LA-SUB--94-64

REGULATION STUDY
for the
FACILITY CONTROL SYSTEM DESIGN
AT THE FACILITY OPERATIONS CENTER AT TA55

MASTER

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Prepared By
Environmental Safety Services

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EXECUTIVE SUMMARY

The NMT-8 Group at Los Alamos National Laboratory is proposing to upgrade the existing Facility Control System (FCS) located at the TA-55 Plutonium Processing and Handling Facility. The FCS modifications will upgrade the existing electronics to provide better reliability of system functions. Modifications to existing Department of Energy (DOE) facilities are regulated under the General Design Criteria, DOE 6430.1A which provides mandatory minimally acceptable requirements for facility design. A compliance methodology was introduced that categorizes the compliance effort into four sequential tasks which together provide a complete compliance umbrella. Task 1, included in this document, identifies the regulations from DOE 6430.1A that are relevant to the FCS design modifications. Accompanying each relevant regulation are supplemental information designed to facilitate compliance resolution. About 100 relevant regulations to the proposed modifications were found in DOE 6430.1A. Some of the regulations can require a substantial special study effort and/or require additional review of specific reference documents for applicable requirements that must be included in the design. Some of the regulations flagged as relevant pertain exclusively to safety class items, although the final determination of safety class items in the FCS awaits completion of the Safety Analysis Report.

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Background	1
1.2	DOE Order 6430.1A	1
1.3	Compliance Methodology	2
1.4	Safety Class Items	5
1.5	Safety Analysis Report	6
2.0	DESCRIPTION OF THE FACILITY CONTROL SYSTEM (FCS) PROPOSED MODIFICATIONS	7
2.1	Functional Description of Current Facility Control System (FCS)	7
2.1.1	Site Electrical Power System Status	7
2.1.2	PF-4 HVAC Air Balance Status (Static Differential Pressure)	7
2.1.3	HVAC Fan System Status	8
2.1.4	Site Chill Water Return Temperature	8
2.1.5	Fire System Information	8
2.1.6	Radioactive Continuous Air Monitors Alarm Information	8
2.2	Functional Description of Proposed FCS Modifications	9
2.2.1	Facility Control System Components	9
2.2.2.1	Datamonitor Systems	9
2.2.2.2	Data Highway	11
2.2.2.3	Programmable Logic Controllers (PLCs)	11
2.2.3	Redundant Features in Proposed Design	11
2.2.4	Human Factors Considerations	12
2.2.5	Safety Class System	12
3.0	DIVISION 1 - GENERAL REQUIREMENTS	13
3.1	Criteria Purpose and Applications (Section-0101)	13
3.1.1	Criteria Deviations (Section 0101-2)	13
3.2	Architectural and Special Design Requirements (Section 0110)	13
3.2.1	General (Section 0110-1.1)	13

3.2.1.1	Design (Section 0110-1.1.1)	13
3.2.1.2	Programming (Section 0110-1.1.2)	13
3.2.1.3	Systems Integration (Section 0110-1.2)	14
3.2.2	Alternative Designs (Section 0110-2)	14
3.2.3	Flexibility (Section 0110-3)	14
3.2.4	Operational Efficiency (Section 0110-4)	15
3.2.5	Health and Safety (Section 0110-5)	15
3.2.5.1	Performance Objectives (Section 0110-5.1)	15
3.2.6	Fire Protection (Section 0110-6)	15
3.2.6.1	General (Section 0110-6.1)	15
3.2.6.2	Fire Resistance Ratings (Section 0110-6.3)	16
3.2.7	Operation Maintenance, Repair and Replacement (Section 0110-9)	16
3.3	Special Facilities (Section 0111-99)	16
3.3.1	Nonreactor Nuclear Facilities (Section 0111-99.0)	16
3.3.1.1	General (Section 0111-99.0.1)	16
3.4	Quality Assurance, (Section 0140)	17
3.5	Demolition, Decontamination, and Decommissioning (Section 0205)	17
3.6	Finishes (Section 0900-99)	18
3.6.1	Nonreactor Nuclear Facilities - General (Section 0900-00.0)	18
4.0	DIVISION 13 - SPECIAL FACILITIES	19
4.1	General Requirements (Section 1300)	19
4.1.1	Coverage and Objectives (Section 1300-1)	19
4.1.1.1	Objectives (Section 1300-1.3)	19
4.1.1.2	Limiting Exposure of Public (Section 1300-1.4)	20
4.1.2	Safety Class Criteria (Section 1300-3)	20
4.1.2.1	General (Section 1300-3.1)	20
4.1.2.2	Safety Class Criteria (Section 1300-3.2)	20
4.1.2.3	Single Failure Criteria and Redundancy (Section 1300-3.3)	21
4.1.2.4	Equipment Environment Considerations (Section 1300-3.4)	22
4.1.2.5	Maintenance (Section 1300-3.5)	23
4.1.2.6	Testing (Section 1300-3.6)	23
4.1.3	Nuclear Criticality Safety (Section 1300-4)	24
4.1.4	Radiation Protection (Section 1300-6)	24
4.1.4.1	General (Section 1300-6.1)	24
4.1.4.2	Internal Radiation Exposure (Section 1300-6.4)	25

4.1.4.3	Monitoring, Warning, and Alarm Systems (Section 1300-6.5)	25
4.1.5	Confinement Systems (Section 1300-7)	28
4.1.6	Effluent Control and Monitoring (Section 1300-9)	28
4.1.7	Decontamination and Decommissioning (Section 1300-11)	29
4.1.7.1	Decontamination (Section 1300-11.1)	29
4.1.7.2	Decommissioning (Section 1300-11.2)	29
4.1.8	Human Factors Engineering (Section 1300-12)	30
4.1.8.1	Objectives (Section 1300-12.2)	30
4.1.8.2	System Development (Section 1300-12.3)	30
4.1.8.3	General Human Factors Implementation Criteria and Considerations (Section 1300-12.4)	32
4.2	Plutonium Processing and Handling Facilities (PPHFs) (Section 1304)	35
4.2.1	Objectives (Section 1304-2)	35
4.2.2	Radiation Protection (Section 1304-4)	35
4.2.3	Confinement System (Section 1304-6)	36
4.2.3.1	Primary Confinement System (Section 1304-6.1)	36
4.2.3.2	Secondary Confinement System (Section 1304-6.3)	36
4.2.4	Effluent Control and Monitoring (Section 1304-7)	37
4.2.4.1	Effluents (Section 1304-7.3)	37
5.0	DIVISION 15 - MECHANICAL, SPECIAL FACILITIES (-99)	38
5.1	Heating, Ventilation, and Air-Conditioning Systems (Section 1550)	38
5.1.1	Special Facilities (Section 1550-99)	38
5.1.1.2	General Ventilation and Off-Gas Criteria (Section 1550-99.01)	38
5.1.2	Confinement Ventilation Systems (Section 1550-99.02)	39
5.1.3	Off-Gas Systems (Section 1550-99.0.3)	40
5.2	Air Pollution Control (Section 1589)	40
5.2.1	Special Facilities (Section 1589-99)	41
5.2.1.1	Radioactive Airborne Effluents (Section 1589-99.01)	41
5.2.1.2	Nonradioactive Airborne Effluents (Section 1589-99.02)	41
5.3	Controls (Section 1595)	42
5.3.1	General (Section 1595.1)	42
5.3.2	Zoning (Section 1595.2)	42
5.3.3	Control of Air Handling Systems (Section 1595-6)	43
5.3.3.1	Mechanical Ventilation Control (Section 1595-6.1)	43
5.3.3.2	Variable-Air Volume System Fan Control (Section 1595-6.4)	43

6.0	DIVISION 16 - ELECTRICAL	45
6.1	Basic Electrical Materials and Methods (Section 1605)	45
6.1.1	General (Section 1605-1)	45
6.1.2	Wiring Systems (Section 1605-2)	45
6.1.2.1	Raceways (Section 1605-2.1)	45
6.1.2.2	Conductors (Section 1605-2.2)	48
6.2	Interior Electrical Systems (Section 1640)	50
6.2.1	General (Section 1640-1)	50
6.2.1.1	Demand and Diversity Factors (Section 1640-1.1)	50
6.2.1.2	Power Factor (Section 1640-1.2)	50
6.2.1.3	Interior Distribution Voltage Levels (Section 1640-1.3)	50
6.2.1.4	Power System Reliability (Section 1640-1.4)	51
6.2.1.5	Power Quality Requirements (Section 1640-1.5)	51
6.2.1.6	System Protection (Section 1640-1.6)	51
6.2.1.7	Ground-Fault Protection (Section 1640-1.7)	52
6.2.1.8	Neutral Conductors (Section 1640-1.8)	52
6.2.2	Service equipment and Facilities (Section 1640-2)	52
6.2.2.1	General (Section 1640-2.1)	52
6.2.2.2	Transformers (Section 1640-2.3)	52
6.2.2.3	Motor Control (Section 1640-2.4)	53
6.2.3	Special Facilities (Section 1640-99)	53
6.2.3.1	Emergency Preparedness Facilities (Section 1640-99.2)	53
6.2.3.2	Telecommunications, Alarm, and ADP Centers and Radio Repeater Stations (Section 1640-99.8)	54
6.3	Special Systems (Section 1660)	54
6.3.1	General (Section 1660-1)	54
6.3.2	Emergency Power Systems (Section 1660-2)	55
6.3.3	Uninterruptible Power Systems (Section 1660-3)	55
6.3.4	Special Facilities (Section 1660-99)	56
6.3.4.1	Nonreactor Nuclear Facilities General (Section 1660-99.0)	56
6.4	Energy Conservation (Section 1694)	60
6.4.1	General (Section 1694-1)	60
6.4.2	Energy Management System and Devices (Section 1694-2)	61
7.0	CONCLUSIONS	62
7.1	General Overview	62

