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ICPP Fluorinel Dissolution Process (FDP)
Plant Protection System (PPS)
Baseline Criteria Evaluation

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**ICPP FLUORINEL DISSOLUTION PROCESS (FDP)
PLANT PROTECTION SYSTEM (PPS)
BASELINE CRITERIA EVALUATION**

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June 1993

**Westinghouse Idaho
Nuclear Company, Inc.**

**PREPARED FOR THE
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
UNDER CONTRACT DE-AC07-84ID12435**

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ATTACHMENTS

Appendix A: Plant Protection System Requirements Manual Evaluation
Appendix B: FAST PPS References

1. PURPOSE

This report documents a baseline criteria evaluation of the FAST Plant Protection System (PPS) at the Idaho Chemical Processing Plant (ICPP). Westinghouse Idaho Nuclear Company (WINCO), Computer Process Application (CPA) personnel originally prepared this report as requested by the FAST Fluorine Dissolution Process (FDP) Operational Readiness Review (ORR) committee. It was required by the ORR committee for the 1992 restart of FDP operations. However on April 29, 1992, the Department of Energy (DOE) directed WINCO to discontinue reprocessing of spent nuclear fuel at the ICPP. This eliminated the mission of the FDP.

The report includes an evaluation of the PPS against criteria requested by the ORR committee and against criteria contained in the WINCO PPS Requirements Manual. This second criteria evaluation is summarized in Appendix A.

2. SYSTEM DESCRIPTION

The PPS prevents criticality at FDP. Therefore, it is imperative that the PPS function in a predictable, reliable, and fail-safe manner as set forth in the FDP design documents. The PPS is a process monitoring system. It controls interlock permissives, which trip process operations when a potential criticality hazard is sensed. The PPS cannot be reset until all monitored process conditions are within safe operating parameters. The PPS does not return or change any violated parameter to previous operating conditions.

FDP last operated in 1988. Between 1988 and 1992, WINCO implemented a number of FDP operational changes that affected the PPS configuration. These changes include:

- Steady-state heel is no longer used as a basis for continued operations. The PPS now calculates a dissolution efficiency. The dissolution efficiency calculation must range between 95 to 105 percent for FDP operations to continue without a heelout. It assumes that during normal operations the end-of-the-run heel is below 1 kg.
- Eliminated the sulfuric acid (for stainless steel heelout) and zirconyl nitrate systems.
- Eliminated feed tank samples (except in cases where the reagent is suspect). FDP operators can use the reagent without resampling it once the sample is certified as within specifications.
- Upgraded several PPS hardware components for improved system reliability and assured continued availability of parts. The PPS hardware upgrades include:
 1. Replacement of operator terminals and the control room line printer.
 2. Replacement of CPU boards.

3. APPLICATION

3.1 Configuration Control

CPA personnel evaluated the FDP PPS in nine categories of configuration control. Each of these categories are discussed below. Overall the system complies with all the original requirements. Hardware upgrades to the computer system have increased reliability while adhering to new requirements. Configuration control areas needing attention include:

1. As-building PPS support drawings.
2. Updating vendor data files.
3. Incorporating the current vendor data into controlled plant documents.

3.1.1 Design Criteria

The original *Design Criteria for Fluorinel Process* was last revised in October 1980. This revision included the FDP PPS. It was based on criteria established in the *Idaho Chemical Processing Plant (ICPP) Requirements and Guidelines for Plant Protection System (PPS) Projects*. Since the original PPS installation, any changes to the PPS were based on criteria contained in this document.

3.1.2 System Design

General Atomics (the PPS vendor) provided the original PPS design from a specification written by ENICO (Exxon Nuclear Idaho, Co.), which is based on original design criteria. The system design has evolved in an orderly and controlled manner. Generally, since FDP Phase I Operations, one PPS System Engineer has maintained the system design continuity. According to Standard Operating Procedures (WE-8 and WE-25) WINCO implemented PPS hardware design changes through Engineering Change Requests (ECRs). PPS software changes were

implemented through Software Change Requests (SCRs). Any changes were, and currently are, automatically classified as Safety Class I due to the PPS role in preventing criticalities. Currently WE-25 requires that all changes are approved through an Engineering Change Board (ECB), a Computer System Change Board (CSCB), or both, and DOE-ID.

In addition to the ECRs and SCRS, the hardware (or software) change requester generates an Engineering Design Input (EDI). Operational Safety and Analysis (OSA) generates a Safety Assessment Document (SAD). WE-5 requires these documents for a complete design. The ECR Board, and/or the SCR Board, and DOE-ID must review and approve these documents before the System Engineer implements any changes on the PPS. Survey of the PPS design documents by CPA shows good compliance of system design as required by written procedures. The surveyed documents included in references in Appendix B.

3.1.3 As Built Drawings

Drawings for the FDP PPS exist in two forms:

1. WINCO plant controlled drawings that show the PPS field configuration.
2. Vendor supplied drawings that show the PPS computer system.

Reviews of the WINCO controlled drawings for this report showed that essential plant drawings are up-to-date. Essential plant drawings are defined by the facility manager, the system engineer, Nuclear and Industrial Safety (N&IS), Operational Safety Analysis (OSA), and Engineering Programs as drawings that directly support the safe operation of the FDP facility (such as the P&ID and instrument loop diagrams).

However, review of support drawings indicate that numerous errors and inconsistencies exist. Support drawings describe the design details of equipment, components, or systems (such as wire termination diagrams and

vendor converted drawings). Some of these active drawings still show the PPS configuration as it appeared before the FDP Phase II Construction. Although the essential drawings for FDP operations appear in good condition, many PPS support drawings need as-built revisions.

3.1.4 Software Control

Software control for the PPS is governed by WINCO procedure WE-25, *Plant Process Computer System Change Control*. The PPS computer located at CPP-666 is strictly for production purposes. A separate computer located at CPP-1631 is dedicated to system and software development.

Both computers run the iRMX operating system. The iRMX operating system enables file access control and prevents unauthorized users from copying, modifying, or destroying valuable data. The PPS System Engineer writes and compiles programs using the PLM86 programming language. The vendor supplies both the operating system and the programming language, which are standard Intel software packages. The PPS System Engineer maintains a detailed inventory list of the PPS software. This list includes version and serial numbers for each piece of commercial software. None of the software contains classified information. General purpose programming is not allowed on the PPS development computer. The PPS System Engineer controls approved process changes, the software maintenance, and additions on the PPS development computer per the Software Configuration Management (SCMP).

Users cannot gain access or make modifications to the underlying PPS operating system. The software application for the PPS protects the operating system. The PPS development computer uses passwords, which allow access to the operating system. The Computer System Security Officer (CSSO) controls all passwords on the development computer. Classified data is further protected with the "Super User" password requirement. Passwords are machine generated and are changed every six months.

The PPS System Engineer maintains the source code on the development computer. The software is field tested on the production PPS at FDP by the System Engineer and other test personnel. The field test is conducted at CPP-666 due to limited testing capabilities on the development computer. The production PPS computer at CPP-666 does not contain a disk system. Therefore, the operating system, new versions of the control software from the development computer, and the process fuel data are programmed onto Erasable Programmable Read Only Memory (EPROM). The EPROM chips are installed and tested on the production PPS computer before each campaign. The PPS System Engineer must make and install new EPROMS to correct any errors that are found during testing of the control logic.

The PPS System Engineer maintains a hardcopy computer program source code printout. Recently, the engineer designed all new software configuration on the Computer Aided Software Engineering (CASE) system. The CASE design allows the PPS System Engineer more control and better review of the software development than previously available. The PPS System Engineer will continue to use CASE design for any future PPS software changes.

3.1.5 Specifications

A number of specifications exist for the FDP PPS. These are listed in Appendix B for reference. The Fluorinel and Storage Facility (FAST) project engineers for Exxon Nuclear Incorporated, Company (ENICO) wrote the original design, purchase, installation, and software specifications. WINCO does not have a program to maintain original design specifications. Therefore, the original PPS specifications were not maintained to reflect changes since the ENICO FDP Phase I Construction.

