dump Valve

AFW   Auxiliary Feedwater Pumps

AOCC   Advanced Outage Control Center

CAD   Containment Atmosphere Dilution

CBE   Control Building Envelope

DHR   decay heat removal

DS   discrete signs

ECCS   Emergency Core Cooling System

EDG-A   Emergency Diesel Generator

EPNs   equipment part numbers

FWP   feedwater pumps

HE   human error

HHSI   High Head Safety Injection

HSSL   Human Systems Simulation Laboratory

IAEA   International Atomic Energy Agency

INL   Idaho National Laboratory

INPO   Institute for Nuclear Power Operations

LERs   Licensee Event Reports

LOSP   loss of offsite power

LSD   large screen displays

LWRS   Light Water Reactor Sustainability

MCR   Main Control Room

MFW   main feedwater

NI   Nuclear Instrumentation

NPP   nuclear power plant

O.S.S   off-site AC supply

OCC   Outage Control Center

PRA   probabilistic risk assessment

PAM   post-accident monitoring

PVNGS   Palo Verde Nuclear Generating Station

QC   quality control

R&D   research and development

RCP-B   Reactor Coolant Pump

RCS   Reactor Coolant System

RHR-A   Residual Heat Removal Pump Alpha

RMAL   Risk Management Action Level

RPS   Reactor Protection System

RWST   Refueling Water Storage Tank

SI   Safety Injection

SSFF   Safety System Functional Failure

SFP-A   Spent Fuel Pump Alpha

SRO   Senior Reactor Operator

T-AFW   Turbine-driven Auxiliary Feedwater pump

TS   Technical Specification

U.S.   United States

WOG   Westinghouse Owners Group

1 INTRODUCTION

This research effort is a part of the Light Water Reactor Sustainability (LWRS) Program, which is a research and development program sponsored by the Department of Energy. The LWRS Program is performed in close collaboration with industry research and development programs that provide the technical foundation for licensing and managing the long-term, safe, and economical operation of current nuclear power plants (NPPs). The LWRS Program serves to help the United States nuclear industry adopt new technologies and engineering solutions that facilitate the continued safe operation of these NPPs and extension of the current operating licenses. One major area selected for capability-enabling research is outage safety and efficiency.

A pilot project in the LWRS program, "Outage Risk Management Improvement," is a multi-year effort targeted at NPP outage improvement. The primary purpose of this pilot project is to improve real-time plant risk management and configuration control during outage as a function of work activities and plant system alignments. It will develop a means for combining actual plant status information with intended component manipulations embedded in procedures and work packages that are underway or scheduled.

Control room and outage control center (OCC) staff must be continually informed about the actual state of the operational and maintained systems. Frequent OCC meetings certainly help to promote the information flow, but an effective system configuration and/or risk monitoring system will be a useful tool to support the decision-making process [1]. There is an opportunity to leverage several technologies to assist control room and OCC personnel in monitoring and verifying that current requirements will allow the planned work. Making outage key performance parameters and requirements and the relationships among them visible in real time would enable all personnel to anticipate and prepare for the configuration changes and requirements during plant evolutions. It would support frequent re-evaluation of the existing outage configuration and help to estimate the effects of the planned interventions and corrective actions. In addition, easy access to system configuration information would support preparation of a daily risk report, which in turn would support the decision-making process and handling of unexpected deviations from the outage plan.

This report describes progress made towards a set of software tools proposed in a previous report by St. Germain et al. (2017) [2]. This previous report determined that a combination of information visualization, natural language processing, and logic modeling would likely be an effective tool for preventing unintended system interactions during NPP outages. It was determined that a software tool would be needed to support the evaluation and further development of concepts in outage risk management improvement. This software tool, which is under development, is called the Outage System Status and Requirements Monitor (OSSREM).

2 OVERVIEW OF THE OSSREM APPLICATION

2.1 Introduction

Outage risk is currently managed primarily by relying on the scheduling of work within work windows that align with compatible plant conditions. There are various requirements that govern what work is allowed to be performed in these work windows.

Ensuring that the plant is continuously compliant with changing requirements while efficiently executing required work continues to challenge outage and operations staff. Better tools for managing the large amount of data associated with maintaining plant conditions within requirements should help reduce errors in configuration management and reduce costs.

This report describes the proposed features, functions, and characteristics of an innovative software tool intended to positively influence the *effectiveness*, *efficiency, safety,* and *satisfaction* with which specific users can perform specific tasks in a defined work context [3] (i.e., improved monitoring and managing of risks during power plant refueling outages).

Statements in this document relate the functionality, features, and usability of the proposed software product to verifiable measures for operational conditions, user and task characteristics, and ergonomic requirements. It essentially specifies what tasks users must be able to perform with the proposed system for it to be described as successful in a given operational context.

NOTE: The features and requirements described in this document are provisional only and are subject to further analysis and verification by subject matter experts.

2.2 Definitions

Usability: The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.

- **Effectiveness:** The accuracy and completeness with which users achieve specified goals.
- **Efficiency:** The resources expended in relation to the accuracy and completeness with which users achieve goals.
- **Satisfaction:** Freedom from discomfort and positive attitudes towards the use of the product.

Context of use: The users, tasks, equipment (hardware, software, and materials), and the physical and social environments in which the product is used.

User: The person who interacts with the product.

Goal: An intended outcome.

Task: The activities required to achieve a goal.

Product: The part of the proposed application (hardware, software, and materials) for which usability is to be specified.

2.3 Applicable Standards

The attributes that a product requires for usability are determined by the nature of the user, task, and environment. A product has no intrinsic usability, only a capability to be used in a particular context. Usability cannot be assessed by studying a product in isolation.

The user interface of the proposed software product may be improved by conforming to good design practices as outlined in the various parts of ISO 9241 ("Human-Centred Design for Interactive Systems" [3]). In addition, the fit between the user and the context of use described in this document may be improved through means such as ensuring compatibility with human abilities and limitations, conformance with task requirements, and compatibility with environmental characteristics. Usability tests should be designed to assess the degree of compliance with criteria as defined in a usability specification based on ISO 9241-11 (to be developed).

The term usability also refers to the capability of a product to be used easily, in terms of the definition of usability as a software quality attribute in ISO/IEC 9126 ("Information Technology - Software Product Quality" [4]), which is, "A set of attributes of software which bear on the effort needed for use and on the individual assessment of such use by a stated or implied set of users."

3 OBJECTIVES AND CONTEXT OF USE

3.1 Business Objective

The primary purpose of the proposed software application is to improve real-time plant risk management and configuration control during outages as a function of work activities and plant system alignments. It will support outage and operations staff in ensuring that the plant is continuously compliant with changing requirements while efficiently executing required work. In particular, it will enable staff to accurately track the status of all critical equipment, plant configurations, work orders, checklists, and procedures. In addition, it could allow review of outage operating experience and add information on observations, surveillances, corrective actions, etc. needed to achieve the objectives of the outage. Specifically, this means critical decisions that would affect safety, cost, time, and resources.

The application will also be a means to combine actual plant status information with intended component manipulations embedded in procedures and work packages that are underway or scheduled. This makes it a better tool for managing the large amount of data associated with maintaining plant conditions within requirements. It should help reduce errors in configuration management and also reduce costs.

3.2 Intended Functions and Uses

The proposed Outage System Status and Requirements Monitor (OSSREM) is an information collection, processing, and visualization tool, intended to assist staff in maintaining awareness of ever-changing conditions and requirements. For example, this might include the status of critical plant equipment, including reactor protection system, equipment cooling systems, residual heat removal, emergency diesel generators, etc. In addition, it would be used to accurately track the status of plant equipment required during specific outage work windows.

The application will not replace any existing system at the plant but will interface with a number of existing systems, including the plant process computer and various plant information systems and databases.

General functional capabilities of OSSREM should include the following:

1. Provide information on:
   - current plant status and operating mode
   - required systems for current plant status and outage work
   - status and acceptability of current system status for safety and outage work
   - compliance with technical specifications.
2. Provide advice on the acceptability of system status for future (e.g., next work window) planned work.
3. Provide the following data processing capabilities:
   - Provide real-time data connections to plant information systems, including the following:
     - plant operating status
     - operating procedures
     - outage schedules
     - clearance orders
     - work packages
     - materials lists
     - risk management systems, etc.

- Provide real-time interfaces to selected sensor data from the plant distributed control system or plant computer
- Import operating experience data from existing databases and process the information for retrieval on demand
- Import plant technical specifications from existing sources into a local relational database that provides data connections to system requirements for outage work
- Perform text mining of critical documents not available in databases.

4. Develop and maintain an outage performance history database.
5. Develop and maintain logic models of system interdependence for specific conditions.
6. Apply logic models in real time to correlate process signals with operability requirements.
7. Apply machine learning methods to outage performance history to extrapolate and predict requirements for future activities, as well as future outages.

3.3 Intended Users

OSSREM is intended for use by all plant managers, outage crew members, control room operators, and any other authorized person. The primary user of the tool during an outage would be the work control SRO who has responsibility for authorizing work. This person is responsible for ensuring each work order and clearance order will not adversely affect plant safety. The tool would also be used by outage schedulers both prior to and during the outage to ensure that scheduled work does not conflict with either plant requirements or other ongoing or new work items. This tool could also support main control room staff in ensuring requirements for mode change are met prior to changing plant parameters that affect the technical specification mode of operation.

3.4 Task Characteristics

The following describes, in general terms, the typical user activities within OSSREM:

- Activate the system by using the mouse, keyboard, or touch screen and make a number of selections from options offered on the screen. The mobile versions (i.e., tablet-based) of the application will use conventional touch interaction.
- Review the high-level status of the main system sections by selecting each of the sections on the status bar at the bottom of the display.
- Review key performance parameters on the Plant Status section and access each item for detailed information.
- Review the Current Configuration section and access each item for detailed information on the current work window.
- Review the Next Configuration section and access each item for detailed information on requirements for the next work window.
- Select any object on the mimic plant graphic to display detailed information on system status and requirements.
- Review additional information from documents, databases, technical specifications, system and sensor information, etc. by selecting one of the buttons on the user interface.

The activities shown above are not definitive and may be expanded or modified during detailed requirements analysis.

3.5 Target Work Environments

The OSSREM system should be designed to be used in any or all of the following work environments:

- Plant manager's office
- Outage control center
- Main control room
- Operations support center
- Work control center
- Technical support center
- Outage scheduling center.

In addition, the application may also be available as a mobile version on handheld devices for use by maintenance and operations personnel in the field.

3.6 Ergonomics and Environmental Requirements for Use

Given adequate training and orientation, OSSREM users will use the system with no assistance other than that provided by the system itself. Possible environmental disruptions may include the following:

- Interruptions from nearby co-workers
- Other environmental disturbances in the form of noise and bad lighting.

In order to contribute to meeting usability objectives, OSSREM will be used in an environment that conforms to relevant ergonomics standards. In particular, attention must be paid to adequate display quality, the avoidance of glare and reflection, adequate lighting, and adjustability of the viewing angle.

4 DESIGN CONCEPT DESCRIPTION

The early design ideas for the OSSREM software tool were presented in a previous report, INL/EXT-17-43234 [2]. Most of the design feature were implemented in the current OSSREM software prototype, so the design information is presented here for completeness.