7.2 Recommendations 62

APPENDIX A - REGULATORY REQUIREMENTS (Section 0106) A-1

APPENDIX B - REFERENCE STANDARDS AND GUIDES (Section 0109) B-1

LIST OF FIGURES

Figure 2-1 Conceptual Block Diagram of Proposed FCS Design Modifications 10

LIST OF ACRONYMS

DOE Department of Energy
FOC Facility Operations Center
FCS Facility Control System
GDC General Design Criteria
OSR Operational Safety Requirements
QA Quality Assurance
SAR Safety Analysis Report

1.0 INTRODUCTION

1.1 Background

NMT-8 is proposing to upgrade the existing Facility Control System (FCS) located within the Facility Operations Center (FOC) at the TA-55 Plutonium Processing and Handling Facility (PPHF). The FCS modifications will upgrade the existing electronics to provide better reliability of system functions. Changes include replacement of the FCS computers and field multiplex units which are used for transmitting systems data. Data collected at the FCS include temperature, pressure, contact closures, etc., and are used for monitoring and/or control of key systems at TA-55. Monitoring is provided for the electrical power system status, PF-4 HVAC air balance status (Static Differential pressure), HVAC fan system status, site chill water return temperature, fire system information, and radioactive constant air monitors alarm information, site compressed air pressure and other key systems used at TA-55. Control output signals are provided for PF-4 HVAC systems, and selected alarms for criticality, fire, loss of pressure in confinement systems. A detailed description of the FCS modifications is provided in Section 2.

1.2 DOE Order 6430.1A

Modifications to existing Department of Energy (DOE) facilities are regulated under the General Design Criteria (GDC), DOE 6430.1A which provides mandatory minimally acceptable requirements for facility design. DOE 6430.1A references hundreds of other regulations, standards and guidance criteria of other regulatory bodies of specialized design concerns (NRC, IEEE, ANSI, NEMA, etc.). The amount of regulatory design criteria that pertains to a given facility is dependent on the facility's function and processes that are affected during upgrade. Voluminous regulatory criteria can be expected for Special Nuclear Facilities including the PPHF for which many requirements (invoked explicitly by DOE 6430.1A) and supplemental requirements (referenced by DOE 6430.1A) are applied. It is recognized that there is a good deal of confusion between the meaning of "regulation" and that of "requirement". For definitive purposes a regulation is defined as a clause directly from a DOE Order that requires an action or a determination, that is, a regulation is treated as a law. A requirement is a specific procedure, fabrication process, specification, or other specific method of complying with a regulation.

DOE 6430.1A is organized into 16 categories of design criteria ranging from a buildings structural design to the design of interior electrical systems. The study provided in this report has determined that three categories are relevant to the proposed FOC upgrade. These categories are Division 1 (General Requirements), Division 13 (Special Facilities) and Division 16 (Electrical). Not all the regulations in those three categories are relevant to the FCS upgrade. TA-55 is assumed to only operate as a Plutonium Processing and Handling Facility (PPHF) and therefore requiring compliance with only the PPHF criteria.

Other facility designations such as Tritium Facility, Uranium Enrichment Facility, etc., are not currently considered in this study.

This document provides a compilation of DOE 6430.1A regulations that are applicable to the upgrade. Additionally, where a regulation references other requirements, a compilation of those requirements is included. This document is designed to envelope the large list of DOE regulations that pertain to the proposed upgrade. While ultimately what is needed is a complete list of specific detailed requirements that impact FCS design, this document provides the necessary groundwork to accomplish that goal.

1.3 Compliance Methodology

The compliance criteria for the proposed FCS modifications are lengthy. Accordingly, a phased approach was employed which categorizes compliance into four discrete sequential tasks. Each phase culminates in a separate document. The four documents together provide a compliance umbrella, which thoroughly demonstrates compliance with DOE 6430.1A regulations. This section describes the four planned phases.

Phase I

Phase I will identify all specific DOE 6430.1A regulations that must be addressed in the FCS design. The list of potentially applicable regulations from DOE 6430.1A numbers several hundreds any one of which can be "a tip of the iceberg" in which dozens of other regulations are referenced and must be addressed. The goal of phase I is to significantly reduce the huge list of potentially applicable regulations to a more manageable list.

Regulations are judged to be applicable and relevant according to the functionality and hardware components that comprise the FCS. Functionality can be very difficult to determine for the FCS because the FCS interacts with many different systems in direct, backup, auxiliary or other capacity. The knowledge-base needed to make system functionality determinations is spread over many different personnel, documents and engineering drawings, etc. To make matters worse, many of the regulations are, at times, conflicting and inconsistent with other applicable regulations and can be difficult to apply to the FCS. Moreover, it is evident that many of the regulations were originally targeted for systems that provided only one function and operated independently from other regulated systems. Since the FCS interacts with many systems **to some extent** it poses a uniquely complex problem from a compliance perspective.

Phase I will identify the list of regulations relevant to the FCS design by considering the functionality and hardware composition of the system in as much as can be determined at the time of writing this document. When a regulation cannot be determined to be applicable because of unclear functionality, the regulation is included and a note is

attached stating as much. In preparing the list of applicable DOE General Design Criteria regulations, three major divisions of DOE 6430.1A (Division 1, General Requirements, Division 13, Special Facilities and Division 16, Electrical) are applicable. The regulations found to be applicable to the upgrade are included by name in the phase I document. For each applicable regulation identified in Phase I, additional information about the regulation are provided. The additional information will aid in Phase II and Phase IV task planning and preparation. Information accompanying each cited regulation includes:

1. Identification as to whether the regulation applies to Safety-Class items, Non-Safety Class items or both (See discussion of Safety Class Items below).

It may later be determined that a specific system may or may not be classified as a Safety Class Item. Consequently upon final determination, the relevance of a regulation pertaining to Safety Class Items can be made and thereby aid in the Phase II preparation.

2. A synopsis of the regulation summarizing the contents and intent of the regulation.
3. A synopsis of the requirements needed to comply with the regulation. This will include a list of other explicitly referenced regulating documents required for compliance (NRC, IEEE, ANSI, NEMA, etc.).
4. An estimated level of effort for completion of Phase II and Phase III. The level of effort is indicative of the relative degree of difficulty imposed by the regulatory requirements. Therefore more difficult regulations are flagged for future planning purposes. The level of effort index is categorized into three levels defined as:

Level-1 Level-1 compliance can be achieved through a relatively small effort for regulations that have plainly visible requirements that are relatively easy to accomplish.

Level-2 Level-2 compliance can be achieved through a moderate effort in order to establish and/or accomplish requirements.

Level-3 Level-3 compliance will pose significant effort to establish and/or accomplish the requirements.

Phase II

Phase II will identify specific detailed requirements and specifications that impact the FCS design for the regulations identified in Phase I. The requirements are either directly from DOE 6430.1A regulations or from explicitly referenced standards, guidelines or other specific design requirements.

Phase II will initially require a thorough system definition study that includes mapping the specific functionality of each signal in and out of the FCS. The level of detail included in this system definition must clearly identify the signal from the sensors and or applicable control or interlock functions such that a clear determination of functionality can be performed. Additionally, the study will determine required, redundant, auxiliary and non-required functions of system components within the FCS. For safety class systems such as confinement systems (including associated HVAC components), a determination must specify what function the associated FCS components (monitors or controls) provide. This is especially important to make a determination whether the FCS component is performing a safety class function or not and thus subjected (or not) to additional formal requirements.

The primary goal of Phase II is identification of specific requirements that impact the FCS design. This will include specifying required studies and actions to be performed such as testing, maintenance, human factors analysis, etc. The prerequisite for preparing the requirements document of Phase II is completion of Phase I and the detailed definition (functionality) study of the FCS described in the previous paragraph. It is anticipated that Phases II and III will require considerably more effort than Phases I and IV combined.

Phase III

Phase III will be the actual performance of special studies, testing, implementation procedures, verifications, etc. identified in the phase II requirements. Because of the nature of the tasks, Phase III is primarily the FCS design engineers' and the associated contractor's function.

Phase IV

Phase IV will document the final actions and studies that were actually performed to satisfy compliance criteria. Consequently Phase IV can be accomplished only after the FCS design and implementation is complete. Phase IV documentation will provide a response to each regulation identified in Phase I. The response will detail how each of the requirements specified in Phase II was actually accomplished.

1.4 Safety Class Items

Safety Class Items have multiple definitions depending upon the document. DOE has multiple and sometimes conflicting definitions of Safety Class Items. The DOE General Design Criteria (GDC) Division 13, Special Facilities provides its own definition of a Safety Class Item (DOE 6430.1A, Section 1300-3). In addition, the GDC stipulates that where there exists a conflict between other criteria and the GDC, **the GDC shall govern**. Other definitions and examples of Safety Class Items are found in DOE 3005, and TIC-11603, Rev 1. However, Proposed DOE-DP-STD-3005-93, explicitly states in the Forward to that document that the "criteria and standard provides a conceptual framework for satisfying DOE Orders 5480.23's requirement for safety assurance in accident analysis." It is clear from this that the definition of Safety Class Items is not to be extended to other DOE regulations. It is also clear from DOE 6430.1A, that in any event, the definition of Safety Class Item provided in Section 1300-3, is to be used when complying with the GDC.