Fluor Technology (the Phase II Architect-Engineer) wrote a number of new, demolition, fabrication, and installation specifications for the PPS during FDP Phase II Construction. These changes included:

1. Dissolver/complexer level heel controls.
2. Dissolver lid closure controls.
3. Complexer to PTV steam jet temperature interlocks.
4. Poison monitor modifications.

The FAST PPS System Engineers implemented Phase II software changes through ECRs and SCRS. They also altered the flow charts from the original software specification to show the new configuration. Flow charts were attached to the SCRS. However, changes were not incorporated into the original software specification.

The System Engineer has implemented numerous PPS modifications since FDP Phase II. He used ECRs, SCRS, and Work Orders (WOs) after receiving change requests from various WINCO departments. Most hardware changes replaced existing old components with similar new components. These similar replacement components serve the same functions as the original components and replaces obsolete equipment. Since there is no change in function, and performance is maintained, the replacement components comply with existing system specifications.

For any other changes since the FDP Phase II, the Engineering Department generates detailed design drawings and specifications to accompany PPS hardware design packages. Software design packages for these changes include revised flow diagrams. The flow diagrams are taken from the original software specification and are attached to the applicable SCR. However, the original PPS software specifications have not been updated. The PPS System Engineer implemented the most recent PPS software changes with CASE tools. In an effort to replace the original software specification, the System Engineer will make future changes by using the CASE tool.

WINCO maintains the PPS functional specifications (or system descriptions) throughout the life of the PPS. The Operational Safety Assessment (OSA) group frequently updates the Plant Safety Document (PSD). The PSD includes a

section that describes the PPS and an appendix for the PPS Probabilistic Risk Assessment (PRA).

3.1.6 Vendor Data

The original PPS vendor data information file appears to be complete. However, changes to the PPS make much of this information obsolete. For example, the PPS System Engineer replaced the PPS Central Processing Unit (CPU) boards, operator terminals, and the line printer with newer and more reliable equipment. Currently, WINCO procedures do not contain a method to remove or update existing vendor data. When the System Engineer makes a change, the original vendor data is red-lined and sent to document control with an approved ECR. Current vendor data is not submitted to the PPS vendor file until the job is closed out. However, the PPS System Engineer maintains a personal copy of vendor data for new equipment and will submit these changes to Engineering Document Control before FDP start-up.

Engineering Support converted some original PPS vendor drawings into plant controlled drawings. Currently, if anyone examines these drawings, they would find old configurations that are no longer applicable to existing configurations. Engineering Support needs to update or deactivate these drawings based on direction from the PPS System Engineer.

Document Control has not updated or maintained original vendor operating and maintenance manuals as WINCO controlled documents. These manuals are still some of the best available sources of information for PPS configuration. However, some of the information is erroneous and users of this vendor information must be cautious. The PPS System Engineer should evaluate these manuals, correct the information, and incorporate them into WINCO controlled documents.

3.1.7 Quality Level of Components

The PPS System Engineer uses the Quality Level Designation Checklist (WINCO-6783) to determine the quality level for PPS components that accompanies all Work Orders. The PPS components are usually designated as Quality Level I due to the sensitive nature of the PPS. However, PPS components under other quality levels may be purchased if another quality level is justified. For example, off-the-shelf commercial grade items are often purchased and installed in the PPS with Quality Level III. CPA personnel always test the components before FDP start-up operations to ensure that the components perform to PPS requirements.

WINCO purchased most of the recent replacement parts, and installed them in the PPS, as Quality Level III components. The replacement parts include PPS auxiliary equipment items such as new operator terminals, and a line printer. Failure of these devices does not affect the PPS performance. Furthermore, WINCO purchased commercial components (such as the new CPU replacement boards) as Quality Level III items and SO tested them to ensure operability and reliability. Quality Assurance receipt inspects these types of items by model number to ensure that the proper component is received. The vendor must also prove that the components meet other necessary requirements (such as seismic qualifications) before the component is accepted and installed.

3.1.8 Component Traceability

Component traceability is a relatively new requirement. WINCO implemented this requirement after installation of the PPS. However, documentation exists for PPS equipment component traceability by serial number to the vendor and to the component manufacturer. WINCO has enforced component traceability in recent PPS modifications. An example is the installation of new reagent addition valves in the FAST Fluorinel Makeup (FM) area.

3.1.9 Fail-Safe Design

The PPS primary requirement is to be fail-safe. CPA and FAST production personnel periodically prove PPS features are fail-safe through SO and Challenge Tests.

PPS interlock trips revoke permissives to applicable control devices. When a trip occurs the PPS activates an audible alarm annunciator, turns on an alarm indicator light, prints an alarm message, and displays a message on the CRT. These steps take place in the control room. Operations personnel must return the violated parameters to safe conditions before using supervisor keys to reset the PPS. After safe conditions are met, and the PPS is reset, operators may then physically restart FDP operations.

All of the PPS control permissives are fail-safe by design. This means permissives must be present for FDP operations to continue. Removal of a permissive shuts down the suspected FDP system. The PPS is designed to remove power from the fail-safe control devices. Also, since the PPS has redundant and independent protective divisions, either division can shut down the FDP process through separate fail-safe control devices.

The FDP PPS has a variety of self-diagnostics that alarm or, in some instances, shut down the system. For example, the PPS has internal and external watchdogs that shut down the PPS when a system error is detected. These self-diagnostics make certain that if a CPU hangs up, or a communications line fails, the PPS shuts down rather than wait for further instructions. After a PPS shutdown, all PPS permissives are disallowed. Operators must completely re-boot the PPS to proceed with normal operations.

3.2 Maintenance

The PPS was evaluated in three maintenance areas. The following section discusses each of these three areas. This evaluation identified two PPS maintenance areas in need of attention:

1. Development of preventative maintenance (PM) procedures.
2. An evaluation of PPS spare parts.

3.2.1 Calibration

Poison monitors and analog field instruments, which interface with the FDP PPS, are on the Instrument Calibration Data Base (ICDB). These instruments are classified as Group I instruments, as required by Technical Specifications/Standards (TS/S) 5.6B12. Instrument personnel calibrate Group I instruments regularly as requirements dictate. Also, instrument personnel calibrate the actual poison monitors per a separate procedure. This procedure is CPOP 4.2.1.12, *Calibrate FDP Poison Monitor Systems*.

3.2.2 Preventative Maintenance (PM)

General Atomics included maintenance procedures with the vendor data. Other than the WINCO generated instrument calibration and PM procedures for the Uninterruptable Power Supply (UPS), ICPP does not have any other PM procedures for the FDP PPS. Normally the PPS System Engineer maintains the PPS. But, regularly scheduled preventative maintenance has not been done. PPS reliability would improve if Engineering initiated procedures for items such as:

1. Cleaning the cabinet air filters,
2. Changing-out the cabinet fans,
3. Replacing the memory backup batteries on the processor boards, and etc.

3.2.3 Components and Spare Parts Traceability

Traceability of the PPS maintenance components and spare parts follows the same traceability requirements as the original PPS system. This relatively new WINCO requirement was put in place after installation of the PPS. Production and CPA personnel examined the PPS spare parts. They determined that some of the stocked spare parts are no longer used in the PPS. Furthermore, the new replacement spare parts are not yet maintained as spares. Examples are the new CPU boards and air flow switches. In anticipation of the FDP start-up, Production and CPA personnel need to evaluate the PPS spare parts in detail to assure that proper components and spare parts are available.

3.2.4 Testing

CPA personnel determined that the PPS test procedures and review results were adequate for FDP start-up.

3.2.4.1 Procedures.

Several levels of tests are implemented for the FDP PPS. The levels depend on the type of changes made to the system and the state of operation. Tests include:

1. FAST-PPS-SO-67 System Operability (SO): performed whenever major software or hardware changes are made.
2. Challenge Test (CT): performed before FDP start-up.
3. Functional Operability (FO): performed per WP-15, which is whenever unscheduled PPS maintenance is done.

The SO test is a comprehensive software test. WINCO and EG&G personnel wrote the SO test independently of the software programmer. They wrote the current SO test as a combination of the original PPS SO test and a system Validation and Verification (V&V) test. The SO test verifies all

PPS software logic functions. Production, Technical, Engineering, and N&IS departments validate the software by review of the formal software data flow diagrams and pseudocode generated by CASE tools during development of the code.