4.1 General User Interface Concept

The OSSREM user interface contains the following information sections:

1. A simplified plant mimic showing the following main systems and equipment:
   - Containment, with reactor, pressurizer, steam generator, and reactor coolant pumps
   - Refueling water tanks
   - Main pump trains for residual heat removal, containment spray, safety injection, and feedwater
   - Turbine-generator system
   - Condenser
   - Ultimate heatsink
   - Main electrical distribution equipment.

   NOTE: The items above may be adapted to the physical characteristics of a specific plant.

2. Key plant status information. This would include the status of key systems and the overall plant condition during Modes 1 through 6, for example, reactor power, containment status, reactor coolant system, decay heat, spent fuel pool temperature and level, etc.

3. Indications of required systems and system trains (e.g., pumps, coolant sources, fuel inventory) should indicate the status of the components (e.g., protected and running, protected and in standby, running but not protected, standby and available for maintenance, and out of service) by means of suitable symbols and coloring.

4. Current plant configuration. Critical parameters to be displayed in this section would include the current mode, Risk Management Action Level (RMAL) bulk coolant Time to Boil, Protected Train, outage work window, etc.

5. Next Configuration. This section of the proposed display would provide a prospective indication of the requirements for the next phase of the evolution or work window.

The proposed display includes a simplified plant mimic diagram that indicates the status of the key systems during the outage, specific modes, and specific work windows. System status would be indicated by means of symbols for systems and trains that are in various conditions, ranging from protected and running to out of service.

The following figures illustrate the basic concept. **Figure 1** shows a possible layout of the sections mentioned above. The annotations provide a brief explanation of the content and intent of each section:
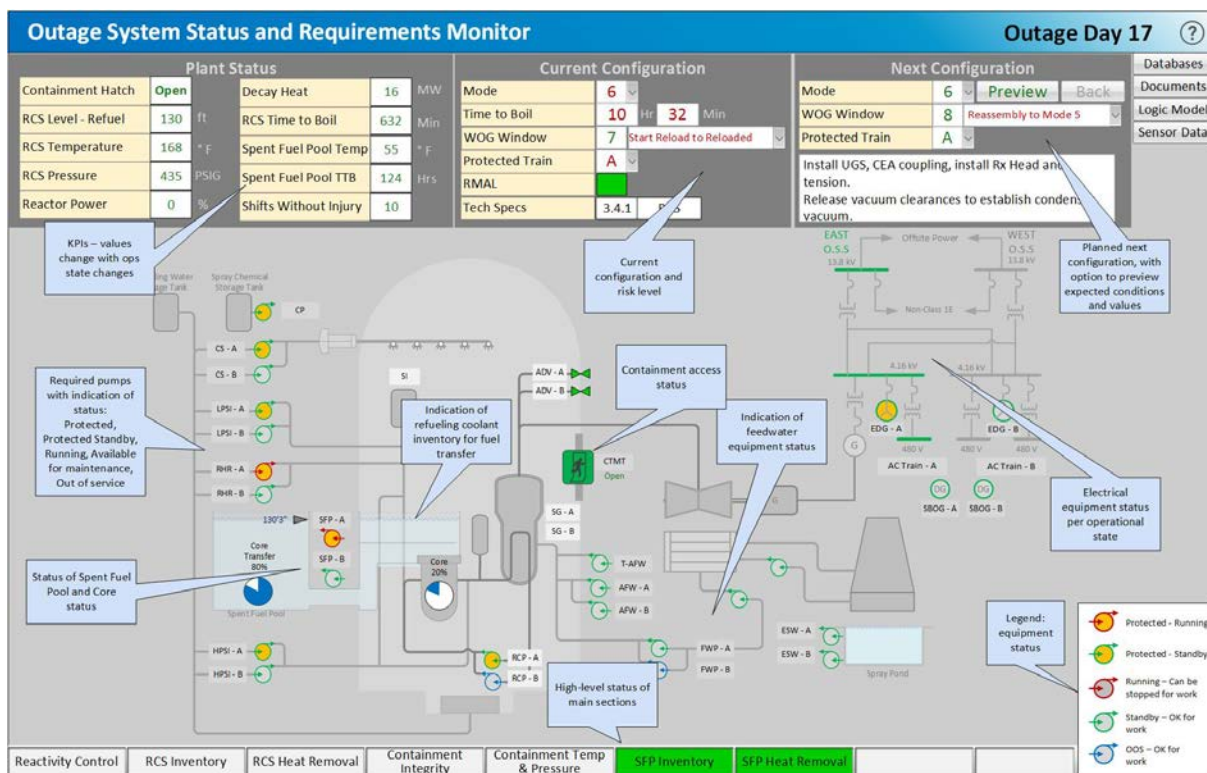
Figure 1. OSSREM interface concept description.

Figure 2 shows an example of the key parameters and plant configuration for work during Mode 6 on Day 17 of the outage. It shows the following conditions for the current configuration:

1. The containment hatch is open.

2. The Reactor Coolant System (RCS) inventory is increased, as shown by the high level of the refueling tanks.

3. The current Westinghouse Owners Group (WOG) work window is 7 ("start core reload to reloaded").

4. RMAL is green.

5. Train Alpha systems are protected.

6. The core is in the process of being unloaded.

7. The Residual Heat Removal Pump Alpha (RHR-A) and Spent Fuel Pump Alpha (SFP-A) are protected and running.

8. Feedwater pumps (FWP), auxiliary feedwater pumps (AFW) and turbine-driven auxiliary feedwater pump (T-AFW) are in standby.

9. FWP-B and Reactor Coolant Pump (RCP-B) are out of service.

10. Off-site AC supply (O.S.S) from Train A is available.

11. The Emergency Diesel Generator (EDG-A) is protected and in standby.

12. The Next Configuration is still in Mode 6, with activities for WOG window 8 ("reassembly to Mode 5").
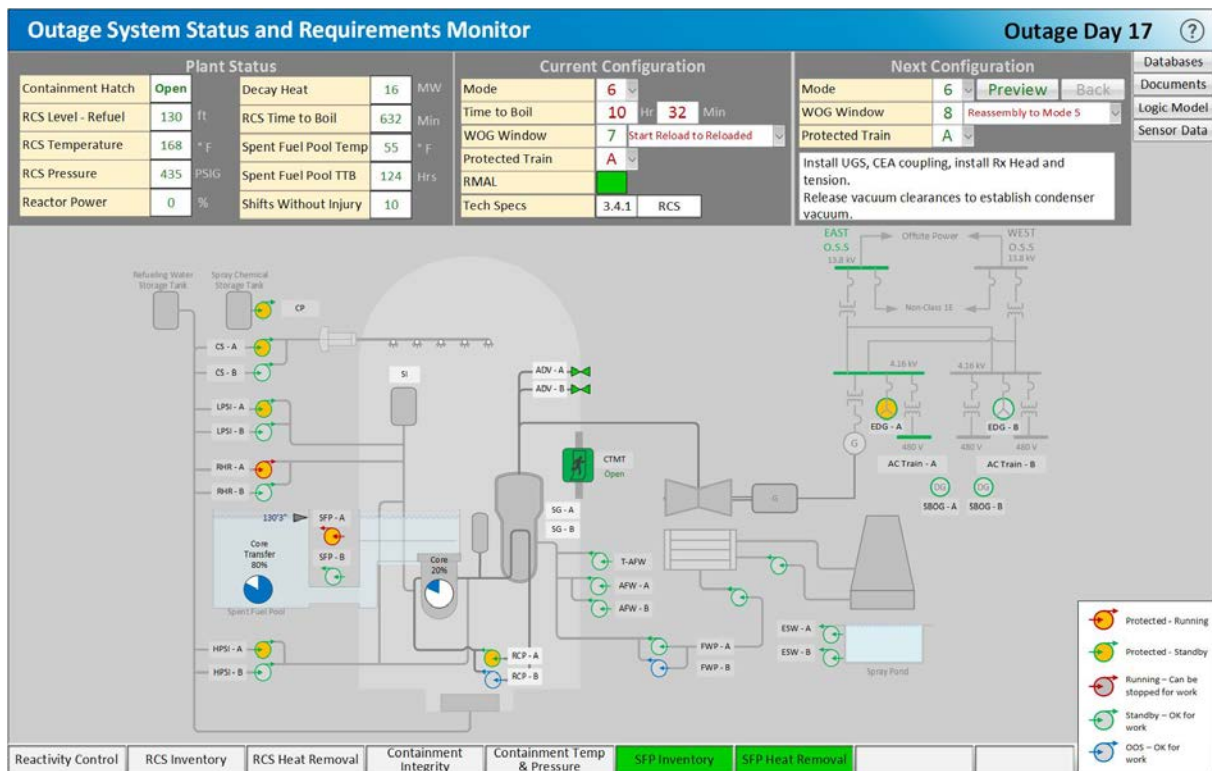
Figure 2. OSSREM interface concept for outage Day 17—Mode 6.

Figure 3 shows the key parameters and plant configuration for work during Mode 6 on Day 18 of the outage. It shows the following conditions for the current configuration:

13. Fuel load is complete and the containment hatch is now closed.

14. WOG Window 7 ("Reassembly to Mode 5") is in progress.

15. FWP-B is still out of service.

16. RCP-B is now in standby.

17. The Emergency Diesel Generator (EDG-A) is protected and in standby.

18. The next configuration is still in Mode 6, with WOG Window 8 ("Mode 5 to Mode 4").
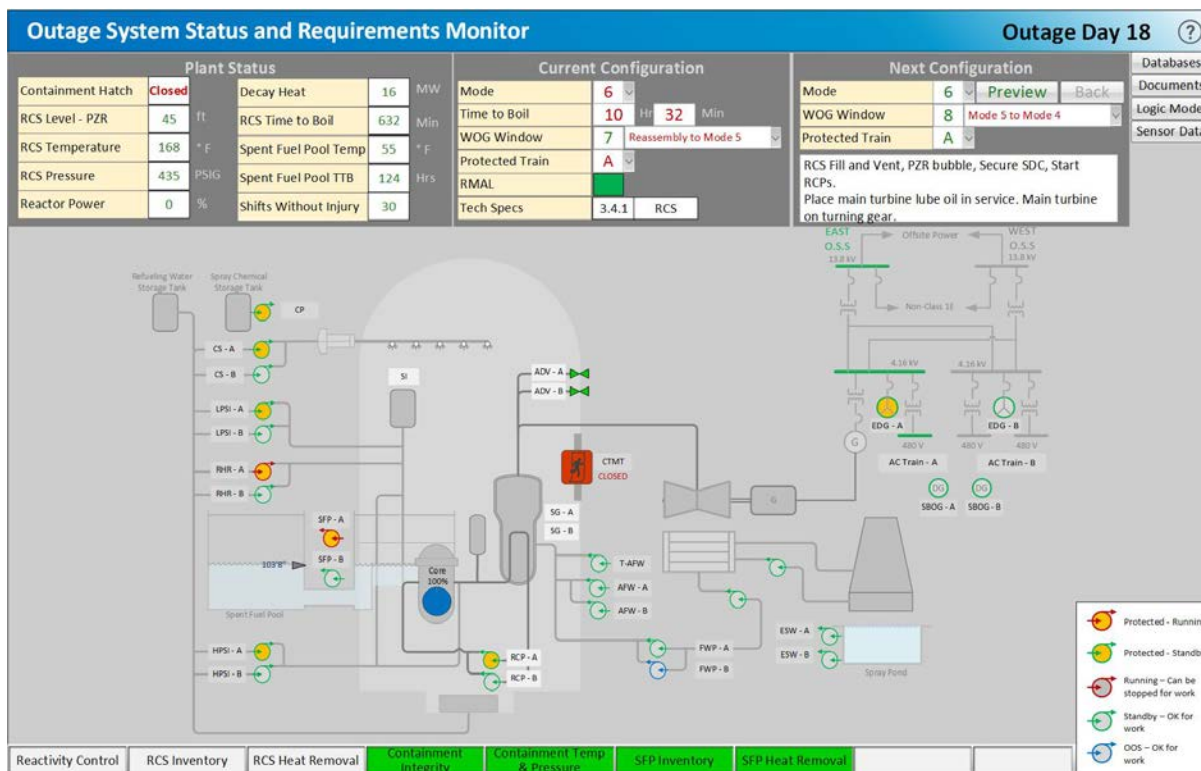
Figure 3. OSSREM interface concept for outage Day 18—containment closed.