TA-55 is a Special Facility as defined in DOE 6430-1A, 1300-1.1. Consequently, this study utilizes the Safety Class Item definition provided in DOE 6430.1A, Section 1300-3. In preparing the applicable regulations contained in this document, Safety Class Items are those systems components and structures with the following characteristics:

- . Those whose failure would produce exposure consequences that would exceed the guidelines in Section 1300-1.4
- . Those required to maintain operating parameters within the safety limits specified in the OSRs (Operational Safety Requirements) during normal operations and anticipated operational occurrences
- . Those required for nuclear criticality safety
- . Those required to monitor the release of radioactive materials to the environment during and after a DBA
- . Those required to achieve and maintain the facility in a safe shutdown condition
- . Those that control the safety class items described above.

Some of the above criteria are directly or indirectly intended to include systems that may impact exposure of the public. Other criteria, independently, include systems that protect workers or that provide required monitoring and alarm capability.

1.5 Safety Analysis Report

Some of the DOE design criteria regulations refer to results of the Safety Analysis Report which is currently uncompleted. Full compliance with those regulations cannot be achieved until the Safety Analysis Report is finalized.

2.0 DESCRIPTION OF FACILITY CONTROL SYSTEM AND PROPOSED MODIFICATIONS

NMT-8 is proposing to upgrade the existing Facility Control System (FCS) located within the Facility Operations Center (FOC) at TA-55. The FCS modifications will upgrade the existing electronics to provide better reliability of system functions. Changes include replacement of the FCS computers and field multiplex units (FMUs) that are used for transmitting systems data. Data collected at the FCS include temperature, pressure, contact closures, etc., and are used for monitoring and/or control of key systems at TA-55. Monitoring is provided for the electrical power system status, PF-4 HVAC air balance status (Static Differential pressure), HVAC fan system status, site chill water return temperature, fire system information, and radioactive constant air monitors alarm information, site compressed air pressure and other key systems used at TA-55. Control output signals are provided for PF-4 HVAC systems, and selected alarms for criticality, fire, loss of pressure in confinement systems.

2.1 Functional Description of Current Facility Control System (FCS)

The Facility Control System (FCS) currently utilizes two Data General computers (to provide redundancy) and 23 field multiplex units (FMUs) that transmit data from a system sensors including pressure, temperature, contact closures, etc., located within the TA-55 Facility. Additionally, a safety class Data Logger that provides historical data for operations and off-normal conditions is contained in the FCS.

The current system monitors site electrical power system status, PF-4 HVAC air balance status (Static Differential pressure), HVAC fan system status, Site chill water return temperature, fire system information, radioactive continuous air monitors alarm information, and site compressed air pressure. A brief discussion of each of the functional systems is discussed below.

2.1.1 Site Electrical Power System Status

Site electric power system is monitored and electric breakers are remotely opened or closed at the three on site substations and placed on the on-site emergency generator system into required operations (exclusive of substation hard-wired, high speed transfer controls). The electrical power system status monitored at the FCS does not constitute a safety class function.

2.1.2 PF-4 HVAC Air Balance Status (Static Differential Pressure)

PF-4 HVAC air balance status provides all PF-4 HVAC relay logic as required to operate

the redundant system. (Otherwise actual static control loop is stand alone). Additionally, this relay logic transmission is used to provide sequential start up and shutdown of the HVAC system as required. The primary HVAC control system is located in an independent panel in the basement. However, since the HVAC system is a safety class system and since the FCS provides the required redundant (i.e., backup) mode of operation for that safety class system (namely redundant monitoring), the HVAC monitoring conducted in the FCS provides a safety class function. Consequently, all hardware required to perform that function are treated as safety class items in this study. Additional functions performed by the FCS for the HVAC system such as sequential startup and shutdown are not safety class functions.

2.1.3 HVAC Fan System Status

The FCS provides monitoring for the HVAC fan system status. Additionally it has the capability for shutting some selected fans within the HVAC system. However, this does not provide any safety class function and is not part of the HVAC safety class system.

2.1.4 Site Chill Water Return Temperature

The FCS monitors site chill water and return temperature. This does not provide a safety class function.

2.1.5 Fire System Information

The fire surveillance system detectors are routed to the FOC where and an automatic audible alarm signal is provided. The FCS control system does not provide fire suppression functions. Fire suppression and other automatic actions besides audible alarms are sent out from an independent monitoring/control panel located in the FOC. Associated FCS fire surveillance signals are independent of the fire surveillance system.

2.1.6 Radioactive Continuous Air Monitors Alarm Information

The continuous air monitors provide signals to both the criticality alarm system panel and to the FCS located within the FOC. Although the criticality alarm system is a safety class system, the signal sent to the FCS is not used as the required redundant signal loop. Therefore that component of the CAM monitoring function of the FCS is passive. However, other CAM signals are used to monitor potential releases to the environment during normal operations, and during and following a Design Basis Accident. Therefore, hardware associated with the FCS (if any) which performs that component of the CAM monitoring function are treated as safety class items.

2.2 Functional Description of Proposed FCS Modifications

The proposed hardware modifications for the FCS include the following:

1. Replacing the two Datageneral computers with Datamonitor software packages. Additionally, Also providing two independent links to the individual PLCs from the Datamonitor software.
2. Replacing the field multiplexed units (FMUs) with 38 total programmable logic controllers (PLCs) for redundancy, including redundant power supply and
3. Installing a new data highway, via a serial link system and an associated integrator, that provides a redundant signal path for data transmissions.

With the upgrades, the data will be routed from the control/sensing systems to remote input/output devices, from where the signal is sent to redundant programming logic controllers and the FCS.

The ETHERNET bus will be retained as the primary communications path for the PLC's. Figure 2-1 presents a conceptual block diagram of the proposed design modifications. The modifications contain four major components (PLCs, power supplies, data highway and monitor software). The interfaces, alarms and logical considerations of operations will not be affected by the modifications.

With the upgraded hardware, the modification will provide a more reliable and redundant FCS. Actual control setpoints, operating limits and other administrative control strategy of the old system will not be impacted, nor will the functionality of the upgraded system differ from the current system described in 2.1. The upgrade will also allow for flexibility and future accommodations should operational needs and requirements change.

2.2.1 Facility Control System Components

The FCS hardware components used in the upgrade are discussed in this section.

2.2.2.1 Datamonitor Systems

There are two independent main monitor software packages (Datamonitor systems) contained in the FCS. One will be used as the primary and the second one will be designated as the backup monitor software package.

Figure 2-1 Conceptual Block Diagram of Proposed FCS Design Modifications

2.2.2.2 Data Highway

The backup communications connection to the PLCs is a data highway (Plus (DH+)) communications path. The data highway information is combined in an integrator (Pyramid) and output on the ETHERNET to the monitor software package.

2.2.2.3 Programmable Logic Controllers (PLCs)

Two independent PLCs and associated power supplies will be provided for each control function in each of 19 different locations. One, designated as the primary will be in control of the system. The second, designated as the backup, will be updated on each program scan with the information from the primary PLC through a high speed serial link.

2.2.3 Redundant Features in Proposed Design

The proposed control system will have various levels of redundancy. Each significant component such as the power supplies and Programmable Logic Controllers (PLCs) of the proposed upgrade will have redundant features incorporated into the design. There are two power supplies providing power for each PLC chassis and they will be configured such that a different bus provides power to each power supply. This provides a continuous uninterruptable source of power and also allows for maintenance and repair on the power supplies without impacting the system.

There will be two independent PLCs provided for each control function each of 19 different locations. One, designated as the primary will be in control of the system. The second will be updated on each program scan with the information from the primary PLC through a high speed serial link. This allows the secondary PLC to be placed into service as the primary PLC should a problem develop and the original primary PLC need to be isolated for repair, maintenance and/or testing purposes. Since the information the secondary PLC was receiving is updated information from the primary, PLC, no loss of control information would exist. Additionally, the high speed serial link providing the information to the secondary PLC is itself coming from a backup communications module (BCM).

The proposed architecture of the design provides for added redundancy. The primary communications path for the PLCs is the ETHERNET bus. This communications bus (ETHERNET) is connected to each of the 38 PLCs in the 19 associated locations and to the main monitor software package in the FCS. Additionally it is also connected to the backup monitor software package contained in the FCS located in the operations center. The backup connection to the PLCs is a data highway (Plus (DH+)) communications path which are combined in an integrator (Pyramid) and output on the ETHERNET to the monitor software package. These three separate data highway (DH+) paths provide for

a backup to the primary ETHERNET path. The smaller loads on each highway provide for a more reliable system. Expansion can easily be incorporated into this data highway for any anticipated future needs.

2.2.4 Human Factors Considerations

Since most of the personnel that have been working with the operation control center have been trained with the old system display devices and information, the new modifications package intends to keep the old display systems and icons. This process is two-fold. First the operators are familiar with the old system graphics and this will ease the integration of the proposed modification into the existing system. Second there will be a cost-effective benefit in reducing the need to retrain and upgrade the knowledge of the operators to a new graphical system. The FCS modification thus incorporates the knowledge of personnel who have used and are intimately familiar with existing operational controls. Since there are no new items (monitors or controls) being introduced, the operators should not be subject to any additional risk or failures associated with operational responses to information. No significant modifications to training manuals, procedures and checklists will be anticipated with this modification.

2.2.5 Safety Class System

Components of the proposed modification upgrade that provide safety class functions will be considered as safety class items based on the General Design Criteria (DOE Order 6430.1A), Section 1300-3. Safety class items will include hardware required to perform HVAC redundancy logic relay functions and the hardware required to perform monitoring functions during and following a Design Basis Accident as discussed earlier in Section 2.1.2.

3.0 DIVISION 1 - GENERAL REQUIREMENTS

This section contains the regulations from Division 1, General Requirements of DOE Order 6430.1A that will have to be considered for the FCS upgrade.

Throughout this chapter, regulations pertain to both safety class and non-safety class items.