The SO test checks the integrity of the PPS software interlocks. The Challenge Test checks the overall operability of the PPS. This test includes field hardware components and operator controls.

3.2.4.2 Test Results Review

Before FDP resumes operations, CPA must complete both the PPS SO test and the FDP PPS Challenge Test. The Test Results Review Team (TRRT) reviews and evaluates the SO test results as required by WE-19, *System Operability and Integrated Testing*. The Operational Readiness Review (ORR) committee also reviews the Challenge Test results before FDP start-up. These reviews ensure adequate closure of any potential operational problems.

3.3 Operating

CPA determined that operating procedures and training for the PPS are adequate for FDP start-up.

3.3.1 Procedures

Production recently revised procedures to reflect current FDP PPS changes. The primary operating procedure for the PPS is Chemical Plant Operating Procedure (CPOP) 4.2.2.6, *Access and Use PPS*, revision 7. It incorporates the most recent PPS changes and is available for FDP start-up.

3.3.2 Training

CPA drafted a PPS lesson plan and presented PPS training to FDP operators. FDP operators must also qualify under the PPS/DPSE Qualification Standard, 0412Q. The Training Department revised both the formal classroom training and the qualification standard to include the latest PPS changes. Furthermore, operators go through an extensive hands-on PPS training during start-up of the FDP facility.

4. RECOMMENDATIONS

The following recommendations are presented for continued operation of the FDP PPS.

4.1 Vendor Data

CPA recommends that the PPS System Engineer evaluate the existing PPS vendor data. Engineering Document Control should extract useful information and convert this information into WINCO controlled documents. Engineering Support should continue with as-building the identified PPS control support drawings and deactivate obsolete drawings.

CPA arrived at these recommendations because of the deficiencies found in the controlled drawings and vendor data. The FDP start-up should not require completion of these items since essential PPS drawings are currently in-place.

4.2 System Design

If FDP should continue operational functions, CPA recommends (since several specifications exist for the PPS) that the PPS System Engineer reactivate the system design specification and update it to current standards. This will generate a sound design basis for future PPS upgrades. Software designers should continue using the CASE design tool for specifications. The CASE design will supersede the original software specification. The current FDP start-up should not require completion of these items; however, WINCO should implement a policy, or program, to maintain PPS specifications.

4.3 Preventative Maintenance

CPA recommends that Engineering Support develop PPS PM procedures. There is a lack of PPS PM procedures for such items as: cleaning the cabinet air filters, periodically changing out the cabinet fans, and replacing the memory backup batteries on the processor boards. Under the PPS System Engineer's supervision, maintenance must perform these procedures while FDP is shut down. FDP start-up should not require that these procedures be in-place. However, the PPS System Engineer should make certain that necessary maintenance items are completed before the next FDP start-up.

4.4 Spare Parts

CPA and Production evaluated the PPS spare parts inventory list before FDP start-up. This evaluation ensured that up-to-date information was available to meet current PPS configurations for the next campaign.

Appendix A

Plant Protection System Requirements Manual Evaluation

The Plant Protection System (PPS) Requirements Manual establishes the minimum functional criteria for design and use of PPSs at ICPP. The manual incorporates the requirements of Nuclear Standard NE-C16-1T, Supplementary Criteria and Requirements for RDT Reactor Plant Protection Systems, which is referenced in DOE-ID Order 5480.5. Therefore, when the requirements of the manual are satisfied, the requirements of the DOE-ID order will be fulfilled.

This appendix evaluates the Fluorine Dissolution Process (FDP) PPS against the requirements of the PPS Requirements Manual.

A.1 Scope and General Requirements

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
1.2	PPSs which meet the requirements of this manual shall be provided when the Design Criteria (DC) and the Safety Analysis Report (SAR) require the plant protection function.	yes	PPS is provided as required in FSAR
1.2.1	The design criteria for PPSs shall be described in a Project Design Criteria (PDC) document for projects or in the Engineering Design Input (EDI) for Work Order designs.	yes	Original installation had PDC. Modifications have EDI/PDC per WE-8.
1.2.2	Each project and work order design which provides or modifies a PPS shall be analyzed for adequacy of the safety function by the cognizant safety analysis organization (usually OSA).	yes	A Safety Assessment Document (SAD) is required for all changes. Changes are incorporated into the PSD.
1.2.3	The general safety functions of the PPS shall be identified and described in the PDC or the EDI in sufficient detail to support the development of an approved detailed design and an approved SAR.	yes	Provided on completed EDI form.
1.3	A PPS shall be provided when active hardware is relied upon to prevent a criticality or warn operators that action must be taken to prevent a criticality.	yes	PPS is provided.
1.4	Responsibility for implementing the requirements for PPSs at ICPP shall be assigned to the project manager for major projects, general plant projects, or line item projects and to the Systems Engineering manager in the Engineering and Plants Projects Dept. for work orders which affect plant protection systems.	yes	WE-8 delegates this responsibility.
1.5	Each project and each work order which implements a new plant protection system or changes an existing PPS shall provide approved documents which describe the essential performance requirements (EPR), design criteria, detailed design, systems specifications, component procurement specs, quality measurements, system installation, and testing requirements.	yes	These are provided per WE-8 and WE-25.

A.2 Basis for Determination

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
2.1	PPSs shall be required when instrument loops are used to monitor and to protect the process against criticality when there are no other contingencies against criticality.	yes	PPS is provided.
2.2	A PPS shall be required when safety class items, as defined in DOE Order 6430.1a, are instruments which are identified for nuclear criticality safety.	yes	PPS incorporates all instruments needed for criticality safety as identified in the PSD.
2.3	Redundant or diverse channels in PPSs shall be provided when there are no other contingencies against criticality.	yes	Redundant, independent channels provided which use 1 of 2 logic.
2.4	PPSs shall be identified as group 1 instrument loops in the SAR and in the Technical requirements.	yes	

A.3 General Design Basis

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
3.1	The design basis shall be described in the PDC for projects or the EDI for work order design engineering and shall be based on the safety functions to be performed by the PPS.	yes	EDI requires this info.
3.2	The PPS shall have documentation which describes the details of the design, documents the analyses which were performed during design, and provides information necessary to procure, install, test, maintain, and operate the complete system.	yes	Vendor data includes this information. WINCO has established an SO Test and Challenge Test. CPOP 4.2.2.6 covers PPS operation.
3.2.1	A system design description shall be provided which describes each individual component of the system, describes the interface between components, and describes the function and operation of the system.	yes	Original in vendor data and spec. Changes per WINCO design procedures.
3.2.2	Engineering drawings shall be prepared by the designer which show assembly details, installation details, and interfaces.	yes	Included in vendor data. Plant drawings made of the PPS beyond field terminations are out-of-date. ECRs and SCRs document changes to original vendor data.
3.2.3	Specifications for procurement, installation, fabrication, and testing shall be provided.	yes	Included in vendor data original specifications, and purchase requisitions.
3.2.4	Maintenance procedures, including preventative maintenance, calibration and testing procedures shall be provided which assure that the system will continue to provide the plant protection function throughout the life of the system.	partial	NO PM procedures currently exist. Testing and calibration procedures do exist.
3.2.5	Operating procedures shall be provided which describe correct method to operate the PPS, the limits for use, and the importance of the safety function which the PPS provides.	yes	Vendor data had operating procedures. CPOP 4.2.2.6 now governs PPS operation.
3.2.6	changes to the PPS which are proposed and approved after the baseline documents are approved shall be described in documents which will be used to revise the design documents for the PPS.	yes	Changes are documented, approved, and attached to the original documents. Plant drawings (field wiring, etc.) are maintained as-built, but there are some deficiencies in revising the design documents.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
3.3	The scope of the PPS shall be described in the system description document and shall include all sensors, wiring, enclosing cabinets and conduits, power supplies, amplifiers, logic circuits, relays, alarms, indicators, actuators, and actuated process components that are necessary to provide the safety function from detection to final action.	yes	Original vendor described PPS completely, but has not been maintained as-built.
3.4	The system boundary for the PPS shall be described in the system description document and in the SAR.	yes	Plant drawings distinguish PPS instrumentation. Some discrepancies exist.
3.5	Applicable controls shall be imposed during design, procurement, installation, maintenance, and testing of the PPS to assure compliance with the quality and inspection requirements of the design.	yes	WINCO controls for Safety Class I systems are used.
3.6	A reliability study (evaluation or study) shall be provided and documented for each protective function.	yes	PPS is documented in Probabilistic Risk Analysis performed by OSA.
3.6.1	The method of performing and documenting the reliability study shall be identified during development of the design.	N/A	Applies to original system.
3.6.2	The results of the reliability study shall be summarized in the SAR.	yes	
3.6.3	The reliability study shall take into account the environment in which the equipment will be used, especially any hostile environment which may accelerate deterioration of performance or require derating of components.	yes	
3.6.4	Reliability data for the reliability study for components or systems of the PPS shall be based on data selected and documented by the analyst and approved by the WINCO reviewers.	yes	PSD is approved by WINCO and DOE. Reliability study is included in PSD.
3.7	PPS design documents (drawings or specifications) shall identify the minimum acceptable performance for each component.	yes	Per WINCO procedures identified by system specifications and purchase requisition information.
3.8	The PPS shall be designed to facilitate troubleshooting recognition, location, replacement, and repair of failed parts, subassemblies, and assemblies.	yes	Modifications have improved troubleshooting.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
3.9	Sufficient software documentation shall be required such that software inadequacies can be recognized and corrected.	yes	Software documentation is included with each Software Change Request (SCR). Data flow diagrams, pseudocode, and source code comments are available.