Figure 4 shows a preview of the key parameters and plant configuration for work during Mode 4 on Day 25 of the outage. The current configuration is grayed out in this display to avoid confusion with the preview of the next configuration. This preview is accessed by clicking the "Preview" button on the Next Configuration panel. It shows the following conditions for the current configuration:

19. The RCS is filled and vented and RCS inventory level is reduced, as shown by the lower level of the tanks.

20. RCPs should be started, but RCP-B is currently in standby, so it is highlighted and flashing to show that it should be running in Mode 4.

21. RHR-B pump and SFP-B pump are running.

22. The T-AFW pump is out of service and is highlighted and flashing (shown in the image as orange highlights) to alert the crew that it would be out of compliance for Mode 4.

23. The statuses of the main operating states are shown in the bottom bar of the display. In this example, it is shown that the RCS would not be fully compliant in Mode 4 due to the RCP-B that is in standby.

Other exceptions can be highlighted in a similar manner.
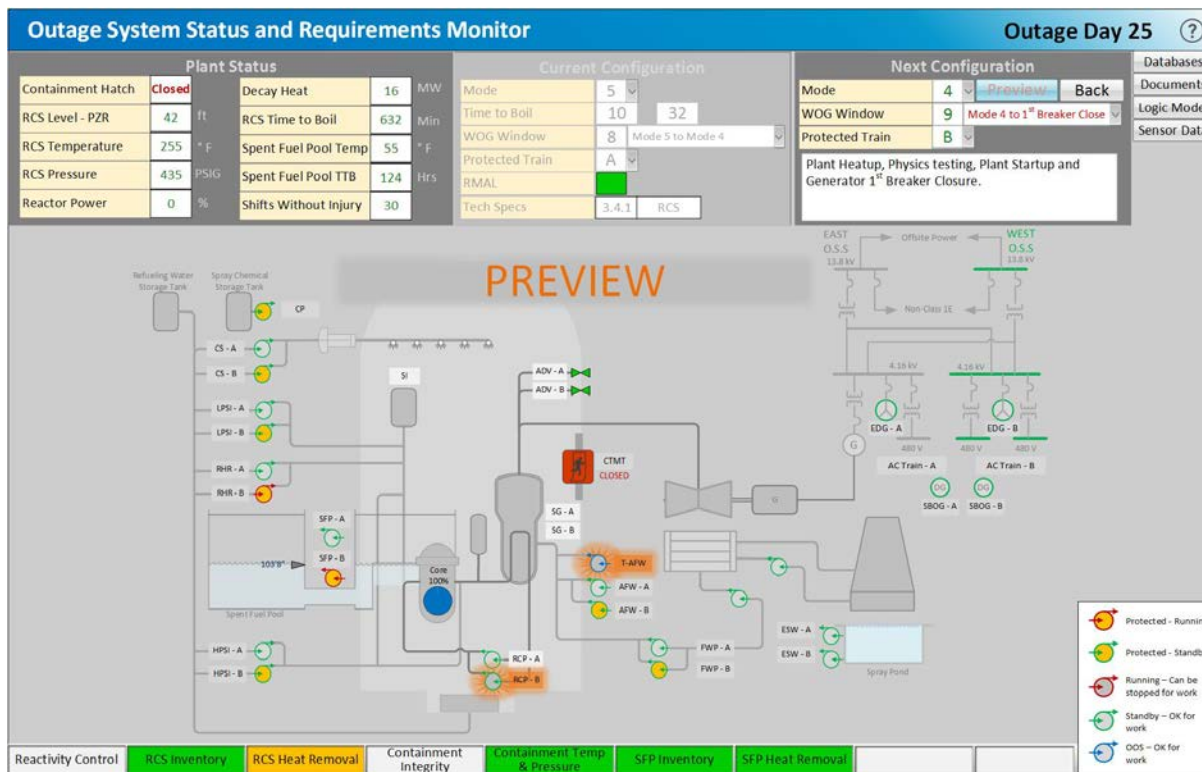
Figure 4. OSSREM interface concept for outage Day 25.

Once these prospective values and requirements have been examined, the user would return to the previous display by clicking the "Back" button.

User interaction functions should include the following:

- Select any component on the mimic diagram to reveal detailed information on the component configuration and status.

- Select any Plant Status item for detailed information.

- Select any Current Configuration item for detailed information.

- Select a Next Configuration section to preview the requirements and compliances for the next work window.

- Select a Forecast section to preview predicted requirements for the next outage.

- Select a References section to view available documentation (technical specifications, procedures, work packages, etc.)

4.2 Description of Equipment

The following describes the possible characteristics and attributes of the hardware and software required for OSSREM:

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- A client-server configuration to enable a distributed application architecture with user access on clients where needed (OCC, control room, etc.)

- Large displays (e.g., 55-inch) in the OCC and control room to serve as overview displays

- Standard workstations for direct user interaction. Workstations may be equipped with touch screens if required.

- Mobile versions of OSSREM installed on handheld devices with wireless network access where possible.

- Any suitable software platform may be chosen (e.g., Windows Presentation Foundation) with suitable interfaces to databases, documents, and real-time plant data.

4.3 Current State of the OSSREM Application

An information technology vendor, ATOS, was contracted to produce a prototype software application using the requirements and proposed design layouts presented in this section. The purpose is to facilitate further research and development of outage data presentation and integration. The OSSREM application is web-based and can be installed on any machine running Microsoft Internet Explorer. The primary data interface is a Microsoft Excel table that can be exported and imported to communicate with other data sources. The current data table is shown in Appendix A. For the purposes of concept evaluation, the table can be manually updated; for actual implementation, the data tables would be automatically updated with data from a plant's work management software, clearance order software, or plant computer. The OSSREM application was installed in INL's Human System Simulation Laboratory (HSSL) for demonstration purposes. Connections to the HSSL simulator code were made to simulate inputs from a plant computer at a utility. Figure 5 shows the primary user interface and can be compared with the design proposal shown in Figure 1.
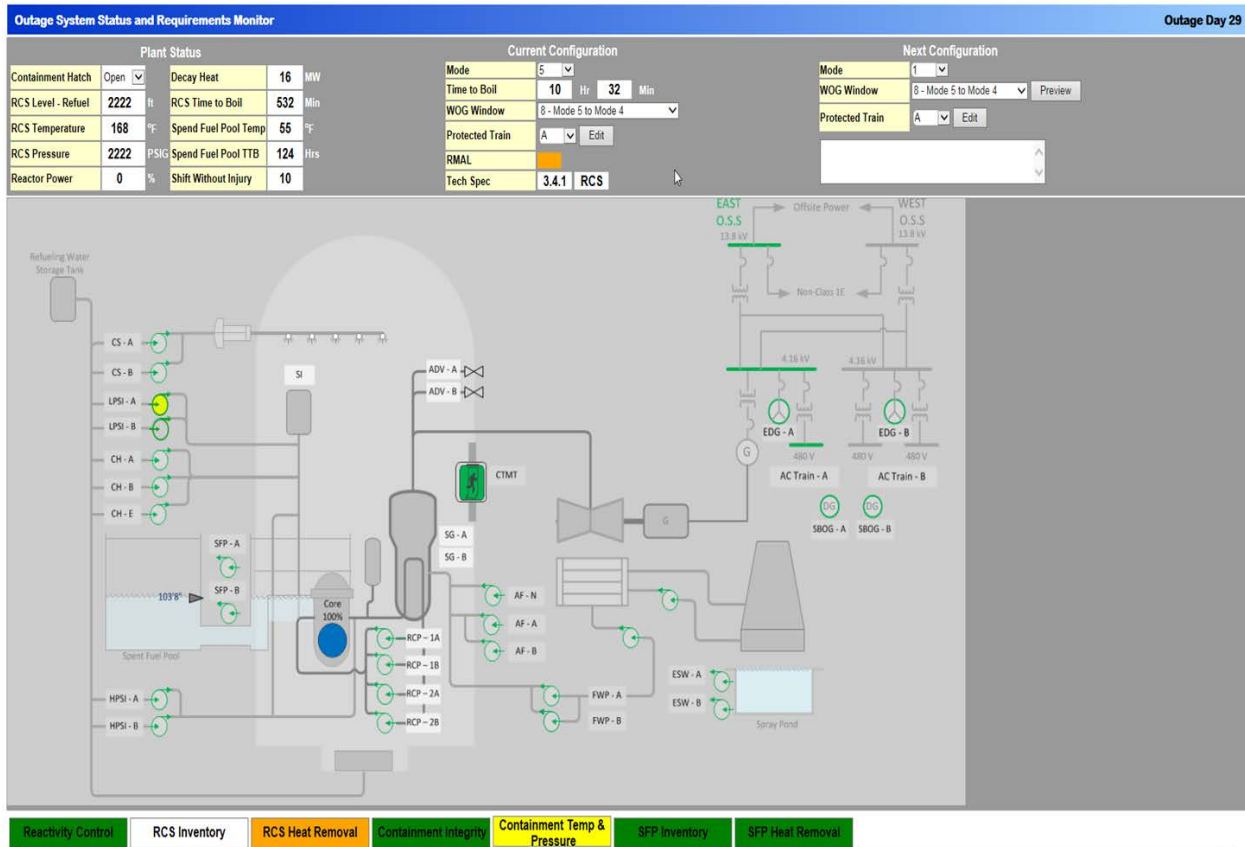
Figure 5. OSREM interface concept description.