3.1 Criteria Purpose and Applications (Section 0101)

3.1.1 Criteria Deviations (Section 0101-2)

For all projects subject to 6430.1 series, deviations from the 6430.1A criteria (i.e. a variance) may be granted by DOE organizations responsible for facility projects or granted by the DOE programmatic office responsible for the design of facilities. Deviations proposed for safety class items may also be granted with Headquarter level review and approval.

No specific requirement exists to comply with this regulation. This regulation can potentially be utilized when specific criteria cannot be met. However, it is unlikely that a deviation from the DOE order would be granted in most cases.

3.2 Architectural and Special Design Requirements (Section 0110)

3.2.1 Design, Programmatic and Operating Requirements (Section 0110-1)

3.2.1.1 Design (Section 0110-1.1.1)

This regulation pertains to design requirements such that the design must respond to user needs and reflect a responsible use of public funds.

Compliance with this regulation will require demonstrating that the design is defensible in terms of scope, cost, appearance, and it shall meet and not exceed users' needs.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

3.2.1.2 Programming (Section 0110-1.1.2)

This regulation pertains to the need for programmatic studies of the design.

Compliance will require the inclusion of the functional programmatic and operating requirements in compliance with explicitly referenced Order, DOE 4700.1. Programmatic studies to ensure maintainability, reliability, and other system features must be performed.

Estimated effort for compliance with this requirement is Level-2.

3.2.1.3 Systems Integration (Section 0110-1.2)

This regulation pertains to systems integration requirements if two or more services or systems from either Data Communications, HVAC control, Energy Management System, Security and Alarm or Fire Detection and Alarm are to be incorporated into a facility complex.

Compliance will require consideration of systems that have to be integrated (or if they can be) including cost-effectiveness concerns.

Level of effort associated with this requirement is level-2. No other compliance document is explicitly referenced.

3.2.2 Alternative Designs (Section 0110-2)

This regulation pertains to the need for alternative designs during project planning phase (conceptual design) in support of cost-usefulness tradeoff considerations.

Compliance will require the development of an alternative design in accordance with DOE 4700.1. Alternative designs must be considered during Title I against programmatic and operating requirements and criteria.

Estimated effort to do this is Level 2.

3.2.3 Flexibility (Section 0110-3)

This regulation pertains to flexibility of design. For special facilities, the design shall provide sufficient flexibility to accommodate for programmatic changes or operational modifications (to maximum extent practicable).

Compliance will require consideration of mechanical and electrical components of system with respect to anticipated future needs. A number of other criteria along these lines are also required.

The estimated effort associated with this requirement is level-2. No other compliance document is explicitly referenced.

3.2.4 Operational Efficiency (Section 0110-4)

This regulation is concerned with the need for promoting operational efficiency and will impact the placement of hardware within the FOC and other organizational aspects.

Compliance will require design to promote operational efficiency in a workable and logical manner based on organizational, functional, spatial and adjacency aspects of design.

The estimated effort associated with this requirement is level-1. No other compliance document is explicitly referenced.

3.2.5 Health and Safety (Section 0110-5)

3.2.5.1 Performance Objectives (Section 0110-5.1)

This regulation is concerned with the need for specifying the performance objectives to be achieved in the design of DOE facilities which include emergency preparedness.

Compliance with this regulation is required only if the FCS upgrade is an integral part of the DOE emergency management/emergency preparedness program. If so, compliance will require a demonstration that the performance objectives are achieved and that the emergency preparedness and emergency management have been developed according to DOE Orders 5500.1A and 5500.3.

The estimated effort associated with this requirement is level-2. Section 0110-99.2 (DOE 6430.1A) is also referenced.

3.2.6 Fire Protection (Section 0110-6)

3.2.6.1 General (Section 0110-6.1)

This regulation pertains to system components that potentially pose a fire hazard, including such things as use of materials with unusual fire characteristics, fire resistance ratings and other fire related factors.

Compliance with this regulation will require review of the following explicitly referenced documents DOE 5480.4, Attachment 2, Section 2.C, DOE 5480.7, Section 1530 (of

6430.1A), 29CFR 1926, 29CFR 1910, NFPA 101 and FM 1-57 for applicable relevance to FCS design components.

The estimated effort associated with this requirement is level-1.

3.2.6.2 Fire Resistance Ratings (Section 0110-6.3)

This regulation is concerned with the need for dividing the facility into areas into which not more than \$75 million dollars of equipment is housed. When equipment is valued at more than \$75 million, facility areas such as the FOC must be subdivided according to special criteria based on potential fire loss in terms of costs.

Compliance with this regulation will require a cost evaluation demonstrating that the valuation of equipment contained in the FOC including the FCS upgrade equipment is less than \$75 million. This regulation references DOE 5480.7.

The estimated effort associated with this requirement is level-1.

3.2.7 Operation Maintenance, Repair and Replacement (Section 0110-9)

This regulation pertains to the need for providing the capability for maintenance type functions including equipment accessibility, dismantling, replacement, repair, inspection, and preventative maintenance.

Compliance with this regulation will require planning and designing proposed modification systems based on operation and maintenance requirements. Design will be based on balancing initial construction cost with operating and maintenance costs over anticipated life of facility from LCC analysis and other programmatic requirements.

The estimated effort associated with this requirement is level-1. No other compliance document is explicitly referenced.

3.3 Special Facilities (Section 0111-99)

3.3.1 Nonreactor Nuclear Facilities (Section 0111-99.0)

3.3.1.1 General (Section 0111-99.0.1)

This regulation is concerned with structural concerns. However, for safety class systems and components, that may be located within structures that are not required to withstand severe phenomena (earthquakes, tornados etc.), sections of this regulation are applicable.

This regulation is concerned with safety class items.

This regulation addresses the need for the failure of components, systems, or structures that are not designed to the severe natural phenomena criteria not to impair the safety class items that must function during or following the severe natural phenomena.

Compliance with this regulation requires that safety class items associated with the FCS are designed to ensure that they will function for the amount of time required to following a severe natural phenomena.

Estimated effort for compliance with this requirement is Level-2.

3.4 Quality Assurance (Section 0140)

This regulation is concerned with the need for incorporating QA design requirements to comply with the existing QA program for modifications to an existing design.

Compliance with this regulation will require verification that design complies to existing QA program in accordance with DOE 5700.6B and using elements of DOE 4700.1 and ANS ANSI/ASME NQA-1. Additionally specific control mechanisms regulating design inputs, organizational and physical interfaces, changes to design, documentation and design verification must be established.

The estimated effort associated with this requirement is level-2.

3.5 Demolition, Decontamination, and Decommissioning (Section 0205)

3.5.1 Decontamination and Decommissioning (Section 0205-2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for facilities where hazardous or radioactive contaminating materials are used to be designed to limit dispersion and simplify dperiodic and decontamination and ultimate facility decommissioning and disposal or reuse.

Compliance with this regulation will require compliance with DOE 6430.1A, Section 1300-11 requirements concerning Decontamination and Decommissioning.

Estimated effort for compliance with this requirement is Level-2.

3.6 Finishes (Section 0900-99)

3.6.1 Nonreactor Nuclear Facilities - General (Section 0900-00.0)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for considering special coating guidelines to enhance decontamination of surfaces or because of environmental conditions.

Compliance with this regulation will require the FCS design professional to review coating guidelines in ASTM-D4256 and ANSI N512 when considering surface coatings for enhancing future decontamination or for environmental reasons.

Estimated effort for compliance with this requirement is Level-2.

4.0 DIVISION 13 - SPECIAL FACILITIES,

This section contains the regulations from Division 13, Special Facilities of DOE Order 6430.1A that will have to be considered for the FCS upgrade. TA-55 is assumed to only operate as a Plutonium Processing and Handling Facility (PPHF).

The only criteria that are applicable for a Plutonium Processing and Handling Facility (PPHF) are the general requirements (Section 1300), and the criteria for a Plutonium Processing and Handling Facility (Section 1304).

Certain regulations in this division pertain to safety class items only. A determination is made for each regulation in this section as to its applicability to safety class designation.

4.1 General Requirements (Section 1300)

Section 4.1 contains regulations relevant to the FCS design from the General Requirements Section 1300

4.1.1 Coverage and Objectives (Section 1300-1)

4.1.1.1 Objectives (Section 1300-1.3)

This regulation pertains to both safety class and non-safety class items.

This regulation pertains to designing special facilities such that compliance with DOE policies regarding nuclear safety, criticality safety, radiation safety, industrial safety, fire protection, environmental protection and other concerns are ensured. Additionally, the health hazards represented by all hazardous materials in enclosures, general work areas, and non-contaminated areas for a design of a modification of an existing special facility must be addressed.

Compliance with this regulation will require reviewing the regulation in full and documenting that the FCS designers are cognizant of Division 13 objectives.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

4.1.1.2 Limiting Exposure of Public (Section 1300-1.4)

Monitoring of Releases (Section 1300-1.4.4)

If the FCS is a formal part of a required radionuclide monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation requires that radionuclide monitoring be conducted in accordance with specific DOE orders.

Compliance with this regulation will require review and implementation of relevant requirements of the directive on Radiological Effluent Monitoring and Environmental Surveillance in the DOE 5400 series.

Estimated effort for compliance with this requirement is Level-2.

4.1.2 Safety Class Criteria (Section 1300-3)

4.1.2.1 General (Section 1300-3.1)

This regulation pertains to safety class items only. Components of the FCS may be safety class items.

This regulation addresses criteria applicable to designing, fabricating, erecting, and testing of facility components/ systems to standards and quality commensurate with the hazards and potential consequences associated with both the facility and the **role of each component**, and system, in mitigating the consequences of DBA's.

Compliance with this regulation will be accomplished by acknowledging the intent and purpose of this section.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

4.1.2.2 Safety Class Criteria (Section 1300-3.2)

This regulation pertains to safety class items only.