A.4 Specific Performance and Implementation Requirements

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.1	The PPS shall reliably initiate the appropriate protective actions for each protective function whenever the specific conditions monitored by the system reach preset values.	yes	SO Test and Challenge Test demonstrate protective actions, PRA documents reliability. Sensors make direct measurements. Manual and automatic shutdown initiation is provided.
4.1.1	The conditions monitored, the method of initiating the protective function, and the preset values shall be determined during the development of the PPS and documented in the SAR, TS-S, and system design document.	yes	
4.1.2	Sensors shall directly, accurately, and unambiguously monitor parameters to detect deviation from safe conditions except where deviation from safe conditions can only be inferred by monitoring secondary parameters or by calculation.	yes	
4.1.3	If manual initiation of the protective function is to be provided, either by manual input, manual actuation of shutdown, or both, the design criteria and the safety analysis report shall document the justification in terms of the following:	yes	
4.1.3a	Complexity of judgment required by the operator (the action required is simple enough for the operator to perform reliably while under stress).	yes	
4.1.3b	Immediacy of action (the operator has adequate time to react and the signal that prompts initiation of operator action will be observed within the allowable response time).	yes	
4.1.3c	Provisions for feedback, alarms, and interlocks associated with the protection action.	yes	
4.1.3d	The likelihood that operator error can increase the severity of the postulated incident.	yes	
4.1.4	If manual initiation of an actuated component in the PPS is the sole means available for initiation to fulfill a design basis objective, the reliability requirements of the system equipment shall be retained.	N/A	Manual initiation is not the sole means.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.2	Manual initiation shall be provided for each protective action.	yes	The manual trip initiates all protective actions simultaneously. Only 1 button, but the button has two sets of contacts (input to Division A and Division B respectively). Requires .2 sec. for software to latch button signal. 1 button (with cover to prevent accidental actuation). Required action is to lift cover and press button.
4.2.1	The manual initiation of the protective function shall override any automatic input which may indicate safe conditions for operation.	yes	
4.2.2	No single failure within the manual, automatic, or common portions of the PPS shall prevent the manual initiation of a protective action.	yes	
4.2.3	Manual initiation shall occur in the most direct manner with the operation of a minimum of components.	yes	
4.2.4	The controls for manually initiating protective actions at the system level shall be accessible to the operator and designed for quick and easy operation.	yes	
4.3	Sensors for seismic acceleration shall be input to the PPS when the SAR and the DC require that the process will shut down during an earthquake.	yes	One seismic input for each division.
4.4	Indication of the tripped condition for PPS outputs shall be provided in the form of visual displays and audible alarms which are clear and distinctive considering human factors engineering.	yes	Audible alarm, alarm light, CRT display, and printed message are provided.
4.4.1	The PPS shall be so designed that, once initiated, any shutdown protective action shall go to completion.	yes	
4.4.2	Manual attempts to reset the shutdown trip shall not be successful until after the condition that caused the trip has returned to acceptable levels.	yes	
4.5	Each PPS channel (trip outputs) shall have a separate manually operated reset, which shall be administratively controlled.	yes	Controlled by supervisor keys.
4.6	The output of a PPS instrument channel shall result in an actuator shutdown trip for all values of the plant input variables that are beyond the shutdown trip set points.	yes	Verified in SO Test and Challenge Test.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.7	PPSs shall be designed so that no credible fault shall result in a reversal of output signal relative to input signal change before the actuator trip has occurred and the continued presence of the trip is ensured.	yes	Trips are locked until cleared by supervisory key.
4.8	PPS channels which are out of service for maintenance or repair shall be tripped or bypassed:	yes	PPS is taken out-of-service. Outages are covered by CPOP 4.2.2.6, WE-3, and WP-10.
4.8a	For systems with multiple channels where safe shutdown results from n trips of n + m channels, the channel or channels which are out of service shall be tripped.	N/A	
4.8b	For systems where safe shutdown results from a single trip, the channel which is out of service shall indicate bypass; bypass shall be allowed for only a limited time.	N/A	
4.9	Provisions shall be made to place the output of each instrument channel in the tripped state for testing and troubleshooting purposes when the PPS is off-line.	yes	Key switches in MUX.
4.10	The PPS shall be configured to support all planned plant operating modes (startup, testing, normal or steady state, and shutdown).	N/A	FDP PPS has no modes.
4.11	The consequence of operating the plant in a mode (see 4.10) inconsistent with the selected PPS mode shall not result in loss of adequate protection.	N/A	FDP PPS has no modes.
4.12	Where the process requires change to a more restrictive PPS setpoint to provide adequate protection for a particular mode of operation or set of conditions, the design shall provide a means of ensuring that the proper setpoint is used for the operating mode.	N/A	Setpoints are constant.
4.13	Where operating conditions or mode requirements necessitate bypass of a protective function, the design shall limit the bypass application to specific permissive conditions by imposing one of the following:	N/A	PPS has no bypasses.
4.13a	Prevent the activation of, or remove (if active) the operating bypass.	N/A	
4.13b	Obtain or retain the permissive conditions for the operating bypass.	N/A	