Figure 6 shows the interface for presenting and updating the status of individual components within each of the monitored systems. Any component that is not in its required position will show up red on the table and the system will be highlighted with an alarm-type indication alerting the operators to a potential issue.
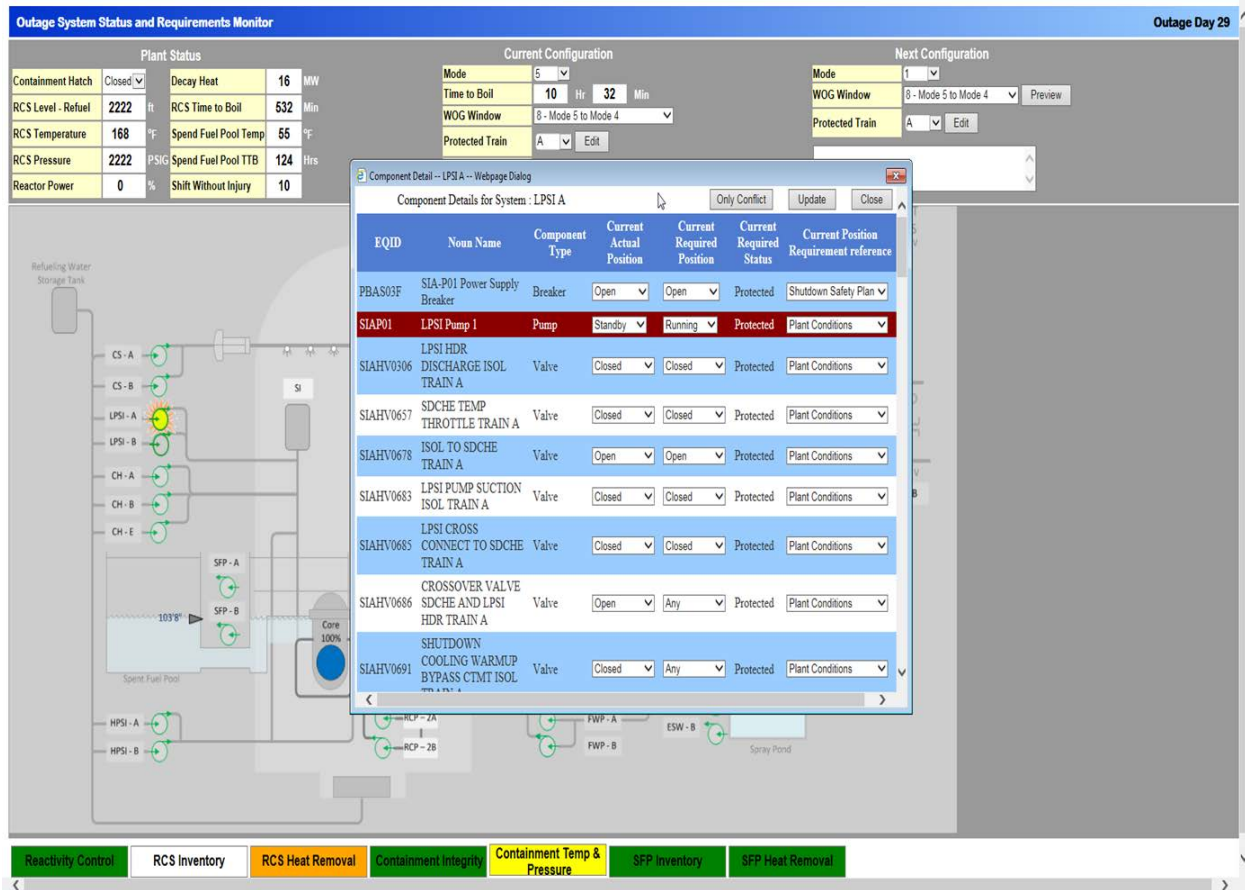
Figure 6. OSSREM component status table interface.

4.4 Natural Language Processing Module

A key capability of the OSSREM system will be to evaluate the potential component manipulations directed by procedures and work orders. The OSSREM application data table contains fields for these procedure-directed manipulations, but a separate application will be developed to extract these component manipulations using a technique known as natural language processing. Researchers at Vanderbilt University are currently developing a tool to extract the expected component manipulations from procedures as work orders. The basic strategy is as follows:

1. The user imports the ORM component list (MS Excel table from OSSREM).
2. The text mining tool reads in the list of monitored components to search for (EQ ID).
3. The user imports the document (procedure or work order) to check.
4. The user identifies the sections of the procedure or work order to check.
5. The text mining tool evaluates the document to identify any instances of the monitored EQ IDs and writes them to the procedure-requested component manipulation table (create a row for each procedure step with a monitored EQ ID).
6. The text mining tool evaluates each identified step with a monitored EQ ID for an identified action verb that indicates the monitored component's state may change (based on an action verb rules list).

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7. The text mining tool equates through a logic table the action verb with a final component state and writes to the temporary table.
8. The text mining tool identifies any procedure steps that involve a monitored component that doesn't understand the action.
    a. The tool presents each of these unidentified steps to the user to create new rules for the action verb rules list.
9. The text mining tool looks for character strings that are close but not exact matches to monitored EQ IDs and presents them to the user.
    a. The user evaluates whether the EQ ID in the procedure is actually a match to the monitored EQ ID. If so, the application writes to an alias table to support future identifications.
10. The text mining tool creates a list in the user interface of any potential conflicts with the current required positions from the ORM component list.
11. The text mining tool eliminates duplicate component manipulations and writes a new ORM component list table to send back to the OSSREM application.

This new tool will use the Java programming language and a modular framework, which will form a sequential processing pipeline to accomplish this difficult task (**Figure 7**). The use of Java will enable portability of the tool across multiple operating systems, including Microsoft Windows, OS X, and Unix. The modular design of the system will reduce the interdependence of elements of the code, which will facilitate continued updates to the system with new or improved capabilities. The communication diagrams (**Figures 8-10**) highlight the tasks of the subcomponents that constitute each of the modules comprising the tool. The stick-figure icons represent various programmatic elements of each subcomponent and include (1) controls, which are the programmatic subcomponents that carry out processing and analysis; (2) entities, which are typically files and databases that store information; and (3) boundaries, which provide interfaces between elements such as users and the system or processing and storage entities. The modules comprising the tool are:

- *Document Analyzer Module* - Reads and processes power plant documentation

- *Depot Loader Module* - Imports existing knowledge from database tables

- *Rule Module* - Identifies new knowledge and identifies configuration conflicts.

The Document Analyzer Module will process documents provided by a user and extract information pertaining to outage management. Like the other modules, the tool will contain submodules to allow for future extensibility. The initial sequence of steps (1-9) is provided in the accompanying diagram (**Figure 8**). To extract the pertinent information, the Document Analyzer will first import documents provided in XML, HTML, Microsoft .docx, or Adobe PDF format. During import, the module will determine the hierarchical organization of the text to allow for proper contextual interpretation. The module will delineate sections, paragraphs, sentences, phrases, and tokens in the text, where "token" is defined as a character sequence that conveys the smallest unit of meaning within text. Tokens are often words, but may also be values, units of measure, acronyms, and the like. A machine-learning-based model will assign parts of speech to each token. The tool will use word synonymy, sentence syntax, and token structure to identify nouns and verbs similar to previously identified components or action verbs, and it will store the identified words as component and action verb candidates for later evaluation by the user.

The Depot Loader Module will import pre-existing database tables, which will contain existing knowledge in the form of previously identified plant system components, action verbs, and component state constraints and potential conflicts. These pre-existing tables will rely on both manually documented, expert knowledge and previous document analyses. The module will load information stored in four different information depots.

- *Component Depot* - Contains previously identified power plant system components

- *Start State Depot* - Holds the initial state of each component (e.g., on/off, open/closed)

- *State Transition Depot* - Stores the state transition induced by an action on a specific component (e.g., "Open valve 'c'" would switch valve "c" from a closed to an open state)

- *State-Component Conflict Depot* - Stores any improper combinations or configurations of components that indicate a conflict.