This regulation pertains to subjecting safety class items to higher-quality design, fabrication, and industrial test standards and codes as specified in Section 0106,

Regulatory Requirements and Section 0109, Reference Standards and Guides (both from 6430.1A). The safety class items must also be designed such that the failure of items that are non-safety class will not prevent safety class items from performing their required functions.

Compliance with this regulation will require reviewing all applicable documents from referenced sections 106 and 109 of DOE 6430.1A listed in Appendix A and Appendix B, and implementing requirements cited in those referenced documents where applicable to the FCS design. Only those regulations and standards applicable to the proposed upgrade are listed in Appendix A and Appendix B. Additionally, a demonstration that non-safety class items associated with modification will not impact the function of the safety class items must be performed.

Estimated effort for compliance with this requirement is Level-3.

An additional requirement of this regulation is applicable to both safety class and non-safety class items. That requirement addresses the need for compliance with Quality Assurance, programmatic requirements (DOE 6430.1A, Section 0140). Compliance with this regulation requires verification that design complies to existing QA program.

The estimated effort associated with this requirement is level-2.

4.1.2.3 Single Failure Criteria and Redundancy (Section 1300-3.3)

This regulation pertains to safety class items only.

This regulation pertains to designing system components such that a single failure does not result in loss of capability of a safety class system to accomplish its required safety functions. Single failure protection is generally accomplished by use of redundancy and diversity.

Compliance with this regulation will require that redundant features be built into the proposed design. Sufficient diversity (if possible) in the redundant features must be demonstrated or else common-mode failures must be addressed.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

4.1.2.4 Equipment Environment Considerations (Section 1300-3.4)

General (Section 1300-3.4.1)

This regulation pertains to safety class items only.

This regulation pertains to the design being able to withstand and be compatible with environmental effects and conditions associated with operations, maintenance, shutdown, testing, and accidents.

Compliance with this regulation will require a demonstration of environmental capability of equipment by testing, analysis, operating experience or other auditable methods and associated documentation.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Environmental Qualification of Equipment (Section 1300-3.4.2)

This regulation pertains to safety class items only.

This regulation pertains to equipment environmental qualification such that safety class items will be capable of performing required safety functions under DBA conditions. Equipment must demonstrate that it can at least perform for the period of time that its safety functions are required during and following a DBA. Subsequent equipment failure, after it performs its safety functions, may be allowable.

Compliance with this regulation will require a determination of what equipment environmental qualification must be met for the FCS upgrade. This will entail:

1. Determining which FCS safety class items/systems must function during and following a DBA,
2. Determining adverse environmental factors during and following a DBA such as temperature, pressure, humidity, and other potentially relevant environmental factors (that information should be available from the SAR).
3. Demonstrate that the FCS systems will function in adverse environments (item-2 above) as required to during and following a DBA.
4. Other considerations.

Estimated effort for compliance with this requirement is Level-3. No other compliance

document is explicitly referenced.

Equipment Operability Qualification (Section 1300-3.4.3)

This regulation pertains to safety class items only.

This regulation pertains to operability qualification of mechanical and electrical equipment and instrumentation required to operate during and following a DBE. Equipment operability is demonstrated by testing or a combination of testing and analysis. Seismic experience data may be used as an alternative to testing or dynamic analysis where such data have been documented and validated.

Compliance with this regulation will require a determination of adverse environmental conditions during and following a DBA (based on SAR), and demonstrating by means of testing and/or analysis that electrical equipment, instrumentation and mechanical equipment required to operate during and following a DBE will.

Estimated effort for compliance with this requirement is Level-3. Section 0111-99.0 of DOE 6430.1A is explicitly referenced.

4.1.2.5 Maintenance (Section 1300-3.5)

This regulation pertains to both safety class and non-safety class items.

This regulation pertains to maintainability factors peculiar to specific equipment to be used in the facility. Design of safety class items must provide for routine maintenance, repair or replacement of equipment subject to failure, inspection and testing to ensure operational readiness of equipment. Ancillary equipment, such as controls, must be located in an area least likely to be contaminated.

Compliance with this regulation will require designing the FCS upgrade such that inspection, testing, routine maintenance, repair and replacement of equipment is feasible. Additionally, this regulation has other criteria that will impact the FCS design such as locating controls in an area least likely to be contaminated.

The level of effort for this regulation is level-2. No other compliance document is explicitly referenced.

4.1.2.6 Testing (Section 1300-3.6)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for having the capability for periodic testing, monitoring, surveillance and alarm systems. For safety class items that are required to function under emergency conditions, the design must provide the capability to test periodically, under simulated emergency conditions.

Compliance with this regulation will require designing the FCS upgrade such that periodic testing of monitoring, surveillance, and alarms systems is feasible. For safety class items, that must function during emergency conditions, equipment testing under simulated emergency conditions must be feasible. There are additional compliance criteria.

Estimated effort for compliance with this requirement is Level-2.

4.1.3 Nuclear Criticality Safety (Section 1300-4)

If the FCS is an integral part of the criticality safety system, including providing a redundant loop for monitoring and alarm functions, then this regulation applies.

This regulation pertains to safety class items only.

This regulation addresses the need for designing FCS equipment and procedures for nuclear criticality control provisions to meet, as a minimum, the requirements of DOE 5480.5 and ANS 8 series on Nuclear Criticality Safety. Components that provide nuclear criticality safety must be designed as safety class systems and capable of performing their criticality safety functions during and following design basis accidents and events. A **criticality monitoring and alarm system (gamma and/or neutron)** must be provided where necessary to meet the requirements of DOE 5480.5 and ANS 8.3.

Compliance with this regulation will require designing equipment and procedures associated with the criticality monitoring and alarm system as per requirements outlined in DOE 5480.5 and ANS 8 series on Nuclear Criticality Safety.

Estimated effort for compliance with this requirement is Level-2.

4.1.4 Radiation Protection (Section 1300-6)

4.1.4.1 General (Section 1300-6.1)

If the FCS is a formal part of a required radionuclide monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for the facility design to minimize personnel exposures to external and internal radiological hazards are minimized and provide adequate radiation monitoring and alarm systems.

Compliance with this regulation will require providing adequate radiation monitoring and alarms capability where the FCS plays a required monitoring role.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

4.1.4.2 Internal Radiation Exposure (Section 1300-6.4)

If the FCS is a formal part of a required radionuclide monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to ensure that occupied operating areas do not exceed the airborne concentration limits of the DOE 5480 series for normal operating conditions.

Compliance with this regulation will require that engineered controls or other features associated with the FCS monitoring program ensure compliance with the limits of the DOE 5480 series and to minimize potential inhalation of radioactive and hazardous materials.

Estimated effort for compliance with this requirement is Level-1.

4.1.4.3 Monitoring, Warning, and Alarm Systems (Section 1300-6.5)

If the FCS is a formal part of a required radionuclide monitoring, warning, and alarm systems (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for annual calibration (using appropriate national standards) of monitoring systems. Additionally, radiation monitoring, alarm, and warning systems that are required to function during a loss of normal power must have emergency UPS (internal or external on-line) unless a temporary loss of function will not lose needed data and standby or emergency (switched) power is provided.

Compliance with this regulation will require calibrating the monitoring systems on an

annual basis against appropriate national standards. Additionally, monitors and alarms required during a loss of normal power must be on ups or on standby or emergency switched power.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

Air Monitoring and Warning Systems (Section 1300-6.5.2)

If the FCS acts as an air monitoring and warning system, this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for installation of air monitoring and warning systems in work areas where hazardous materials are stored or handled and where hazardous airborne particles or vapors may be present. Air monitoring systems must comply with ANSI N13.1.

Compliance with this regulation will require reviewing and implementing air monitoring systems requirements of ANSI N13.1 into the design of the FCS.

Estimated effort for compliance with this requirement is Level-1.

Personnel Monitoring and Warning Devices (Section 1300-6.5.3)

If the FCS is used to warn personnel of possible contamination, this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for devices (CAMs and alarms) to warn personnel of possible contamination at prescribed levels of airborne radioactivity.

Compliance with this regulation will require ensuring that the CAMs and warning devices associated with the FCS detect and alarm at the prescribed airborne radioactivity levels.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

Ionizing Radiation Monitoring System (Section 1300-6.5.4)

If the FCS is used as an ionizing radiation monitoring system to warn personnel of possible contamination, this regulation is relevant to the upgrade.

This regulation pertains to safety class and non-safety class items.

This regulation pertains to providing an area radiation monitoring and alarm system to alert personnel of unexpected increases in ionizing radiation levels where ionizing radiation is present (due to process material, equipment, or operations).

Compliance with this regulation will require ensuring that the FCS systems associated with the ionizing radiation monitoring system will adequately monitor and alarm if unexpected increases in ionizing radiation levels occur.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

Warning and Alarm System Features (Section 1300-6.5.5)

If the FCS provides a functional warning and alarm system capability (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to design, install and test warning and alarm systems, such that they can be heard in the ambient conditions of the area they are intended to cover. Evacuation alarm systems must comply with ANSI N2.3.

Compliance with this regulation will require reviewing ANSI N2.3 for applicable requirements concerning evacuation alarm systems (for FCS associated evacuation alarms), and testing all warning and alarm systems associated with the FCS to ensure that they can be heard over the ambient noise conditions in the locations they will cover.

Estimated effort for compliance with this requirement is Level-1.

Central Radiation Monitoring and Alarm Readout (Section 1300-6.5.7)

If the FCS provides central radiation monitoring and alarm readout capability, this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses specific design requirements of the central radiation monitoring and alarm readout function of the facility (criticality alarms, CAM's, alarms associated with stack monitoring systems, etc.).