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.13c	Initiate the protective function.	N/A	
4.14	The PPS shall be qualified for the environmental conditions of operation and storage for which the system is designed.	yes	Documented in vendor data and PRA.
4.14.1	Where failure to maintain design basis environmental conditions could cause failure of a protective system, then one of the following requirements shall be met:	yes	'b' and 'c' below are met.
4.14.1a	The system maintaining the conditions shall be considered as part of the PPS and shall meet all requirements of this manual.	no	Fans are used but are currently not part of PPS. Fan failure only produces a PPS warning alarm.
4.14.1b	When conditions are no longer maintained within the required limits, appropriate protective actions shall be automatically initiated.	yes	High temperature causes PPS shut down.
4.14.1c	Visual indication and audible annunciation that the specially maintained conditions are not being maintained within the required limits if operator action to remedy the situation can be taken. The design analysis shall show that the operator action can be taken in time to protect the PPS.	yes	Operator warning is issued at lower setpoint.
4.14.2	If the PPS design basis is for environments other than the anticipated extreme environmental conditions of the facility, then defenses must be provided for the most severe conditions that credibly could be experienced.	yes	Cabinets are fan-cooled. Cabinets in operating corridors are NEMA-4 to protect components.
4.14.3	The PPS shall be designed to withstand the design basis tornados, floods, and wind-generated missiles if the design criteria and safety analysis require such protection.	yes	Documented in PSD ad PRA.
4.14.4	The PPS shall be designed to withstand the design basis earthquake unless the requirement 4.3 is judged to be adequate.	yes	Original system was shake-tested. Changes are evaluated by Engineering Analysis or vendor data.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.15	The PPS design shall be such that no credible failure in or consequential action by unrelated systems shall prevent the PPS from meeting the performance requirements of this document or of the design criteria for the PPS in the presence of any failure specified in the PPS design basis.	yes	
4.15.1	Where PPS equipment is used for purposes other than plant protection, the ability of the PPS to meet the requirements of this document shall not be impaired.	yes	Shared instruments are electrically isolated.
4.15.2	Equipment that is shared and consequently is used for both protective actions and nonprotective actions shall meet the same requirements as PPS equipment and shall be classified as PPS unless isolated by PPS BUFFERS.	yes	Shared instruments are designated PPS, and non-PPS equipment is electrically isolated from the instruments.
4.15.3	The PPS shall be isolated from the effects of credible failures in or actions by, other systems to the degree necessary to retain its protective function capabilities.	yes	PPS independent of other systems.
4.16	Equipment in other systems not shared with, but in physical proximity to PPS equipment, shall be separated from PPS equipment by physical barriers or acceptable distance as stated in the approved design.	yes	Separate conduits and cabinets.
4.17	The detection time plus response time for the PPS shall be less than the time required for an off-normal condition to exceed the margin between the PPS trip point and the safety limit.	yes	PPS detection to response time is approx. 0.2 seconds. Limiting conditions for operation are well above safety limits.
4.18	PPS signal and power and non-PPS signal and power shall be carried in separate conduits or raceways.	yes	But note possible violation in 0'0" corridor? (LP-FO-375)
4.19	For applications which require redundant or diverse subsystem channels each PPS subsystem channel shall be independent of other redundant or diverse subsystem channels such that no credible detectable or undetectable failure in one subsystem channel will reduce the capability of the other subsystem channels to perform their protective function.	yes	Divisions A and B are independent.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.20	For applications which require redundant or diverse subsystem channels, the wiring for redundant PPS circuits shall be routed in separate conduits, trays, or raceways, or shall be otherwise physically separated to maintain reasonable independence.	yes	Wiring of divisions A and B is physically separate.
4.21	Before initial process operation, the PPS shall be established as capable of meeting the performance and reliability requirements set forth in the design criteria by testing, inspection, and quality records which document the design, procurement, fabrication, installation, and testing conformance to specifications of the entire PPS.	yes	SO Test; Challenge Test.
4.22	PPS challenge test shall be performed prior to each initial use for each processing campaign with fissionable material and after each modification throughout the life of the PPS.	yes	
4.23	Information pertinent to the plant conditions requiring protective action and the status of the protective subsystems and of the PPS shall be available to the operator. The displays shall be designed using human factors engineering principles, and shall show information as defined in the PDC and design documents.	yes	Advisory messages appear green, warning messages appear yellow, alarms/trips in red on alarm CRT. Field device status available from operator terminals.
4.24	Selection of the power supplies, UPS, and utilities necessary for proper operation of the PPS shall be by design analysis and by detailed specifications which take into account the consequences of failure of the power supply.	yes	Analyses done during design.
4.25	The PPS design shall provide access to the systems components through administrative control.	yes	Supervisor keys. Locks on all PPS cabinets.
4.26	Design drawings and other design documents which contain PPS design, operating, or maintenance information shall identify PPS components, ordering data, operating requirements and other special limiting situations.	yes	PPS symbol used on design drawings and documents.
4.27	Exceptions to the requirements of this manual shall be documented and approved in the design criteria and the SAR.	N/A	The Requirements Manual is new.

Section No.	PPSRM Requirement Description	Meets Req'ts?	Comments
4.28	In addition to the safety functions of the PPS, the importance of providing reliable, continuous operation of the plant process shall be considered in the design of the system.	yes	Upgrades have improved system reliability.
4.29	When computer technology and hardware is used in the PPS, the application software which instructs the system to perform the safety function shall be verified and validated during development of the programs and as part of the testing after completion of the PPS by methods similar to those described in Standard ANSI-7-4.3.2-1982.	yes	Software validated by review of data flow diagrams and pseudocode during software design. Software verified by SO test.
4.30	The software configuration shall be controlled by review and approval of any changes as described in ANSI-IEEE 828-1983 or equivalent approved procedure.	yes	Software control governed by WE-25 and implemented by system engineer.
4.31	The PPS and component parts of the PPS shall be uniquely labelled in the facility after installation as described in the design.	yes	Unique labels and color coding used. Some discrepancies identified.

Appendix B: FAST PPS REFERENCES

I. PPS DESIGN CRITERIA

A. Plant Protection System Requirements Manual (PPSRM).

II. WINCO PPS DRAWINGS

A. P&ID Drawings

1. 091522, FM Area Reagent Feed Tank Isolation Flowsheet - Nitric Acid.
2. 091523, FM Area Reagent Feed Tank Isolation Flowsheet - Alum. Nitrate.
3. 091524, FM Area Reagent Feed Tank Isolation Flowsheet - Cadmium Sulfate.
4. 091525, FM Area Reagent Feed Tank Isolation Flowsheet - Hydrofluoric Acid.
5. 092701, FM Area Nitric Acid Flowsheet.
6. 092702, FM Area Aluminum Nitrate Flowsheet.
7. 092703, FM Area Hydrofluoric Acid System Flowsheet.
8. 092704, FM Area Poison Water System Flowsheet.
9. 092708, FM Area Sulfuric Acid & Decon System Flowsheet.
10. 092709, FM Area Zirconyl Nitrate System Flowsheet.

B. Loop Drawings

1. 063595, Loop No. FC-131-24.
2. 063596, Loop No. FC-121-24.
3. 063597, Loop No. FC-111-24.
4. 063658, Loop No. FC-114-25.
5. 063659, Loop No. FC-124-25.
6. 063660, Loop No. FC-134-25.
7. 063708, Loop No. FC-512A-1,2.
8. 063709, Loop No. FC-522A-1,2.

9. 063710, Loop No. FC-523A-1,2.
10. 091582, FM Area Reagent Feed Tank Isolation Loops L-FM-151-1, 152-1, 156-1, & 157-1.
11. 091583, FM Area Reagent Feed Tank Isolation Loops L-FM151-4B & 151-3B.
12. 091584, FM Area Reagent Feed Tank Isolation Loops L-FM-156-3B & 4B & 157-4B.
13. 091585, FM Area Reagent Feed Tank Isolation Loops A-FM-151-4A & 152-3A.
14. 091586, FM Area Reagent Feed Tank Isolation Loops L-FM-156-3A & 4A & 157-4A.
15. 143841, Loop No. FC-111-32.
16. 143846, Loop No. FC-121-32.
17. 143851, Loop No. FC-131-32.
18. 143858, Loop No. FC-114-23.
19. 143868, Loop No. FC-124-23.
20. 143878, Loop No. FC-134-23.

C. Electrical Control Schematics

1. 091563, FM Area Reagent Feed Tank Isolation Schematic Diagrams.
2. 091577, FM Area Reagent Feed Tank Isolation Schematic Diagrams.
3. 142118, Instrumentation & Control Schematic Diagram No. 12.
4. 142119, Instrumentation & Control Schematic Diagram No. 13.
5. 142124, Instrumentation & Control Schematic Diagram No. 19.
6. 142129, Instrumentation & Control Schematic Diagram No. 14.
7. 142134, Instrumentation & Control Schematic Diagram No. 29.
8. 149741, Instrumentation & Control Schematic Diagram line 1 Steam Jets.
9. 149742, Instrumentation & Control Schematic Diagram No. 4.
10. 149743, Instrumentation & Control Schematic Diagram No. 2.

11. 149744, Schematic Diagrams Dissolver/Complexer Liquid Heel Control.
12. 149756, Instrumentation & Control Schematic Diagram Line 2 Steam Jets.
13. 149757, Instrumentation & Control Schematic Diagram Line 3 Steam Jets.