The Rule Module will present any candidate action verbs and components identified by the Document Analyzer Module to a user, who will decide whether to add them to existing knowledge bases. This interactive updating will thus expand the tool's capabilities through regular use. The Rule Module will also compare proposed configuration changes to conflicts stored within the *State-Component Conflict Depot*. Conflicts will be transmitted to the user via the OSSREM graphical user interface.
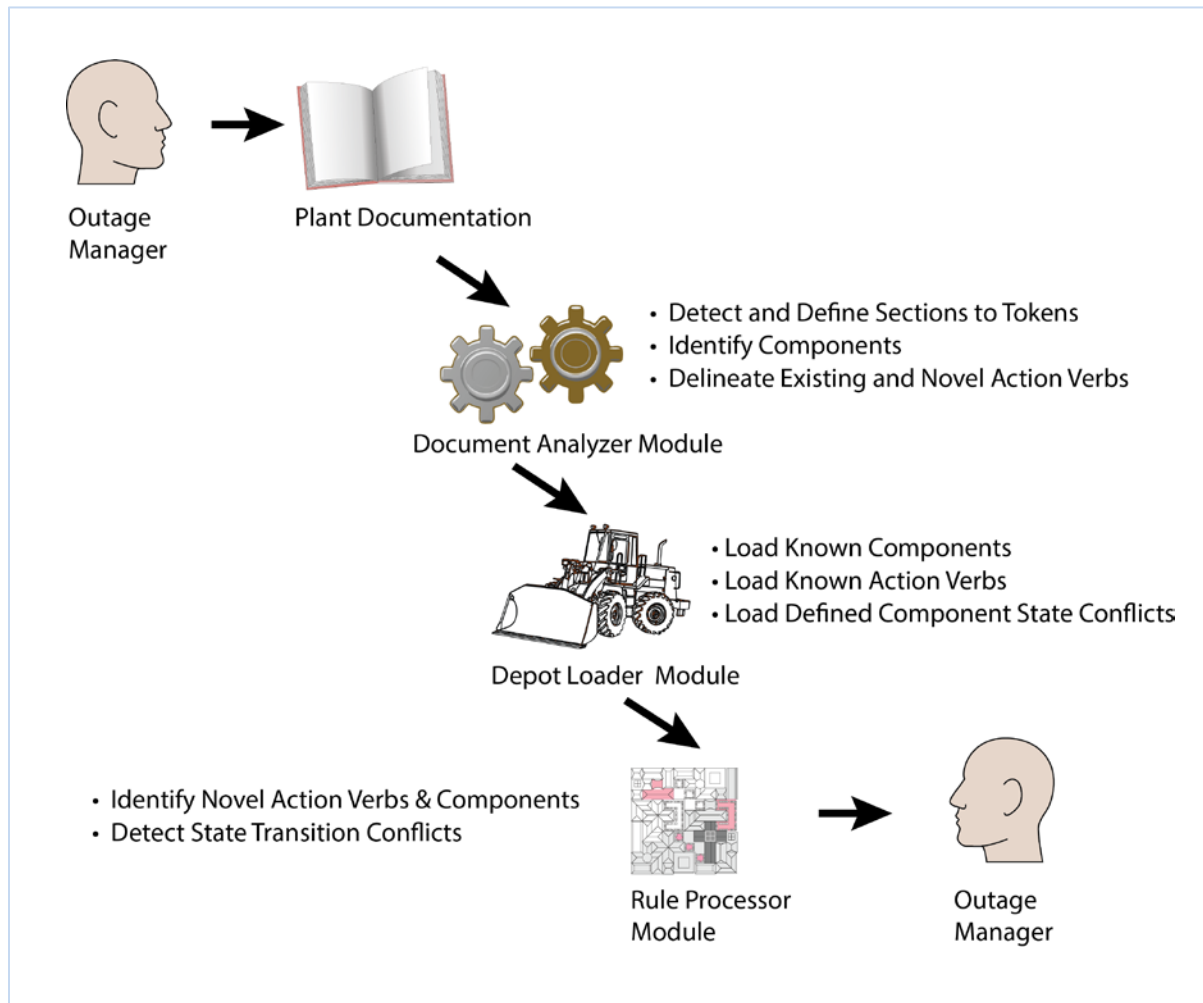
Figure 7. Overall Process for NLP of Procedures.
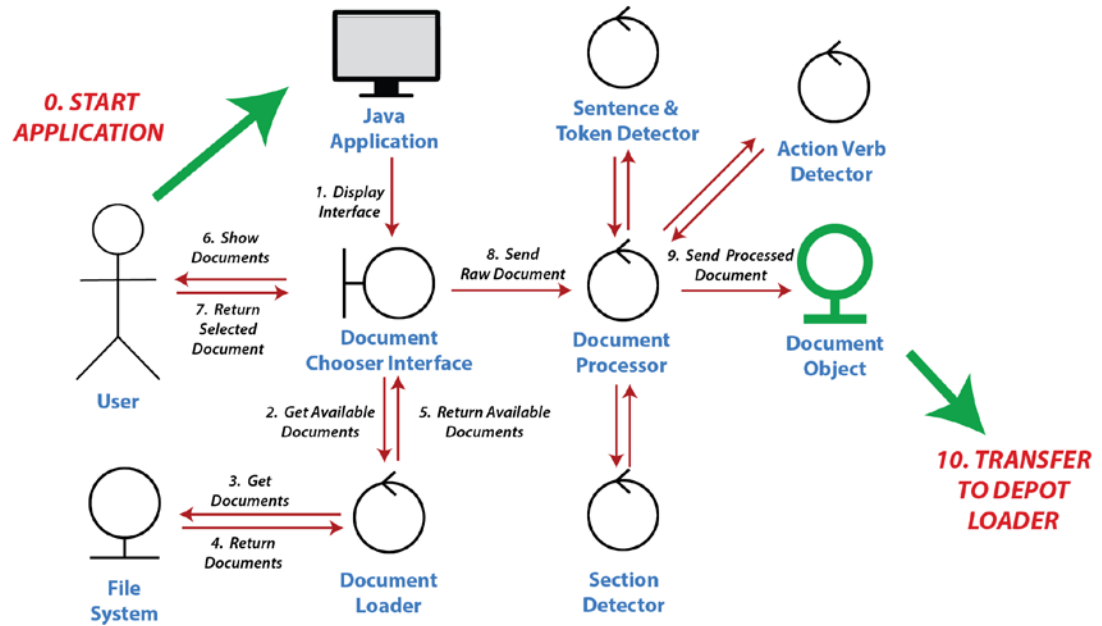
Figure 8. Document Analyzer Module.
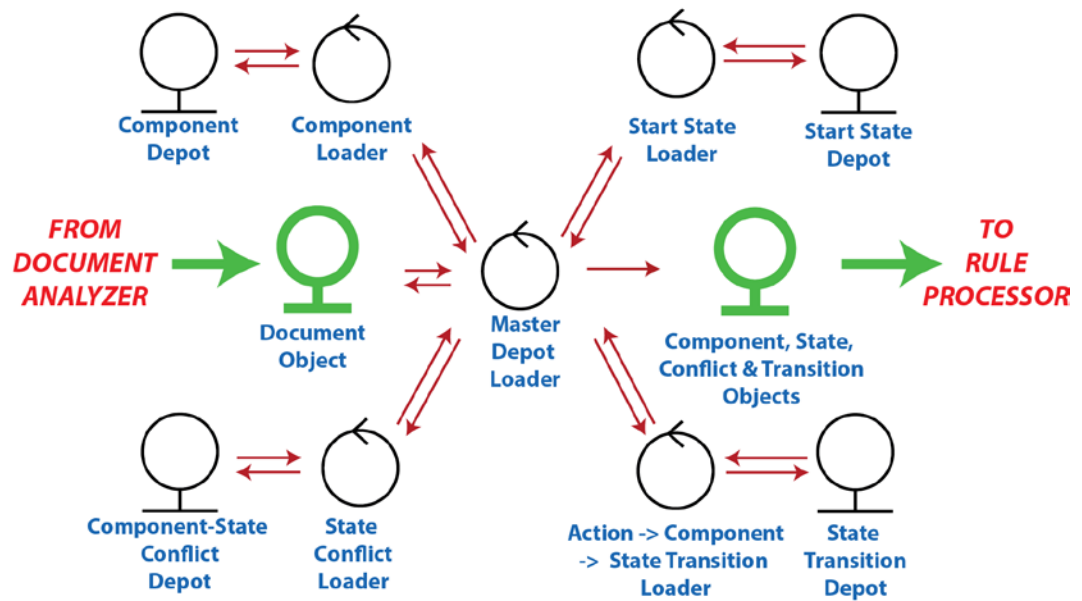
Figure 9. Depot Loader Module.
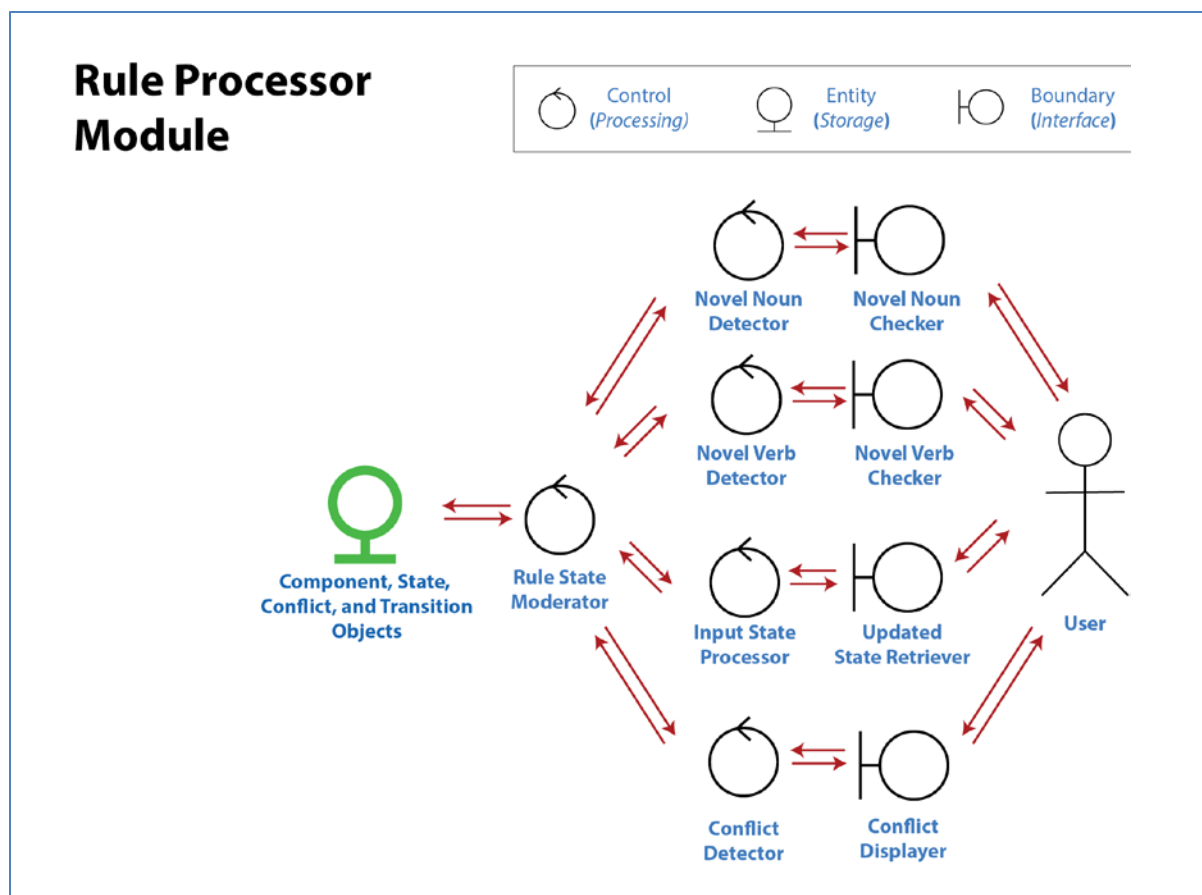
Figure 10. Rule Processor Module.

4.5 Industry Feedback

The OSSREM application design concepts have been shared with industry through several venues. The Outage Risk Management Improvement (ORMI) project, including the OSSREM application, was presented to a group of outage managers at the Westinghouse Outage Optimization Workshop in July 2018 and to industry probabilistic risk analysis (PRA) professionals at the PSAM 14 Conference in September 2018. The application concept was also presented to several utility outage managers through meetings at utilities and at INL. The overall feedback has been positive for both the information contained in the overview display and the idea of processing work orders and procedures using natural language processing techniques to identify component manipulations.

5 CONCLUSIONS

Previous work completed under the ORMI project determined that the cognitive load placed on plant staff to ensure that scheduled work will comply with plant conditions and requirements is very challenging. There is an enormous amount of information related to the current plant conditions and requirements (as well as future conditions and requirements) to consider. It appears that recent advances in data processing and analytics may provide a technology solution to provide a backup to plant operators in ensuring plant work is in compliance with requirements. A combination of data visualization and natural language processing could be employed to develop an advanced requirements monitor to support outage operations. To support further research and development of these techniques, a software

application was developed. The OSSREM application will be used to test the capabilities of natural language processing to extract expected component manipulations and detect conflicts that arise between procedures.

6 REFERENCES

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Appendix A

OSSREM Component Table

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APPENDIX A

OSSREM COMPONENT TABLE

ID	EQID	Noun Name	System	Component Type	Current Actual Position	Current Required Position	Current Required Status	Current Position Requirement reference	Next Operating State Required Position	Next Operating State Required Status	Procedure Requested Position
AFA-P01	AFAP01	Essential Turbine Driven AFW Pump	AF A	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
AFB-P01	AFBP01	Essential Motor Driven AFW Pump	AF B	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
AFN-P01	AFNP01	Non-Essential Motor Driven AFW Pump	AF N	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
CHA-P01	CHAP01	Charging Pump A	CH A	Pump	Running	Any	Protected	Shutdown Safety Plan	Running	OK for Work	Any
CHB-P01	CHBP01	Charging Pump B	CH B	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
CHE-P01	CHEP01	Charging Pump E	CH E	Pump	Standby	Any	OK for Work	N/A	Standby	OK for Work	Any
DG A	DG A	Diesel Generator A	DG A	Generator	Standby	Any	Protected	Shutdown Safety Plan	Any	Protected	Any
DG B	DG B	Diesel Generator B	DG B	Generator	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
DGA-HS-1	DGAHS1	Diesel Generator A Hand Switch	DG A	Switch	Normal	Normal	Protected	Shutdown Safety Plan	Normal	Protected	Normal