Compliance with this regulation requires providing a central readout and alarm panels (i.e. control room or radiation monitoring office). The central readout and alarm panels must be accessible following a DBA to evaluate internal conditions.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

4.1.5 Confinement Systems (Section 1300-7)

If the FCS can directly or indirectly (i.e. part of a sequence of events) affect the HVAC confinement system (i.e. causes changes or modifies system airflow in certain situations) during normal operations or a DBA, then this regulation applies.

This regulation pertains to safety class items only.

This regulation addresses the functional requirements of the facility confinement systems.

Compliance with this regulation will require that the design of the facility confinement systems minimize spread and release of radioactive and hazardous materials during normal operations and during DBA events. Control functions of the FCS that affect the HVAC must perform as prescribed by this regulation and Section 1300-1.4.2, Section 0111-99.0, Sections 1550-99.01 and Sections 1550-99.02 of DOE 6430.1A.

Estimated effort for compliance with this requirement is Level-1.

4.1.6 Effluent Control and Monitoring (Section 1300-9)

If the FCS provides a required part of the effluent control and monitoring system, including providing monitoring or control signals, a redundant loop for monitoring and/or alarm functions, then this regulation applies.

This regulation pertains to safety class items only.

This regulation pertains to the design of monitoring and sampling of all effluent streams, particularly air monitoring.

Compliance with this regulation will require review of DOE 5400.1, and directive on Radiological Effluent Monitoring and Environmental Surveillance in DOE 5400 series to

ensure adequate and accurate measurements are performed by the air monitoring FCS associated components during normal, anticipated operational occurrences, and DBA conditions.

Estimated effort for compliance with this requirement is Level-2.

4.1.7 Decontamination and Decommissioning (Section 1300-11)

4.1.7.1 Decontamination (Section 1300-11.1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to incorporate design features that facilitate future decontamination of materials that may become contaminated with radioactive or other hazardous materials.

Compliance with this regulation will require providing means to simplify future decontamination including minimizing and arranging items such as piping, conduits, and ductwork in areas that may become contaminated. Surfaces must be finished in compliance with Section 0900-99, Finishes, Special Facilities to provide a smooth surface that facilitates decontamination.

Estimated effort for compliance with this requirement is Level-2.

4.1.7.2 Decommissioning (Section 1300-11.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for the FCS design to develop a decommissioning or conversion plan.

Compliance with this regulation will require development of a future decommissioning plan which considers conversion packaging of contaminated equipment, removal, ease of dismantlement, etc. The plan must be consistent with program requirements of DOE 5820.2A and DOE 6430.1A, Section 0205.

Estimated effort for compliance with this requirement is Level-1.

4.1.8 Human Factors Engineering (Section 1300-12)

4.1.8.1 Objectives (Section 1300-12.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the intended objectives of regulations relating to human factors engineering.

Compliance with this regulation will require review and acknowledgement of Section 1300-12.2 by FCS designers.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

4.1.8.2 System Development (Section 1300-12.3)

General (Section 1300-12.3.1)

This regulation pertains to both safety class and non-safety class items.

This regulation describes the extent to which integration of human factors engineering is to be incorporated into the overall system development.

Compliance with this regulation will require integrating human factors engineering into four phases of system development including; planning, requirements analysis, system design, and system test and evaluation.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Planning the Human Factors Engineering Role in System Development (Section 1300-12.3.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for the FCS design to develop a human factors engineering program plan.

Compliance with this regulation will require providing a human factors engineering program plan appropriate to the level of importance of the FCS system. The plan shall

detail the kinds of human factors engineering analysis, evaluations, and other aspects necessary for the design.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

Requirements Analysis (Section 1300-12.3.3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for the FCS design to include a systems requirements analysis specifying human factors engineering considerations.

Compliance with this regulation will require performing a systems requirements analysis for the FCS that identifies needs and requirements of system user and/or operators with respect to human factors. The analyses spans several subjects including human-machine function allocation, task analysis, system performance criteria, safety, cost maintainability, scheduling, and training. Analysis techniques are discussed in NUREG CR-3331, and Meister and Rabideau, Human Factors Evaluation and System Development.

Estimated effort for compliance with this requirement is Level-3.

Process System Design Interfaces (Section 1300-12.3.4)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the designing and selection of equipment to be operated and maintained by personnel.

Compliance with this regulation will require studies to examine special features of the system design with respect to equipment selection. The studies must incorporate many human factors criteria detailed in the regulation.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

Test and Evaluation (Section 1300-12.3.5)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to verify the operability and maintenance (under all

anticipated designed conditions) of system equipment by intended user personnel based on testing and evaluation.

Compliance with this regulation will require verification testing and evaluation of system design based on normal and abnormal procedures and scenarios. Test findings must be incorporated into the FCS system design.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

4.1.8.3 General Human Factors Implementation Criteria and Considerations (Section 1300-12.4)

Human Dimension Considerations (Section 1300-12.4.2)

This regulation pertains to both safety class and non-safety class items only.

This regulation addresses the need for the design of equipment to accommodate personnel body dimensions.

Compliance with this regulation will require selection of equipment such as control panels, stand-up/sit-down consoles and work stations, such that operating personnel body dimensions are accommodated. Guidelines for selection of equipment are presented in NUREG-0700, Section 6.1, and MIL-STD-1472C, Section 54.6.

Estimated effort for compliance with this requirement is Level-2.

Component Arrangement (Section 1300-12.4.4)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to arrange controls and displays on a control panel to promote efficiency, ease of referencing, and operator awareness.

Compliance with this regulation will require arranging controls and displays on a control panel to promote efficient use of task-related components, rapid location of any given component, and maximum operator awareness of plant conditions, and other considerations. These considerations are addressed in EPRI NP-3659., Chapter 4, and NUREG 0700, Sections 6.8 and 6.9.

Estimated effort for compliance with this requirement is Level-2.

Display Devices (Section 1300-12.4.6)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for displays to provide only the information about system status and parameter values needed to meet task requirements in normal, abnormal and emergency situations.

Compliance with this regulation will require establishing and designing FCS operator display information needs based on the operator task analysis. For important parameters status, rather than demand information must be displayed. Displays (CRTs, LCDs etc.) must identify reflected information and provide requirements such that information is readable, understandable, rapidly accessible (2-sec. query response) and transmittable (0.2-sec. control feedback). Other information is provided in NUREG-0700, Section 6.5, and MIL-STD-1472C, Section 5.2. Failure of any type display must be easily recognized and not affect equipment or system performance.

Estimated effort for compliance with this requirement is Level-2.

System Controls (Section 1300-12.4.7)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for designs to provide a display panel that allows the control panel operator to rapidly locate each component.

Compliance with this regulation will require the design to utilize various control display integration techniques including component groupings, system mimics, system demarcation and hierarchial labeling. Considerations to reduce operator information overload and other information are addressed in EPRI NP 3659, Chapter 4, NUREG 0700, Sections 6.1, 6.3, 6.7, and 6.9, and VAN Cott and Kincade, Human Engineering Guide to Equipment Design, Chapter 9.

Estimated effort for compliance with this requirement is Level-2.

Component Controls

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for control devices to provide appropriate control capability, range, and sensitivity for necessary control settings, and manipulations.

Compliance with this regulation will require selection of control devices such that they fulfill control requirements described in the task analysis of system functions (see Section 1300-12.3.3). In addition, control devices must be selected for durability, not prone to accidental activation, have capability to discern between a discrete and continuous function, control/display compatibility, and other criteria. Additional requirements are addressed in NUREG-0700, Section 6.4 and NUREG 0700, Section 6.4; MIL-STD-1472C, Section 5.4; and Van Cott and Kincade, Chapter 8.

Estimated effort for compliance with this requirement is Level-2.

Warning and Annunciator Systems (Section 1300-12.4.8)

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need for the design to provide an effective warning system to alert personnel to the problem or abnormal condition, and to provide sufficient time to respond appropriately to the problem.

Compliance with this regulation will require implementation of an effective warning system containing effective alerting stimulus and/or visual stimuli, periodic testing and other criteria. The warning system should be designed following guidelines found in MIL-STD-1472C, Section 5.3, NUREG 0700, Section 6.3, and NUREG 0700, Section 6.2 and Van Cott and Kincade, Chapter 4.

Estimated effort for compliance with this requirement is Level-2.

Maintainability (Section 1300-12.4.10)

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need for equipment design to incorporate the objective of efficient maintainability.

Compliance with this regulation will require the design to incorporate surveillance, testing, and maintenance of the FCS system and its restoration to operational effectiveness to be achievable at minimum cost with a minimum level of support services. UCRL 15673 shall be considered for system design.

Estimated effort for compliance with this requirement is Level-1.

Labels (Section 1300-12.4.11)

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need for the FCS design to incorporate appropriate identification labeling for equipment and any parts of equipment that are to be used by personnel.

Compliance with this regulation will require incorporation of a labeling plan into the design. The labels shall indicate clearly and concisely the function and purpose of the item being labeled. Specific guidelines for addressing labeling considerations are contained in DOE 6430.1A, Sections 1300-12.4.1.1 and 1040, NUREG 0700, Section 6.6: and MIL-STD-1472C, Section 5.5.

4.2 Plutonium Processing and Handling Facilities (PPHFs) (Section 1304)

4.2.1 Objectives (Section 1304-2)

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need for design objectives to ensure that conservatively estimated consequences of normal operations and credible accidents are limited in accordance with the guidelines.

Compliance with this regulation will require FCS designers to review and acknowledge plutonium facilities design objectives contained in Section 1300-1.4, Guidance on Limiting Exposure of the Public.

Estimated effort for compliance with this requirement is Level-1.