D. Electrical Termination Drawings

1. 142085, Control Terminal Box Schedule No. 8 (PPS).
2. 142086, Control Terminal Box Schedule No. 7 (PPS).
3. 142092, Control Terminal Box Schedule No. 1 Non-PPS.

E. Vendor Converted Drawings

1. 149105, CPP-666 Block Diagram Division Logic Process.
2. 149106, CPP-666 Block Diagram FAST PPS Communications Console.
3. 149107, CPP-666 Block Diagram Operating and Makeup Area Multiplexer.
4. 149114, CPP-666 Channel Schematic Diss. #1 Steam Jet Timer Protective Channel 6A & Channel 6B (no longer applies).
5. 149128, CPP-666 Channel Schematic HF Poison Monitor Protective Channel 1A & 1B.
6. 149129, CPP-666 Channel Schematic AlNO_3 Poison Monitor Protective Channel 2A & Channel 2B.
7. 149130, CPP-666 Channel Schematic HNO_3 Poison Monitor Protective Channel 3A & Channel 3B.
8. 149131, CPP-666 Channel Schematic CdSO_4 Poison Monitor Protective Channel 4A & Channel 4B.
9. 149132, CPP-666 Channel Schematic H_2SO_4 Poison Monitor Protective Channel 5A & Channel 5B (no longer applies).
10. 149133, CPP-666 Channel Schematic Diss. #2 Steam Jet Timer Protective Channel 7A & Channel 7B (no longer applies).

11. 149134, CPP-666 Channel Schematic Diss. #3 Steam Jet Timer Protective Channel 8A & Channel 8B (no longer applies).
12. 149135, CPP-666 Channel Schematic Complexer Train #1 Steam Jet Timer Protective Channel 9A & Channel 9B (no longer applies).
13. 149136, CPP-666 Channel Schematic Complexer Train #2 Steam Jet Timer Protective Channel 10A & Channel 10B (no longer applies).
14. 149137, CPP-666 Channel Schematic Complexer Train #3 Steam Jet Timer Protective Channel 11A & Channel 11B (no longer applies).
15. 149138, CPP-666 Channel Schematic Seismic Level Protective Channel 12A & Channel 12B.
16. 149140, Plant Protection System - PPS Assembly Console.
17. 149142, Plant Protection System - PPS Assembly Console.
18. 149143, Plant Protection System - PPS Logic Processor Cabinet Assembly.
19. 149147, Plant Protection System - PPS Multiplexer Interface Box Assembly.
20. 149148, Plant Protection System - PPS Multiplexer Computer Box Assembly.
21. 149152, Plant Protection System - PPS Multiplexer A100 Signal Conditioner Wiring Diagram.
22. 149153, CPP-666 Wiring Diagram Multiplexer.
23. 149154, CPP-666 Wiring Diagram Communications Console.
24. 149157, CPP-666 Wiring Diagram Communications Console.
25. 149162, CPP-666 Wiring Diagram Division Logic Processor.
26. 149163, CPP-666 PPS Wiring Diagram Division Logic Processor.
27. 149164, CPP-666 Wiring Diagram Division Logic Processor.

F. Miscellaneous Drawings

1. 063711, Control Diagram Loops FC-512A, FC-522A, & FC-532A.
2. 142102, Process Make-Up Area Plan E1 0'-0" & 20'-0" (PPS).

3. 142104, Control Rms. and Cutting Pool Cable Tray & Conduit Plan (PPS).
4. 142106, Rem. Disconnect Plug & Conduit Wall Penetrations (PPS).
5. 349455, Instrumentation & Control PPS Conduit Routing Diagram.

III. PPS HARDWARE/SOFTWARE CONTROL

- A. PPS Software Documentation, Volume 1 - General Information, Volume 2 - Communications Processor part 1, Volume 3 - Communications Processor part 2, Volume 4 - Communications Processor part 3, Volume 5 - Logic Processor part 1, Volume 6 - Logic Processor part 2, Volume 7 - Multiplexer.
- B. Software Control Management Plan for the FDP Plant Protection System and the FDP PPS Development System.

IV. PPS VENDOR DATA

- A. General Atomic Company (GA), Technical Proposal for FAST Plant Protection System (PPS), SPEL-95-30A, Volumes 1 & 2.
- B. VP41705-2020-378A-155 R3, FAST PPS Operation and Maintenance, E-269-1163, Volume I - PPS Operation Manual, Volume II - Communication Processor, Volume III - Logic Processor, Volume IV - Multiplexer. The following 24 appendices are included as part of the O&M manual. Appendices A through X provide PPS drawings and OEM manuals.

Appendix A: FAST PPS Engineering Drawings and Parts List.

Appendix B: Aydin Controls 5217 Single Channel Display Generator Installation and Operation Manual.

Appendix C: Conrac Installation, Operation, and Maintenance Manual
- Models 5211 and 5411.

Appendix D: ADM 31 Intermediate Terminal Video Display Unit Maintenance Manual (no longer applies).

Appendix E: Model 40 Printer Operations Manual (no longer applies).

Appendix F: Model 40 Printer Installation and Service Manuals (no longer applies).

Appendix G: 1983 Model 40 Printer Shop Manual (no longer applies).

Appendix H: iSBC 544 Four Channel Communications Expansion Board Hardware Reference Manual.

Appendix I: iSBC 544 Intelligent Communications Controller Board Hardware Reference Manual.

Appendix J: iSBC 640 Power Supply Hardware Reference Manual.

Appendix K: iSBC 604/614 Modular Cardcage/Backplane Hardware Reference Manual.

Appendix L: iCS 80 Industrial Chassis Hardware Reference Manual.

Appendix M: iSBC 016A.032A.064A//028A/056A RAM Board Hardware Reference Manual.

Appendix N: iCS 920 Digital Signal Conditioning/Termination Panel Hardware Reference Manual.

Appendix O: iSBC 464 PROM/ROM Board Hardware Reference Manual.

Appendix P: SBC 519 Programmable I/O Expansion Board Hardware Reference Manual.

Appendix Q: iSBX 350 Parallel Multimodule Board Hardware Reference Manual.

Appendix R: iSBC 86/05 Single Board Computer Hardware Reference Manual (no longer applies).

Appendix S: iSBC 377 Multimodule Numeric Data Processor Hardware Reference Manual.

Appendix T: ACDC Electronics RT Series Power Supply Modules Installation and Operation Manual (+12 V, -12 V, +5 V).

Appendix U: iSBC 88/25 Single Board Computer Hardware Reference Manual (no longer applies).

Appendix V: Black Box EIA Loop Interface Model 101.

Appendix W: ACDC Electronics RS Series Power Supply Modules Single Output Installation and Operation Manual (24 V).

Appendix X: Exide UPS Instruction Manual and Drawings.

- C. VP41705-2020-378A-167, FAST PPS Detailed System Software Specification.
- D. VP41705-2020-378A-297 RI, Seismic Qualification Report for FAST PPS.
- E. iRMX 86 Release 7 Operating System Manuals, Volume 1 - User Guides, Volume 2 - System Calls, Volume 3 - System Utilities, Volume 4 - Installation and Programmers Guides, Volume 5 - Interactive Configuration Utility Reference Manual, Volume 6 -

Language and Utilities part 1, Volume 7 - Language and Utilities part 2.

- F. Hewlett-Packard RuggedWriter 480 High Performance Printer Owner's Manual, 02235-90002.
- G. Hewlett-Packard RuggedWriter 480 High Performance Printer Service Manual, 02235-90003.
- H. Hewlett-Packard HP 700/44 Display Terminal User's Manual, C1007-90001.
- I. Hewlett-Packard HP 700/92 HP 700/94 Terminal Reference Manual, 5957-9982.
- J. iSBC 86C/38 Single Board Computer User's Guide.

V. PPS SAFETY DOCUMENTS

- A. Safety Assessment Document, FAST PPS Terminals and Printer Replacement, C.D. Meng, 3/3/1989.
- B. Safety Assessment Document FAST PPS CPU Replacement (see ECR 128697-1).