DGB-HS-1	DGBHS1	Diesel Generator B Hand Switch	DG B	Switch	Normal	Normal	OK for Work	N/A	Normal	OK for Work	Normal
ECA-E01	ECAE01	Chiller Package A	EC A	Chiller	Running	Any	Protected	Plant Conditions	Running	OK for Work	Running
ECA-P01	ECAP01	Essential Chilled Water Pump A	EC A	Pump	Running	Any	Protected	Plant Conditions	Running	OK for Work	Running
ECB-E01	ECBE01	Chiller Package B	EC B	Chiller	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
ECB-O01	ECBO01	Essential Chilled Water Pump B	EC B	Pump	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
EWA-P01	EWAP01	Essential Cooling Water Pump A	EW A	Pump	Running	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any
EWB-P01	EWBP01	Essential Cooling Water Pump B	EW B	Pump	Running	Any	OK for Work	N/A	Any	Protected	Any
PBA-S03	PBAS03	Class 1E Essential Switchgear A	PB A	Switchgear	Available	Available	Protected	Shutdown Safety Plan	Available	Protected	Available
PBA-S03C	PBAS03C	SPA-P01 Power Supply Breaker	SP A	Breaker	Open	Any	Protected	Shutdown Safety Plan	Any	Protected	Any
PBA-S03D	PBAS03D	SIA-P03 Power Supply Breaker	CS A	Breaker	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any
PBA-S03E	PBAS03E	SIA-P02 Power Supply Breaker	HPSI A	Breaker	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any
PBA-S03F	PBAS03F	SIA-P01 Power Supply Breaker	LPSI A	Breaker	Open	Open	Protected	Open	Open	OK for Work	Open
PBA-S03G	PBAS03G	ECA-E01 Power Supply Breaker	EC A	Breaker	Closed	Any	Protected	Plant Conditions	Closed	OK for Work	Closed
PBA-S03M	PBAS03M	EWA-P01 Power Supply Breaker	EW A	Breaker	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any
PBA-S03S	PBAS03S	AFN-P01 Power Supply Breaker		Breaker	Open	Any	OK for Work	N/A	Any	OK for Work	Any

PBB-S04	PBBS04	Class 1E Essential Switchgear B	PB B	Switchgear	Available	Available	OK for Work	N/A	Available	OK for Work	Available
PBB-S04C	PBBS04C	SPB-P01 Power Supply Breaker	SP B	Breaker	DTO	DTO	OK for Work	N/A	DTO	OK for Work	DTO
PBB-S04D	PBBS04D	SIB-P03 Power Supply Breaker	CS B	Breaker	Open	Any	OK for Work	N/A	Any	Protected	Any
PBB-S04E	PBBS04E	SIB-P02 Power Supply Breaker	HPSI B	Breaker	Open	Any	OK for Work	N/A	Any	Protected	Any
PBB-S04F	PBBS04F	SIB-P01 Power Supply Breaker	LPSI B	Breaker	Open	Any	OK for Work	Shutdown Safety Plan	Open	Protected	Open
PBB-S04G	PBBS04G	ECB-E01 Power Supply Breaker	EC B	Breaker	Open	Any	OK for Work	N/A	Any	OK for Work	Any
PBB-S04M	PBBS04M	EWB-P01 Power Supply Breaker	EW B	Breaker	Open	Any	OK for Work	N/A	Any	Protected	Any
PBB-S04S	PBBS04S	AFB-P01 Power Supply Breaker	AF B	Breaker	Open	Any	OK for Work	N/A	Any	Protected	Any
PCA-E01	PCAE01	Spent Fuel Pool Cooling Heat Exchanger	PC Hx A	Heat Exchanger	In Service	In Service	Protected	Plant Conditions	In Service	Protected	In Service
PCA-P01	PCAP01	Spent Fuel Pool Cooling Pump A	SFP A	Pump	Running	Any	Protected	Plant Conditions	Running	OK for Work	Running
PCB-E01	PCBE01	Spent Fuel Pool Cooling Heat Exchanger	PC HX B	Heat Exchanger	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
PCB-P01	PCBP01	Spent Fuel Pool Cooling Pump B	SFP B	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
SIA-P01	SIAP01	LPSI Pump 1	LPSI A	Pump	Running	Running	Protected	Shutdown Safety Plan	Any	OK for Work	Standby
SIA-P02	SIAP02	HPSI Pump 1	HPSI A	Pump	Standby	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any
SIA-P03	SIAP03	CS Pump 1	CS A	Pump	DT - OOS	DT - OOS	Protected	Shutdown Safety Plan	Running	OK for Work	Any
SIA-UV672	SIAUV672	Spray header isolation valve	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Any

SIB-P01	SIBP01	LPSI Pump 2	LPSI B	Pump	Standby	Any	OK for Work	Shutdown Safety Plan	Standby	Protected	Standby
SIB-P02	SIBP02	HPSI Pump 2	HPSI B	Pump	Standby	Any	OK for Work	N/A	Any	Protected	Any
SIB-P03	SIBP03	CS Pump 2	CS B	Pump	Standby	Any	OK for Work	N/A	Standby	Protected	Any
SIB-UV615	SIBUV615	LPSI Header Injection Valve	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Closed	Protected	Closed
SIB-UV625	SIBUV625	LPSI Header Injection Valve	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Closed	Protected	Closed
SIB-UV671	SIBUV671	Spray header isolation valve	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SPA-P01	SPAP01	Essential Spray Pond Pump A	SP A	Pump	Standby	Any	Protected	Shutdown Safety Plan	Any	Protected	Any
SPB-P01	SPBP01	Essential Spray Pond Pump B	SP B	Pump	DTO	DTO	OK for Work	N/A	DTO	OK for Work	DTO
			Offsite Power		Available	Available	Protected	Shutdown Safety Plan	Available	Protected	Available
		Station Blackout Generator	SBOG	Generator	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
			CT A								
			CT B								
		Containment Hatch	Containment	Door	Open	Open	Protected	Plant Conditions			Open
SIA-HV306	SIAHV0306	LPSI HDR DISCHARGE ISOL TRAIN A	LPSI A	Valve	Closed	Closed	Protected	Closed	Closed	OK for Work	Closed
SIA-HV604	SIAHV0604	HPSI LONG TERM RECIRC ISOL TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-HV605	SIAHV0605	SAFETY INJ TNK 2A ATMOSPHERIC VENT ISOL	SIT B	Valve	Closed	Closed	OK for Work	N/A			Closed
SIA-HV606	SIAHV0606	SAFETY INJ TNK 2B	SIT B	Valve	Closed	Closed	OK for Work	N/A			Closed

		ATMOSPHERIC VENT ISOL								
SIA-HV607	SIAHV0607	SAFETY INJ TNK 1A ATMOSPHERIC VENT ISOL	SIT A	Valve	Closed	Closed	OK for Work	N/A			Closed
SIA-HV608	SIAHV0608	SAFETY INJ TNK 1B ATMOSPHERIC VENT ISOL	SIT A	Valve	Closed	Closed	OK for Work	N/A			Closed
SIA-HV657	SIAHV0657	SDCHE TEMP THROTTLE TRAIN A	LPSI A	Valve	Closed	Closed	Protected	Closed	Closed	OK for Work	Closed
SIA-HV678	SIAHV0678	ISOL TO SDCHE TRAIN A	LPSI A	Valve	Open	Open	Protected	Open	Open	OK for Work	Open
SIA-HV683	SIAHV0683	LPSI PUMP SUCTION ISOL TRAIN A	LPSI A	Valve	Closed	Closed	Protected	Closed	Closed	OK for Work	Closed
SIA-HV684	SIAHV0684	CTMT SPRAY TO SDCHE ISOL TRAIN A	CS A	Valve	Closed	Any	Protected	Plant Conditions	Any	OK for Work	Closed
SIA-HV685	SIAHV0685	LPSI CROSS CONNECT TO SDCHE TRAIN A	LPSI A	Valve	Closed	Closed	Protected	Closed	Closed	OK for Work	Closed
SIA-HV686	SIAHV0686	CROSSOVER VALVE SDCHE AND LPSI HDR TRAIN A	LPSI A	Valve	Open	Open	Protected	Shutdown Safety Plan	Any	OK for Work	Any
SIA-HV687	SIAHV0687	CTMT SPRAY ISOL TRAIN A	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Closed	OK for Work	Closed
SIA-HV688	SIAHV0688	CTMT SPRAY BYPASS TRAIN A	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Open	OK for Work	Open
SIA-HV691	SIAHV0691	SHUTDOWN COOLING WARMUP	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any

		BYPASS CTMT ISOL TRAIN A									
SIA-HV698	SIAHV0698	HPSI HDR DISCARGE ISOL TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-PSV151	SIAPSV0151	RELIEF PRESSURE TO TRAIN A FROM FUEL POOL COOLING	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV161	SIAPSV0161	VALVE PRESSURE CONTMT REICR SUMP TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV162	SIAPSV0162	VALVE RELIEF PRESSURE S/D CLG HTEXCH OUTLET	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV179	SIAPSV0179	VALVE RELIEF PRESSURE LPSI A TO FUEL POOL COOLING	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV194	SIAPSV0194	VALVE RELIEF PRESSURE SHUTDOWN COOLING TRAIN A RETURN	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV285	SIAPSV0285	VALVE RELIEF PRESSURE S/D CLG HTEXCH OUTLET	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV289	SIAPSV0289	VALVE RELIEF PRESSURE TRAIN A RECIRC	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV417	SIAPSV0417	VALVE RELIEF PRESSURE S/D	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any

		CLG BYPASS CS TRAIN A									
SIA-PSV439	SIAPSV0439	VALVE RELIEF PRESSURE HPSI TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-PSV468	SIAPSV0468	VALVE RELIEF PRESSURE LPSI TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-PSV469	SIAPSV0469	VALVE RELIEF PRESSURE HPSI LONG TERM RECIRC TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-UV617	SIAUV0617	VALVE RELIEF PRESSURE SHUTDOWN COOLING LINE TRAIN A	LPSI A	Valve	Closed	Any	Protected	Plant Conditions	Any	OK for Work	Any
SIA-UV617	SIAUV0617	HPSI DISCH HDR CTMT ISOL VLV TRAIN A TO RC LOOP 2A	HPSI A	Valve	Closed	Any	Protected	Plant Conditions	Any	OK for Work	Any
SIA-UV627	SIAUV0627	HPSI 1 FLOW CONTROL TO RC 2B O RC LOOP 2B	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-UV634	SIAUV0634	SAFETY INJ TANK 1A DISCH ISOL	SIT A	Valve	Closed	Closed	Protected	Plant Conditions			Closed
SIA-UV635	SIAUV0635	LPSI DISCH HDR CTMT ISOL VLV TRAIN A TO RC LOOP 1A	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-UV637	SIAUV0637	HPSI DISCH HDR CTMT ISOL VLV TRAIN A TO RC LOOP 1A	HPSI A	Valve	Closed	Any	Protected	Plant Conditions		OK for Work	Closed

SIA-UV644	SIAUV0644	SAFETY INJ TANK 1B DISCH ISOL	SIT A	Valve	Closed	Closed	Protected	Plant Conditions			Closed
SIA-UV645	SIAUV0645	LPSI DISCH HDR CTMT ISOL VLV TRAIN A TO RC LOOP 1B	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-UV647	SIAUV0647	HPSI DISCH HDR CTMT ISOL VLV TRAIN A TO RC LOOP 1B	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-UV651	SIAUV0651	SHUTDOWN COOLING SUCTION ISOL VLV TRAIN A	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-UV655	SIAUV0655	SHUTDOWN COOLING SUCTION CTMT ISOL VLV TRAIN A	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-UV660	SIAUV0660	SI PUMPS RECIRC TO RWT TRAIN A	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-UV664	SIAUV0664	CTMT SPRAY PUMP RECIRC TO RWT TRAIN A	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Open
SIA-UV666	SIAUV0666	HPSI PUMP RECIRC TO RWT TRAIN A	HPSI A	Valve	Open	Any	Protected	Shutdown Safety Plan		OK for Work	Open
SIA-UV669	SIAUV0669	LPSI PUMP RECIRC TO RWT TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-UV672	SIAUV0672	CTMT SPRAY CONTROL VLV TRAIN A	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed

SIA-UV673	SIAUV0673	CONTAINMENT SUMP ISOLATION VALVE TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-UV674	SIAUV0674	CONTAINMENT SUMP ISOLATION VALVE TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-UV682	SIAUV0682	SAFETY INJ TNK FILL LINE CTMT ISOL	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIB-HV307	SIBHV0307	LPSI HDR DISCHARGE ISOL TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Closed	Protected	Open
SIB-HV609	SIBHV0609	HPSI LONG TERM RECIRC ISOL VLV TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-HV613	SIBHV0613	SAFETY INJ TNK 2A ATMOSPHERIC VENT ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-HV623	SIBHV0623	SAFETY INJ TNK 2B ATMOSPHERIC VENT ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-HV633	SIBHV0633	SAFETY INJ TNK 1A ATMOSPHERIC VENT ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-HV643	SIBHV0643	SAFETY INJ TNK 1B ATMOSPHERIC VENT ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any

SIB-HV658	SIBHV0658	SDCHE TEMP THROTTLE VLV TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Closed	Protected	Closed
SIB-HV679	SIBHV0679	ISOL VALVE TO SDCHE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Closed	Protected	Closed
SIB-HV689	SIBHV0689	CTMT SPRAY TO SDCHE ISOL TRAIN B	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Open
SIB-HV690	SIBHV0690	SHUTDOWN COOLING WARMUP BYPASS CTMT ISOL TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Shutdown Safety Plan	Any	Protected	Open
SIB-HV692	SIBHV0692	LPSI PUMP SUCTION ISOL TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-HV693	SIBHV0693	CTMT SPRAY BYPASS TRAIN B	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-HV694	SIBHV0694	LPSI CROSS CONNECT TO SDCHE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-HV695	SIBHV0695	CTMT SPRAY ISOL TRAIN B	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-HV696	SIBHV0696	CROSSOVER SDCHE AND LPSI HDR TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Closed
SIB-HV699	SIBHV0699	HPSI HDR DISCARGE ISOL TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-PSV141	SIBPSV0141	PRESSURE CONTAINMENT RECIRC SUMP B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV166	SIBPSV0166	TRAIN B PRESSURE TO TRAIN B FROM	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

		FUEL POOL COOLING								
SIB-PSV169	SIBPSV0169	RELIEF PRESSURE HPSI LONG TERM RECIRC TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-PSV189	SIBPSV0189	RELIEF PRESSURE SHUTDOWN COOLING LINE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV191	SIBPSV0191	RELIEF PRESSURE SHUTDOWN COOLING TRAIN B RETURN	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV192	SIBPSV0192	RELIEF PRESSURE ON S/D CLG HTEXCH OUTLET	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV193	SIBPSV0193	RELIEF PRESSURE LPSI B TO FUEL POOL CLG	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV286	SIBPSV0286	RELIEF PRESSURE DISCHARGE S/D CLG HTEXCH TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV287	SIBPSV0287	RELIEF PRESSURE TRAIN B RECIRC ECCS PUMPS	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-PSV409	SIBPSV0409	RELIEF PRESSURE TO	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

		S/D CLG BYPASS CS TRAIN B									
SIB-PSV449	SIBPSV0449	RELIEF PRESSURE HPSI B TO EDT	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-UV322	SIBUV0322	RELIEF PRESSURE LPSI TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV614	SIBUV0614	SAFETY INJ TANK 2A DISCH ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV615	SIBUV0615	LPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 2A	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV616	SIBUV0616	HPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 2A	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-UV618	SIBUV0618	SAFETY INJECTION TANK 2A CK VLV LEAKAGE LINE ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV624	SIBUV0624	SAFETY INJ TANK 2B DISCH ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV625	SIBUV0625	LPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 2B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV626	SIBUV0626	HPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 2B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any

SIB-UV628	SIBUV0628	SAFETY INJECTION TANK 2B CK VLV LEAKAGE LINE ISOL	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV636	SIBUV0636	HPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 1A	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-UV638	SIBUV0638	SAFETY INJECTION TANK 1A ISOL ON CK VLV LEAKAGE LINE	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV646	SIBUV0646	HPSI DISCH HDR CTMT ISOL VLV TRAIN B TO RC LOOP 1B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-UV648	SIBUV0648	SAFETY INJECTION TANK 1B ISOL ON CK VLV LEAKAGE LINE	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIB-UV652	SIBUV0652	SHUTDOWN COOLING SUCTION ISOL VLV TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV656	SIBUV0656	SHUTDOWN COOLING SUCTION CTMT ISOL VLV TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV659	SIBUV0659	SI PUMPS RECIRC TO RWT TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

SIB-UV665	SIBUV0665	CTMT SPRAY PUMP RECIRC TO RWT TRAIN B	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-UV667	SIBUV0667	HPSI PUMP RECIRC TO RWT TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-UV668	SIBUV0668	LPSI PUMP RECIRC TO RWT TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV671	SIBUV0671	CTMT SPRAY CONTROL VLV TRAIN B	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-UV675	SIBUV0675	CONTAINMENT SUMP ISOLATION VALVE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-UV676	SIBUV0676	CONTAINMENT SUMP ISOLATION VALVE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIC-HV321	SICHV0321	HPSI LONG TERM RECIRC CTMT ISOL TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIC-UV653	SICUV0653	SHUTDOWN COOLING SUCTION CTMT ISOL VLV TRAIN A	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SID-HV331	SIDHV0331	HPSI LONG TERM RECIRC CTMT ISOL TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SID-UV654	SIDUV0654	SHUTDOWN COOLING SUCTION CTMT	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

		ISOL VLV TRAIN B									
SIE-PSV221	SIEPSV0221	RELIEF PRESSURE SAFETY INJECTION TANK 2A	SIT A	Valve	Closed	Any	OK for Work	N/A			Any
SIE-PSV231	SIEPSV0231	RELIEF PRESSURE SAFETY INJECTION TANK 2B	SIT B	Valve	Closed	Any	OK for Work	N/A			Any
SIEP-SV241	SIEPSV0241	RELIEF PRESSURE SAFETY INJECTION TANK 1A	SIT A	Valve	Closed	Any	OK for Work	N/A			Any
SIE-PSV288	SIEPSV0288	RELIEF PRESSURE SAFETY INJECTION TANK 1B	SIT A	Valve	Closed	Any	OK for Work	N/A			Any
SIA-V005	SIAV005	ROOT FOR PRESSURE POINT SUCTION LPSI P-1	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V006	SIAV006	ROOT FOR PRESSURE POINT SUCTION LPSI P-1	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V007	SIAV007	ROOT FOR PRESSURE POINT SUCTION CSP P-1	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Open
SIA-V009	SIAV009	ROOT FOR PRESSURE	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Open

SIA-V016	SIAV016	POINT SUCTION CSP P-1									
SIA-V016	SIAV016	ROOT FOR PRESSURE POINT SUCTION HPSI P-1	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V018	SIAV018	ROOT FOR PRESSURE POINT DISCHARGE CSP P-1	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Open
SIA-V023	SIAV023	SHUTDN COOL LOOP 1	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V028	SIAV028	DRAIN ON HPSI RECIR	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V032	SIAV032	VENT ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V037	SIAV037	DRAIN ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V039	SIAV039	VENT ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V046	SIAV046	VENT HP RECIRC LOOP 1	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V047	SIAV047	VENT ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V068	SIAV068	DRAIN ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V069	SIAV069	LPSI RECIRC	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V070	SIAV070	DRAIN LPSI DISCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V071	SIAV071	DRAIN CS PP A DISCH	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V080	SIAV080	DRAIN CS PP A DISCH	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed

SIA-V081	SIAV081	VENT LPSI/SHTNDN HTEXCH DISCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V083	SIAV083	DRAIN SHTDN HTEXCH DISCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V084	SIAV084	VENT CS HEADER DISC	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V088	SIAV088	DRAIN CS HEADER DISC	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V089	SIAV089	VENT LPSI DISCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V1006	SIAV1006	VENT SHUTDN HTEXCH 1 DISCH TO CS HEADER	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V1010	SIAV1010	VENT HPSI LONG TERM RECIRC TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V1012	SIAV1012	VENT SHUTDOWN HEAT EXCHANGER TRAIN A TO SHTDN PURIFICATION	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V1024	SIAV1024	VENT TRAIN A CS HEADER DISCHARGE	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V1028	SIAV1028	VENT ON HPSI TRAIN A DISCHARGE	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V1030	SIAV1030	VENT VALVE FOR LINE 01PSIAL089 TO CS HDR NO. 1	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V157	SIAV157	VENT VALVE FOR LINE	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any

		01PSIAL307, SUMP RECIRC									
SIA-V164	SIAV164	SUCTION LINE TO CS PMP SIA-P03	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V184	SIAV184	DISCHARGE SHUTDOWN COOLING TRAIN A FOR CTMT SPRAY	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V184	SIAV184	CS PP A ALTERNATE SUCTION LINE	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V257	SIAV257	TEST RECIR SUMP SUCTION	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V260	SIAV260	SAMPLE POINT SHTDN CLN HTEXCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V262	SIAV262	ROOT VALVE ESF SUMP A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V404	SIAV404	ISOL TO EDT FROM SHTNDWN CLN HTEXCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V424	SIAV424	HPSI A DISCH TEST PT	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V434	SIAV434	ROOT FOR SAMPLE COOLER AX-12	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V485	SIAV485	ROOT FOR SAMPLE COOLER AX-12	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V551	SIAV551	LPSI PP A SUCT DRN/TEST	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V552	SIAV552	CS PP A SUCT DRN/TEST	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed

SIA-V807	SIAV807	TEST TO PRESSURE POINT HPSI PMP SUCT	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V811	SIAV811	VENT SHUTDN HTEXCH 1	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V817	SIAV817	DRAIN HPSI DISCH TO CHARGING SYSTEM	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V819	SIAV819	VENT SHTDN COOLING TO FUEL POOL COOLING	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V820	SIAV820	VENT ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V821	SIAV821	VENT HP RECIRC LOOP 1	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V824	SIAV824	ISOL TO CHARGING SYSTEM DRAIN LINE	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V828	SIAV828	VENT OFF HPSI DISCHARGE TO RC LOOP 2A TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V833	SIAV833	VENT LPSIR RECIRCULATION SUCTION	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V836	SIAV836	VENT OFF HPSI DISCHARGE TO RC LOOP 1A TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V839	SIAV839	VENT OFF HPSI DISCHARGE TO	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed

		RC LOOP 1B TRAIN A								
SIA-V840	SIAV840	DRAIN & TEST OFF HPSI LONG TERM RECIRC TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V841	SIAV841	LPSI PP 1 DISCH VENT	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V848	SIAV848	VENT CS PP A DISCH	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V849	SIAV849	VENT ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V850	SIAV850	DRAIN ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V851	SIAV851	VENT HP RECIRC LOOP 1	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V856	SIAV856	DRAIN HP RECIRC LOOP 1	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V859	SIAV859	SHUTDN CLNG LOOP 1 VENT	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V864	SIAV864	DRAIN & TEST OFF HPSI LONG TERM RECIRC TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V866	SIAV866	DRAIN RECIR SUMP DISCH	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V874	SIAV874	VENT OFF HPSI DISCHARGE TO RC LOOP 2B TRAIN A	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V876	SIAV876	DRAIN & TEST OFF LPSI DISCHARGE TO RC LOOP 1B TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any

SIA-V908	SIAV908	VENT & TEST OFF SUCTION LINE TO SHUTDOWN COOLING TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V909	SIAV909	DRAIN & TEST OFF LPSI DISCHARGE TO RC LOOP 1A TRAIN A	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V951	SIAV951	SHUTDN CLNG LOOP 1 VENT	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V955	SIAV955	DRAIN ON HPSI DISCH	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V956	SIAV956	HPSI PUMP A DRAIN	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V959	SIAV959	HPSI PUMP A DRAIN	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-V960	SIAV960	LPSI PP A SUCT STRNR PRESS TAP ISOL	LPSI A	Valve	Open	Any	Protected	Any	Any	OK for Work	Any
SIA-V976	SIAV976	CS PP A SUCTION STRAINER PRESS TAP ISOL	CS A	Valve	Open	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Open
SIA-V977	SIAV977	CS PP A CASING VENT VA MK NO GB15S2GN2	CS A	Valve	Closed	Any	Protected	Shutdown Safety Plan	Any	OK for Work	Closed
SIA-V980	SIAV980	LPSI PMP SIA-P01 CASING VENT VA MK NO GB15S2GN2	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-V981	SIAV981	HPSI PP A CASING DRAIN	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed

		VALVE VA MK NO GB15S2GN2								
SIA-V997	SIAV997	HPSI PP A CASING VENT VALVE VA MK NO GB15S2GN2	HPSI A	Valve	Closed	Any	Protected	Shutdown Safety Plan		OK for Work	Closed
SIA-VA10	SIAVA10	VENT LPSI / SHUTDOWN HEAT EXCHANGER DISCHARGE	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-VA13	SIAVA13	VENT AND TEST CONNECTION FOR LINE SIAL516	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-VA19	SIAVA19	DRAIN AND TEST CONNECTION FOR LINE SIAL516	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-VA21	SIAVA21	DRAIN/FILL ISOLATION VALVE ON CNTMNT RECIR SUMP DISCH LINE 3PSIAL307	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-VA25	SIAVA25	DRAIN/FILL ISOLATION VALVE ON CNTMNT RECIR SUMP DISCH LINE 3PSIAL307	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any
SIA-VA29	SIAVA29	VENT ISOLATION & TEST VALVE CNTMNT RECIR	LPSI A	Valve	Closed	Any	Protected	Any	Any	OK for Work	Any

		SUMP LINE (INBOARD)									
SIB-V11	SIBV011	ISOLATION VALVE ON COMMON DRAIN/FILL HEADER FOR CNTMNT SUMP RECIRC LINE	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V12	SIBV012	ROOT FOR PRESSURE POINT HPSI PUMP SUCT.	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V13	SIBV013	ROOT FOR PRESS POINT SUCT CSP P-2	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V14	SIBV014	ROOT FOR PRESS POINT SUCT CSP P-2	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V15	SIBV015	ROOT TO PRESSURE POINT SUCTION LPSI SIB-P01	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V17	SIBV017	ROOT TO PRESSURE POINT SUCTION LPSI SIB-P01	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V19	SIBV019	ROOT FOR PRESSURE POINT DISCHARGE CSP P-2	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V24	SIBV024	SHUTDOWN CLNG LOOP 2	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V30	SIBV030	DRAIN ON HPSI RECIR	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any

SIB-V31	SIBV031	VENT ON HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V40	SIBV040	DRAIN AND FLUSH ON HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V41	SIBV041	DRAIN HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V42	SIBV042	VENT ON HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V45	SIBV045	VENT ON HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V50	SIBV050	VENT HPSI TRAIN B LONG TERM RECIRC	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V73	SIBV073	DRAIN ON HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V74	SIBV074	DRAIN CS DISCH	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V75	SIBV075	DRAIN CS DISCH	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V90	SIBV090	DRAIN LPSI DISCH PMP 2	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V91	SIBV091	VENT CS HEADER LINE	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V92	SIBV092	VENT CS HEADER LINE	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V93	SIBV093	DRAIN CS HEADER LINE	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V94	SIBV094	VENT LPSI AND SHTNDN HTEX DISCH	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V96	SIBV096	VENT LPSI DISCH	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V97	SIBV097	VENT INLET SHUTDN HX	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

SIB-V1007	SIBV1007	DRAIN OFF LPSI DISCHARGE TO RC LOOP 2A TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V1011	SIBV1011	VENT HPSI LONG TERM RECIRC TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V1025	SIBV1025	VENT SHUTDOWN HEAT EXCHANGER TRAIN B TO SHTDN PURIFICATION	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V1029	SIBV1029	VENT ON HPSI TRAIN B DISCHARGE	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V158	SIBV158	VENT VALVE FOR LINE 01PSIBL194 SD CLG RETURN	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V185	SIBV185	CS PP B ALTERNATE SUCTION	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V206	SIBV206	SAMPLE POINT SHTDN COOLING HEAT ENHANCER	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V264	SIBV264	TEST ON RECIR SUMP SUCTION	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V266	SIBV266	ROOT TO ESF SUMP B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V405	SIBV405	ISOL TO EDT FROM SHTDWN CLN HTEXC	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

SIB-V408	SIBV408	HPSI PUMP SIB-P02 DISCHARGE	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V426	SIBV426	HPSI B DISCH TEST PT	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V445	SIBV445	ROOT FOR SAMPLE COOLER AX-13	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V446	SIBV446	ROOT FOR SAMPLE COOLER AX-13	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V554	SIBV554	TEST TO PRESSURE POINT HPSI PUMP SUCTION	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V555	SIBV555	CS PP B SUCTION LINE TEST AND FLUSH CONN	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V814	SIBV814	LPSI PP B SUCT DRN/TEST	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V825	SIBV825	DRAIN SHTNDN HTEX DISCH	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V829	SIBV829	VENT OFF HPSI DISCHARGE TO RC LOOP 2A TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V831	SIBV831	VENT LPSI RECIRC SUCTION	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V832	SIBV832	DRAIN & TEST OFF LPSI DISCHARGE TO RC LOOP 2B TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V834	SIBV834	DRAIN/TEST HPSI TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any

		LONG TERM RECIRC									
SIB-V837	SIBV837	VENT OFF HPSI DISCHARGE TO RC LOOP 1A TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V842	SIBV842	VENT OFF HPSI DISCHARGE TO RC LOOP 1B TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V843	SIBV843	LPSI PMP 2 DISCH VENT	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V852	SIBV852	CS PP B DISCH LN VENT	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V853	SIBV853	VENT HPSI LONG TERM RECIRC	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V854	SIBV854	DRAIN HPSI LONG TERM RECIRC	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V855	SIBV855	VENT HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V861	SIBV861	DRAIN HPSI DISCH	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V862	SIBV862	VENT LPSI RECIRC	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V867	SIBV867	DRAIN RECIR. SUMP DISCH	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V869	SIBV869	VENT OFF HPSI DISCHARGE TO RC LOOP 2B TRAIN B	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V870	SIBV870	TEST OFF SUCTION LINE TO SHUTDOWN	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

		COOLING TRAIN B									
SIB-V871	SIBV871	VENT & TEST SHUTDOWN COOLING SUCTION LINE TRAIN B	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V886	SIBV886	TEST HPSI TRAIN B LONG TERM RECIRC	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V891	SIBV891	SHUTDOWN CLNG LOOP 2 VENT	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V895	SIBV895	VENT ON DISCHARGE SHUTDOWN COOLING TRAIN B FOR CTMT SPRAY	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V896	SIBV896	VENT SHUTDOWN HEAT EXCHANGER TRAIN B TO SHTDN PURIFICATION	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V910	SIBV910	DRAIN VALVE SHUTDOWN COOLING HEAT EXCHANGER TRAIN B TO SHUTDOWN PURIFICATION	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V952	SIBV952	VENT FUEL POOL COOLING LINE	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

SIB-V953	SIBV953	DRAIN HPSI DISCHARGE	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V954	SIBV954	HPSI PUMP B DRAIN	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V961	SIBV961	HPSI PUMP B DRAIN	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V962	SIBV962	CS PUMP B SUCTION STRAINER PRESS TAP ISOLATION	CS B	Valve	Closed	Any	OK for Work	N/A	Any	Protected	Any
SIB-V978	SIBV978	LPSI PP B SUCTION STRNR. PRESS TAP ISOL	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V979	SIBV979	CONTAINMENT SPRAY PUMP CASING VENT VA MK NO GB15S2GN2	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V982	SIBV982	LPSI PUMP B CASING VENT VA MK NO GB15S2GN2	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-V983	SIBV983	HPSI PUMP SIB-P02 CASING DRAIN VALVE VA MK NO GB15S2GN2	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-V998	SIBV998	HPSI PUMP SIB-P02 CASING VENT VA MK NO GB15S2GN2	HPSI B	Valve	Closed	Any	OK for Work	N/A		Protected	Any
SIB-VA15	SIBVA15	VENT LPSI / SHUTDOWN HEAT	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any

		EXCHANGER DISCHARGE									
SIB-VA18	SIBVA18	VENT AND TEST CONNECTION FOR LINE SIBL517	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-VA20	SIBVA20	DRAIN AND TEST CONNECTION FOR LINE SIBL517	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-VA22	SIBVA22	DRAIN/FILL ISOLATION VALVE ON CNTMNT RECIR SUMP DISCH LINE 1PSIBL308	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-VA26	SIBVA26	DRAIN/FILL ISOLATION VALVE ON CNTMNT RECIR SUMP DISCH LINE 3PSIBL308	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
SIB-VA30	SIBVA30	VENT ISOLATION & TEST VALVE CNTMNT RECIR SUMP LINE (INBOARD)	LPSI B	Valve	Closed	Any	OK for Work	Any	Any	Protected	Any
	RCEP01A	Reactor Coolant Pump 1A	RCP 1A	Pump	Running	Any	Protected	N/A	Any	OK for Work	Any
	RCEP01B	Reactor Coolant Pump 1B	RCP 1B	Pump	Running	Any	OK for Work	N/A	Any	Protected	Any
	RCEP02A	Reactor Coolant Pump 2A	RCP 2A	Pump	Running	Any	Protected	N/A	Any	OK for Work	Any

	RCEP02B	Reactor Coolant Pump 2B	RCP 2B	Pump	Running	Any	OK for Work	N/A	Any	Protected	Any
	FWNP01A	Main Feedwater Pump A	FWP A	Pump	Standby	Any	OK for Work	N/A	Any	OK for Work	Any
	FWNP01B	Main Feedwater Pump B	FWP B	Pump	Standby	Any	OK for Work	N/A	Standby	Protected	Any

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