4.2.2 Radiation Protection (Section 1304-4)

If the FCS is a formal part of a required external radiation protection program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need for the facility design to provide continuous monitoring of external radiation exposure levels in process areas during entries required for maintenance or repair operations.

Compliance with this regulation will require design of the FCS associated components for the external radiation continuous monitoring program to be consistent with USNRC R.G. 3.35 and other criteria provided in DOE 6430.1A, Section 1304-4.

Estimated effort for compliance with this requirement is Level-1.

4.2.3 Confinement System (Section 1304-6)

The actual confinement system requirements for a specific plutonium facility shall be determined on a case-by-case basis. The TA-55 PPHF has essentially only two confinement systems, a primary confinement and a secondary confinement. There are no tertiary confinement systems.

4.2.3.1 Primary Confinement System (Section 1304-6.1)

If the FCS can directly or indirectly (i.e. part of a sequence of events) affect the PPHF primary confinement system (i.e. causes changes or modifies system airflow in certain situations) then this regulation applies.

This regulation pertains to safety class items only.

This regulation addresses the need for primary confinement systems to prevent release of plutonium to areas other than where processing operations are normally conducted.

Compliance with this regulation will require providing primary confinement barriers between the process material and any auxiliary system in a manner that minimizes risk of material transfer to an unsafe location or introduction of an undesirable medium into the process area. Differential pressure across the barriers must be used where appropriate. Special ventilation problems related indirectly to primary confinement and are discussed in Section 1550-99, Special Facilities.

Estimated effort for compliance with this requirement is Level-1.

4.2.3.2 Secondary Confinement System (Section 1304-6.3)

If the FCS can directly or indirectly (i.e. part of a sequence of events) affect the PPHF's secondary confinement system (i.e. causes changes or modifies system airflow in certain situations) then this regulation applies.

This regulation pertains to safety class items only.

Secondary confinement system in plutonium processing facilities generally consist of the confinement barriers and associated ventilation systems serving the operating area that confine any potential release of hazardous material from the primary confinement (usually area associated with the inside of gloveboxes).

This regulation addresses the need to maintain the integrity of the secondary confinement through all normal operations, anticipated operational occurrences, and any DBA the secondary barrier is required to withstand.

Compliance with this regulation will require the FCS design to maintain secondary confinement integrity by providing for continuous monitoring capability to detect loss of proper differential pressure with respect to both the process area and the operating area. Redundant sensors are to be considered based on the potential hazards.

Estimated effort for compliance with this requirement is Level-1.

4.2.4 Effluent Control and Monitoring (Section 1304-7)

4.2.4.1 Effluents (Section 1304-7.3)

Airborne Effluents (Section 1304-7.3.1)

If the FCS can is a formal part of a required PPHF effluent control and monitoring system (including acting as a required redundant component) then this regulation is relevant to the upgrade.

This regulation pertains to safety class and non-safety class items.

This regulation addresses the need in designing airborne effluent systems to consider and minimize plutonium holdup at locations in off-gas and ventilation ductwork and to provide for detecting and monitoring the buildup of material and for its recovery. Additionally, nuclear criticality safety must be incorporated into airborne effluent systems.

Compliance with this regulation will require the FCS design for effluent monitoring and controls in accordance with 40 CFR 61, Radiation Protection of the Public and the Environment in the DOE 5400 series, Radiological Effluent Monitoring and Environmental Surveillance directive in the DOE 5400 series, and applicable Federal, State and local requirements.

Exhaust outlets that may contain plutonium contaminants, must have two monitoring systems capable of covering a range from normal concentrations to credible accident concentrations and they must comply with DOE 6430.1A, Section 1589-99.0.1.

Estimated effort for compliance with this requirement is Level-2.

5.0 DIVISION 15 - MECHANICAL

5.1 Heating, Ventilation, and Air-Conditioning Systems (Section 1550)

5.1.1 Special Facilities (Section 1550-99)

This section contains the regulations from Division 15, Mechanical, Section 1550-99 Special Facilities of DOE Order 6430.1A that will have to be considered for the FCS upgrade.

5.1.1.2 General Ventilation and Off-Gas Criteria (Section 1550-99.01)

If the FCS is a formal part of a required general ventilation and Off-Gas system (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class items only.

This regulation addresses the need for safety class ventilation and off-gas systems to be designed to operate in conjunction with physical barriers to form a confinement system to limit the release of radioactive and other hazardous material to the environment and to minimize or prevent the spread of contamination within the facility.

Compliance with this regulation will require ensuring that the design of the FCS associated with the ventilation and off-gas systems provide adequate instrumentation and controls to assess the ventilation or off-gas system performance and allow the necessary control of system operation to ensure a continuous airflow pattern from the environment into the building and from uncontaminated areas of the building to potentially contaminated areas and to normally contaminated areas. **Components of ventilation and off-gas systems that require electric power to perform their safety functions must be considered safety class loads.** Equipment in ventilation and off-gas systems associated with the FCS must be appropriately qualified to ensure reliable operation during normal operating conditions, anticipated operational occurrences, and during and following a DBE. Ventilation must be balanced such that a negative air pressure exists with respect to outside atmosphere. Additionally, ventilation and off-gas system that provide required functions following a seismic event must function following a DBE, the failure of ventilation and off-gas systems not designated as safety class must not prevent other facility safety class systems from performing required safety functions, and other requirements apply.

Ventilation and air-conditioning systems design to provide a comfortable working environment and whose functions are not required to provide confinement are generally

not designed as safety class systems.

Estimated effort for compliance with this requirement is Level-2.

5.1.2 Confinement Ventilation Systems (Section 1550-99.02)

If the FCS is a formal part of a required confinement ventilation system (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class items only.

This regulation addresses the need for the ventilation system design to provide the required confinement capability under all credible circumstances with the addition of a single failure in the system.

Compliance with this regulation will require the associated ventilation/confinement system FCS design to ensure that safety class electric power and emergency power is provided for electrical equipment and components that maintain a controlled continuous confinement airflow such that desired airflow characteristics are provided. Additionally air cleanup systems that limit or minimize the release of radioactive or hazardous material to the environment or within the facility must be continuously monitored with appropriate alarms and manual or automatic protective features and appropriate test and measuring devices must be provided as well as other requirements.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

Hot Cell Exhaust Systems

If the FCS is a formal part of a required hot cell exhaust system, (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class items only.

This regulation addresses the need for hot cell exhaust systems to have monitors and associated alarms for detecting a significant increase in the concentration of hazardous material in the exhaust.

Compliance with this regulation will require reviewing the safety analysis report (SAR) for minimum specified performance requirements for the ventilation system and response requirements of system components, instrumentation, controls, redundancy, etc. Those

components associated with the FCS must be addressed in accordance with the SAR. Additional specific requirements for plutonium or enriched uranium is processed include capability for switchover from a recirculation to a once-through ventilation system, and other instrumentation, controls, and filtration requirements based on the safety analysis, as well as numerous other requirements specified.

Estimated effort for compliance with this requirement is Level-2.

5.1.3 Off-Gas Systems (Section 1550-99.0.3)

If the FCS is a formal part of a required off-gas system (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class items only.

This regulation addresses the need to design an off-gas system commensurate with the characteristics of the radioactive material in the off-gas and the potential risk associated with its release as an effluent to maintain off-site doses associated with normal system operation within the guidelines referenced in Section 1300-1.4.2, Routine Releases, and that they are ALARA.

Compliance with this regulation will require providing adequate redundancy for portions of off-gas system and components that are required to control or limit the release of radioactive material or for safe operation of system. Electric equipment and components of off-gas system requiring electric power for safety function performance must be considered safety class loads. Additionally adequate instrumentation to monitor, assess system performance, alarm and maintain manual or automatic protective features must be provided such that an uncontrolled release of radioactive material to the environment is prevented and the spread of contamination within the facility is minimized as well as other requirements.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

5.2 Air Pollution Control (Section 1589)

This section contains the regulations from Division 15, Mechanical, Section 1589-99 Special Facilities of DOE Order 6430.1A that will have to be considered for the FCS upgrade.

5.2.1 Special Facilities (Section 1589-99)

5.2.1.1 Radioactive Airborne Effluents (Section 1589-99.01)

If the FCS is a formal part of a required radioactive airborne effluent monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to safety class items only.

This regulation addresses the need for airborne effluents from confinement areas to be exhausted through a ventilation system to remove particulate material, vapors and gasses to comply with appropriate guidelines.

Compliance with this regulation will require reviewing Section 1300-1.4.3 (Routine Releases) for applicability for radioactive effluents and reviewing DOE 5400.1 for other hazardous materials to ensure FCS design is in accordance with these guidelines. Additionally, all exhaust ducts or stacks that may contain radioactive airborne effluents to have effluent monitoring systems. Backup capability for monitoring systems **must be considered** in the design of each system (e.g. redundant detectors, additional sample line ports, additional sampler trains, etc).

Continuous stack sampling and continuous radiation detection must be considered and sampling systems must be designed in accordance with ANSI N13.1, and applicable requirements directive of Radiation Protection of the Public and the Environment and the directive on Radiological Effluent Monitoring and Environmental Surveillance in the DOE 5400 series to ensure representative sampling of the effluent stream. The range capability of continuous monitors must cover from routine to potential DBA releases of radionuclides. Nuclear criticality safety must be considered in the design of equipment used to treat and discharge radioactive airborne effluents.

Estimated effort for compliance with this requirement is Level-2.

5.2.1.2 Nonradioactive Airborne Effluents (Section 1589-99.02)

If the FCS is a formal part of a required nonradioactive airborne effluent monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for nonradioactive gaseous or airborne effluents exhausted from special facilities not to exceed specified guidelines.

Compliance with this regulation will require reviewing DOE 5400.1 guidelines and applicable Federal, State and Local requirements to ensure that associated effluent limits will not be exceeded and its applicability to the FCS design.