VI. WINCO MANUALS, PROCEDURES AND TRAINING

A. WPDs

- 1. WPD 3-01, Unclassified Computer Security Protection Program.
- 2. WPD 3-11, Classified Computer Security Protection Program.

B. QMPs

- 1. QMP 3-1, Design Control.
- 2. QMP 3-3, Quality Levels.
- 3. QMP 8-1, Identification and Control of Items.
- 4. QMP 11-1, Test Control.
- 5. QMP 11-2, Software Control.
- 6. QMP 15-1, Control of Nonconforming Items.

C. Department Procedures

- 1. WE-1, Quality Level Designation.

2. WE-3, Calibration Program.
3. WE-5, Work Order Design Engineering.
4. WE-7, Formal Design Reviews.
5. WE-8, Design Changes.
6. WE-9, As-Build Program.
7. WE-17, Traceability Program.
8. WE-19, System Operability and Integrated Testing.
9. WE-20, Preventive Maintenance Activities.
10. WE-25, Plant Process Computer System Change Control.
11. WP-10, Isolation and Tag/Lockout of ICPP Systems and Equipment.
12. WP-12, Work Order Control.
13. WP-15, FDP PPS Unscheduled Maintenance.
14. WQ-15.1, Controlling Nonconformances.
15. WS-1, Classification, Review, and Approval of Documents.
16. E.40, Plant Process Software Development.
17. E.43, Engineering Computer Program Verification.

D. Operating Procedures

1. CPOP 4.2.1.1, FDP Administrative Procedures.
2. CPOP 4.2.1.3, Make Up Hydrofluoric Acid Solution.
3. CPOP 4.2.1.4, Make Up Aluminum Nitrate Solution.
4. CPOP 4.2.1.5, Make Up Nitric Acid Solution.
5. CPOP 4.2.1.7, Make Up Cadmium Sulfate Solution.
6. CPOP 4.2.1.12, Calibrate FDP Poison Monitor Systems.
7. CPOP 4.2.2.6, Access and Use PPS.

E. TRAINING

1. PPS/DPSE Qualification Standard, 0412Q.

VII. INSTRUMENT CALIBRATIONS AND PREVENTATIVE MAINTENANCE PROCEDURES

A. Calibration Work Sheets

1. L-FC-111-24 Calibration Work Sheet.

2. L-FC-121-24 Calibration Work Sheet.
3. L-FC-131-24 Calibration Work Sheet.
4. L-FC-111-32 Calibration Work Sheet.
5. L-FC-121-32 Calibration Work Sheet.
6. L-FC-131-32 Calibration Work Sheet.
7. L-FC-114-23 Calibration Work Sheet.
8. L-FC-124-23 Calibration Work Sheet.
9. L-FC-134-23 Calibration Work Sheet.
10. L-FC-114-25 Calibration Work Sheet.
11. L-FC-124-25 Calibration Work Sheet.
12. L-FC-134-25 Calibration Work Sheet.
13. T-FC-512A-1 Calibration Work Sheet.
14. T-FC-512A-2 Calibration Work Sheet.
15. T-FC-522A-1 Calibration Work Sheet.
16. T-FC-522A-2 Calibration Work Sheet.
17. T-FC-523A-1 Calibration Work Sheet.
18. T-FC-523A-2 Calibration Work Sheet.
19. A-FM-161-1A Calibration Work Sheet.
20. A-FM-161-1B Calibration Work Sheet.
21. A-FM-162-1A Calibration Work Sheet.
22. A-FM-162-1B Calibration Work Sheet.
23. A-FM-166-1A Calibration Work Sheet.
24. A-FM-166-1B Calibration Work Sheet.
25. A-FM-167-1A Calibration Work Sheet.
26. A-FM-167-1B Calibration Work Sheet.
27. X-FO-200-1 Calibration Work Sheet.
28. X-FO-300-1 Calibration Work Sheet.

B. Preventative Maintenance Procedures

1. UPS-FP-1 (EUPS-FP-416) Quarterly Inspection.
2. UPS-FP-1 (EUPS-FP-416) Cleaning and Internal Inspection.
3. SUPS-FP-415 Annual Electrical Inspection and Load Test.

VIII. TECHNICAL SPECIFICATIONS/STANDARDS (TS/S)

- A. TS/S 10E3.2, Control of Plant Equipment Function and Configuration.
- B. TS/S 15C2, Group I Instruments.

IX. DOE ORDERS

- A. DOE 1330.1C, Computer Software Management.
- B. DOE 5480.1B, Environment, Safety, and Health Program for Department of Energy Operations.
- C. DOE 5637.1, Classified Computer Security Program.
- C. DOE 6430-1A, General Design Criteria.
- D. DOE-ID 1360.2, Computer Security Program for Unclassified Computer Systems.
- E. DOE-ID 5480.5A, Safety of Nuclear Facilities.
- F. DOE-ID 5636.2, Security Requirements for Classified Automatic Data Processing.
- G. DOE-ID 5637.1A, Classified Computer Security Program.
- H. DOE-ID 5700.6C, Quality Assurance.

X. TESTS

- A. FAST Plant Protection System, FAST-PPS-S067.
- B. FDP PPS Functional Operability Test Procedure, attachment to WP-15, FDP PPS Unscheduled Maintenance.
- C. PPS Challenge Test, attachment to CPOP 4.2.2.7, Start Up Fluorine1 Dissolution Process.
- D. FDP Plant Protection System Independent Validation and Verification Report.

XI. ECRs

- A. FAST ECRs
 - 1. ECR 168, Plant Protection System (PPS) Requirements.
 - 2. ECR 223, Deletion of Level Switch PPS Requirements and Coordination.

3. ECR 245, Revise PPS Specification to Show Procurement.
4. ECR 263, PPS Seismic Trigger Assemblies Design and Fabrication.
5. ECR 264, Revise PPS to Allow for Forced Air Ventilation.
6. ECR 265, Revise PPS to Define Failure Restart.
7. ECR 268, Recommended Fluorinel Dissolution Facility Modifications Prior to Initial Operation.
8. ECR 270, Nuclear Poison Receipt, Makeup and Addition (Phase I).
9. ECR 283, Fluorinel Dissolution & Uranium Heelout Flowsheets (Revised) for Train 3 Start-up.
10. ECR 314, Dissolver Charging and Closure Modification.
11. ECR 326, Removal of Product Filters, Receivers, and Solids Removal Systems.
12. ECR 347, Zirconyl Nitrate, Fluoboric Acid Additions, Cadmium Nitrate & Sulfate Bulk Storage.
13. ECR 358, Poison Monitor Calibration (Phase II).
14. ECR 382, PPS Limit Switches for Complexed Solution Pump Control.
15. ECR 413, Revise FAST PPS Default Status Panel Indications and Vessel Level vs. Volume Data.
16. ECR 438, Remove Complexer Pumps - Install Steam Jets.
17. ECR 444, PPS Level VES-FC-114, 124, and 134 and Valve Instrumentation Task 30444.
18. ECR 452, PPS Modifications, Phase II.
19. ECR 459, Poison Monitor System Mods.
20. ECR 477, PPS Modifications: Uranium Inventory Calculation.
21. ECR 509, Dissolver/Complexer Liquid Heel Control.
22. ECR 520, Reagent Adjustment PPS Interlock.
23. ECR 541, Add Indicator to PPS Level Interlock for Dissolver Lid.

B. WINCO ECRs

1. ECR 108394, New A/D Converter board for FDP PPS.
2. ECR 108454-1, FDP Steam Jet Rinse System.
3. ECR 11-0554-1, FDP PPS A/D Omissions.
4. ECR 111183-1, alternate EPROM Board for FDP PPS.
5. ECR 112973-1, PPS Debug Hookup to DPSE.
6. ECR 114063-1, FAST PPS Terminals and Printer Replacement.
7. ECR 115429-1, FDP FM area reagent Feed Tanks Isolation.
8. ECR 121429, Adding PPS Signals to DPSE.
9. ECR 126770-1, Provide Cooling for (PPS) Mux boxes.
10. ECR 128128-1, Install DPSE and PPS Status Alarms.
11. ECR 128697-1, FAST PPS CPU Replacement.
12. ECR 130060-1, Update FAST PPS Vendor Dwgs. and Put in System.
13. ECR 135846-1, PPS Correction in FM Area.
14. ECR 135846-2, Paint Substitution.
15. ECR 137124-1, H₂SO₄ System PPS Wiring Cleanup.

XII. SCRs

1. P-001, PPS Filter Heel Calculation.
2. P-002, Revise PPS Sample Records and Nuclear Poison Tests.
3. P-003, Set Reagent Sample Timer.
4. P-004, PPS Uranium 235 Fuel Charge Test.
5. P-005, Dissolver Charge and Heel Calculation.
6. P-006, Revise FAST PPS Default Status Panel Indications.
7. P-007, Set Point Changes.
8. P-008, PTV and Complexer Level Corrections.
9. P-010, Complexer Level Check.
10. P-011, Charge Rod Removal.
11. P-012, Filter Heel Accumulation.
12. P-013, Steam Jet Monitor.
13. P-014, Test Switch Configuration.
14. P-015, Makeup to Feed Tank Transfer Logic.
15. P-016, Delete PMS Lab Analysis.

16. P-017, Zirconyl Nitrate.
17. P-018, Ten Second Response.
18. P-019, Setpoints, Ranges.
19. P-020, Menus.
20. P-021, Operator Information Displays.
21. P-022, Heel Calculations.
22. P-023, Mass Monitors Div. A & B.
23. P-024, Recycle.
24. P-025, Warm Restart.
25. P-026, Correct FDP PPS Deficiencies.
26. P-027, FDP PPS Deficiencies LP.
27. P-028, PPS Memory Test.
28. P-029, FDP PPS Message to DPSE.
29. P-030, Changes to FDP PPS Charge Monitor Logic.
30. P-031, Change PPS Screens.
31. P-032, FDP PPS CP is Swamped with PM Messages.
32. P-033, Correct FDP PPS Poison Monitor Nuisance Trips.
33. P-034, Correct FDP PPS Heel Confidence Equation.
34. P-035, FDP PPS Software Changes for New A/D Converter Board.
35. P-036, New FDP PPS Heel Equation (canceled).
36. P-036, Uranium 235 Rinse Limit for Complexer.
37. P-037, New PPS Poison Monitors.
38. P-038, Delete H₂SO₄ System From PPS.
39. P-039, New Terminals for PPS.
40. P-040, Display PPS Set Points Before Warmstart (canceled).
41. P-041, Add module ID to PPS Source Code.
42. P-042, Revised Inspection Request for Dissolver Inspection
(superseded by SCR P-043).
43. P-043, PPS Efficiency Equation.
44. P-044, PPS Task Watch Dogs.
45. P-045, PPS Data Security.

XIII. WORK ORDERS

1. 482053, FAST PPS Seismic Trigger Assembly Fabric.
2. 517451, Change PPS Cabinet Filters.
3. 656256, Connect Up Air Supply Line to PPS H₂SO₄ Supply Feed Valves.
4. 656508, Label PPS Conduit and Transmitter.
5. 108394, PPS A/D Board Replacement.
6. 108454, Evaluate FDP Steam Jet Rinse System.
7. 108835, PPS A/D Board Installation.
8. 110212, Repair PPS Computer Terminal.
9. 110554, PPS A/D Omissions.
10. 110663, Repair PPS Conrac Color Display.
11. 111183, Alternate EPROM Board for FDP PPS.
12. 111408, PPS Spares.
13. 111586, FAST PPS Wiring Deficiencies.
14. 112110, Program New Fuel ROM for FDP PPS.
15. 112111, Develop PPS Software Changes.
16. 112973, PPS Debug Hoodup to DPSE.
17. 114063, FAST PPS Terminals and Printer Replacement.
19. 115429, FM Area Reagent Feed Tank Isolation.
19. 118224, PPS-Write SCMP for FDP PPS.
20. 120204, ZON Isolation From Process.
21. 122363, Install Locks on PPS Leak Detector Boxes.
22. 126219, Power Lost to PPS Div. B.
23. 126944, Replace FAST PPS Fans.
24. 128128, Install DPSE and PPS Status Alarms.
25. 128697, FAST PPS CPU Replacement.
26. 130060, Update FAST PPS Drawings & Put in System.
27. 135846, PPS Corrections in FM Area.
28. 137124, H₂SO₄ System PPS Wiring Cleanup.

XIV. FORMS

- A. WINCO-5368, Request for Determination of Safety Analysis Requirements.**
- B. WINCO-5506, Work Order.**
- C. WINCO-6190, Request for Addition to Spares.**
- D. WINCO-6704, Software Change Request (SCR).**
- E. WINCO-6777X, Engineering Design Input (EDI).**
- F. WINCO-6783, Quality Level Designation Checklist.**
- G. WINCO-6879, PPS Setpoint Checklist.**
- H. WINCO-7116X, NonConformance Report (NCR).**
- I. WINCO-8000X, Engineering Change Request (ECR).**

XV. APPLICABLE STANDARDS

- A. ANSI/ANS-3.2-1988, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants.**
- B. ANSI/ASME NQA-1, Quality Assurance Program Requirements of Nuclear Facilities, Basic Requirements 2, 3, and 4, and Supplement 3S-1.**
- C. ANSI/IEEE Std 828, Software Configuration Management Plans.**
- D. IEEE-279, Criteria for Protection Systems for Nuclear Power Generation Stations.**
- E. ANSI/IEEE Std 379-1988, Trial-Use Guide for the Application of the Single-Failure Criterion to Nuclear Power Generating Station Protection Systems.**
- F. IEEE 603-1980, Criteria for Safety Systems for Nuclear Power Stations.**
- G. ANSI-7-4.3.2-1982, Application Criteria for Programmable Digital Computer Systems in Safety Systems of Nuclear Power Generation Stations.**
- H. Nuclear Standard NE (RDT)-C 16-1T, Supplementary Criteria and Requirements for RDT Reactor Plant Protection Systems.**
- I. Nuclear Standard NE (RDT)-C 16-3T, PPS Buffers.**
- J. NRC Regulatory Guide 1.53, Application of the Single Failure Criterion to Nuclear Power Plant Protection Systems.**

- K. ANSI/IEEE Std 830, IEEE Guide to Software Requirements Specifications.
- L. ANSI/IEEE Std 1012, Software Verification and Validation Plans.
- M. DOE-ID Architectural Engineering Standards.

XVI. UORs AND CRITIQUES

A. UORs

- 1. UOR 88-0021, PPS Div. A Supply Valve Trip.
- 2. UOR 88-0022, Incorrect PPS Heel Calculated for FDP Train 3.

B. Critiques

- 1. Critique Report 86-132, FAST Dissolver Heel Confidence Level Calculation.
- 2. Critique Report 86-143, FDP PPS Remote Power Supply Failure.
- 3. Critique Report 87049, Failure to Enter UHO 812 Heel Update Sample Results to PPS and Verify.
- 4. Critique Report 87101, Div. B PPS Lid Trip.
- 5. Critique Report 87165, PPS Evaluation.
- 6. Critique Report 88050, PPS Div. A Supply Valve Trip (see UOR 880021).
- 7. Critique Report 88054, Incorrect PPS Heel Calculated for FDP Train 3 (see UOR 880022).
- 8. Critique Report 88077, Unplanned Transfer of FM-151 to 161.
- 9. Critique Report 88078, Determination of Allowable Deviation Between Channels on the Poison Monitor System and Allowable Deviation Between PMS and Lab Analysis Results.
- 10. Critique 90007, Violation of DOG HEPA Filter Delta Pressure Surveillance Requirement Due to Shutdown of the DPSE at FAST.

XVII. MISCELLANEOUS LETTERS AND LOGS

- A. FDP PPS Status, R. J. Clayton to J. H. Valentine, RJC-02-90.
- B. Productivity Improvement/Suggestion, Cooling of FDP PPS MUX Boxes.

- C. DPSE Actions to Prevent Operator Caused PPS Trips, A. K. Herbst to
B. K. Hampton, AKH-11-87.
- D. FAST Control Room PPS Log.

END

**DATE
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11/22/93