Estimated effort for compliance with this requirement is Level-2.

5.3 Controls (Section 1595)

5.3.1 General (Section 1595.1)

If the FCS provides a control function of a required system or monitoring program (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for safety and operating controls, automatic temperature and humidity controls, energy monitoring and (central supervisory) control systems, energy conservation requirements for controls, and zoning requirements and restrictions and their associated requirements.

Compliance with this regulation will require reviewing DOE 6430.1A, Section 1550 (Heating Ventilation and Air-Conditioning Systems, Section 0110-12 (central supervisory and fire protection control systems), and Division 16 (electrical) for control system requirements. Selection of control system types and associated equipment must be based on the most economical and maintainable system. Additionally control systems must be designed to use the closed-loop feedback method of control and proportional-type control must be used for all control systems; other type control systems must be used as needed according to the degree of control required. Other requirements for accessibility, temperature and piping must be incorporated.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

5.3.2 Zoning (Section 1595.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for appropriate zoning of automatic controls such that DOE health and safety and NFPA 101 project requirements are satisfied.

Compliance with this regulation will require FCS design to

zone automatic control of space temperatures, static pressures, humidities, ventilation, smoke and fire detection in accordance with health and safety requirements as indicated by DOE project criteria, and NFPA 101 space operational and occupancy requirements and zoning exposure with relation to building size, orientation and configuration. Additionally,

each HVAC system must have a separate thermostat for space temperature regulation and a separate humidistat if humidity control is provided with automatic controls provided such that heating or cooling to any individual zone can be shut off.

Estimated effort for compliance with this requirement is Level-2.

5.3.3 Control of Air Handling Systems (Section 1595-6)

5.3.3.1 Mechanical Ventilation Control (Section 1595-6.1)

If the FCS is a formal part of a required mechanical ventilation control system (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for automatic and manual control of fan operation for supply, return and exhaust ventilation system.

Compliance with this regulation will require associated FCS design associated with the supply, return, and exhaust ventilation systems to provide automatic and manual control of fan operation to shut off the fan when ventilation is not required. Additionally, manual gravity-operated or automatic control of dampers for outside air intake and exhaust or relief to prevent introduction of outside air (when ventilation is not required) must also be provided. Systems that circulate air must be provided with minimum outdoor air damper position control to assure that the minimum outdoor air quantity is being introduced to the system. Automatic dampers must fail open for return air and fail closed for outside air.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

5.3.3.2 Variable-Air Volume System Fan Control (Section 1595-6.4)

If the FCS is a formal part of a required variable-air volume system fan control (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for providing control devices that sense ductwork static air pressure, velocity air pressure, control supply fan airflow and static pressure output through modulation of variable inlet vanes, and mechanical speed drive controls or variable frequency electric drive controls for variable-air-volume systems.

Compliance with this regulation will require variable-air-volume control systems to have a minimum of one static pressure sensor mounted in ductwork downstream of the fan and one static pressure controller to vary fan output either through inlet vane, damper, belt modulator, or speed control. Exhaust fans, supply fans, and return or relief fans must have control devices that interface the operation of the fans to "track" air volumes and maintain fixed minimum outdoor air ventilation requirements.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

6.0 DIVISION 16, ELECTRICAL

This section contains the regulations from Division 16, Special Facilities of DOE Order 6430.1A that will have to be considered for the FCS upgrade.

Certain regulations in this division pertain to safety class items only. A determination is made for each regulation in this section as to its applicability to safety class designation.

The proposed modification to the TA-55 operations center will be involving changes within an interior electrical system only. Henceforth the requirements concerning the changes will be specifically aimed at only internal electrical systems requirements

6.1 Basic Electrical Materials and Methods (Section 1605)

6.1.1 General (Section 1605-1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for systems to be designed such that all components operate within their capacities for initial and projected loads, UL or FM equipment is used, proper installation is done, and electrical systems meet acceptance testing criteria.

Compliance with this regulation will require the FCS to be designed in accordance with NFPA 70 and ANSI C2 (electrical loads), and ANSI C84.1 (voltages) standards, use UL- or FM- tested electrical equipment, and to perform on-site acceptance testing for demonstrating to government representatives that function and parameters are implemented for each major electrical system .

Estimated effort for compliance with this requirement is Level-2.

6.1.2 Wiring Systems (Section 1605-2)

6.1.2.1 Raceways (Section 1605-2.1)

General (Section 1605-2.1.1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for ensuring that raceways penetrating fire-rated assemblies are non-combustible.

Compliance with this regulation will require the FCS design to ensure that complete installation is suitably sealed to maintain the established fire ratings as defined in UL Building Materials Directory and UL 1479. Additionally, raceways must be at least 1/2-inch in diameter unless they are embedded in concrete or masonry (then 3/4 in minimum raceways must be used) and they must be adequate in number and capacity for the initial and projected facility requirements.

Estimated effort for compliance with this requirement is Level-1.

Electrical Metallic Tubing (Section 1605-2.1.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for enclosing circuit power conductors, alarm and signal circuits in Electric Metallic Tubing (EMT) and locating them in non-hazardous and non-corrosive locations.

Compliance with this regulation will require installing EMT enclosing circuit power conductors and alarm and signal circuits (not encased in concrete or underground) in locations where they will not be subjected to physical damage during installation or while in service.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

Flexible Steel Conduit (Section 1605-2.1.3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for using flexible steel conduit when design equipment is either subject to vibration or from junction boxes to recessed lighting fixtures.

Compliance with this regulation will require the FCS design to determine and incorporate the use of flexible steel conduit for connections to either recessed lighting fixture junction boxes or equipment subject to vibration.

Estimated effort for compliance with requirement is Level-1. No other compliance document is explicitly referenced.

Rigid Steel Conduit and Intermediate Metal Conduit (Section 1605-2.1.4)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for using rigid steel conduit or intermediate metal conduit in hazardous locations.

Compliance with this regulation will require a determination of the hazardous location classification based on NFPA 70. If any equipment is to be located in these hazardous locations, rigid steel conduit or intermediate metal conduit must be used.

Estimated effort for compliance with this requirement is Level-1.

Aluminum Conduit (Section 1605-2.1.5)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for the FCS design to use aluminum conduit for high-frequency circuits where potential magnetic problems exist or where steel conduit is unsuitable.

Compliance with this regulation will require a determination of the frequency of the circuits and associated magnetic atmospheres, to determine if aluminum conduit should be used.

If aluminum conduit is used, it must not be installed in potentially unsuitable locations, underground, nor in concrete.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

Nonmetallic Conduit (Section 1605-2.1.6)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for using nonmetallic conduit only for red/black design, or where allowed by guidance criteria.

Compliance with this regulation will require a determination, if nonmetallic conduit is to be used based on FCS design. If nonmetallic conduit is to be used, it must be located in accordance with NFPA 70. Electromagnetically sensitive areas prohibit the use of this type of conduit. Secure conductors may not be enclosed by nonmetallic conduit except for red/black design in accordance with NSA NACSIM 5203.

Estimated effort for compliance with this requirement is Level-1.

Surface-Metal or Nonmetallic Systems (Section 1605-2.1.7)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for using surface-metal or nonmetallic raceways only for vertical routings to source or termination points and for providing mechanical protection if raceways are passing from one floor to another.

Compliance with this regulation will require determining if the FCS design will utilize surface-metal or nonmetallic systems. If they are to be used, they must be located in accordance with NFPA 70, and raceways that pass from one floor to another must have mechanical protection up to 4 feet above floor level.

Estimated effort for compliance with this requirement is Level-1.

Cable Trays (Section 1605-2.1.8)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for using cable trays for large multiple-cable applications in interior locations.

Compliance with this regulation will require determining if cable trays are to be utilized based on the size of cable applications. If cable trays are located such that they penetrate security barriers, they must be placed in appropriate locations and conform to appropriate criteria.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

6.1.2.2 Conductors (Section 1605-2.2)

General (Section 1605-2.2.1)

This regulation pertains to both safety class and non-safety class items.

This regulation specifies the type and size of conductors based on utility. It also requires a justification document if aluminum conductors are to be used.

Compliance with this regulation will require reviewing design to determine type of electrical systems, and appropriate conductor selection based on 6430.1A, Section 1605-2.2.1. Additionally a class determination for remote-control and signal circuits must be performed, appropriate conductors selected, and installation must be performed in accordancy with appropriate NFPA regulation. If aluminum conductors are chosen, the contract documents must provide the basis for the size of conductor selected.

Estimated effort for compliance with this requirement is Level-2.

Aluminum Conductor Termination (Section 1605.2.2.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for appropriate termination of aluminum conductors.

Compliance with this regulation will require terminating aluminum conductors used in FCS design in compliance with IEEE 141 if aluminum lugs, aluminum pads or Belleville washers are used. Setscrew termination is allowed for connection to approved circuit breakers however, split-bolt terminators must not be used.

Estimated effort for compliance with this requirement is Level-1.

Conductor Identification (Section 1605-2.2.3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for identifying conductors and voltage levels.

Compliance with this regulation will require identifying all FCS design voltage levels, grounded conductors, equipment grounding conductors, and ungrounded phase conductors with existing field center wire color-code systems. If such a color code is nonexistent the color coding must be done according to DOE 6430.1A, Section 1605-2.2.3.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

6.2 Interior Electrical Systems (Section 1640)

6.2.1 General (Section 1640-1)

6.2.1.1 Demand and Diversity Factors (Section 1640-1.1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for demand and diversity factors to be consistent with appropriate load requirements.

Compliance with this regulation will require demand and diversity factors associated with the FCS design to comply with DOE 6430.1A, Section 1630-1.1, Load Requirements

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

6.2.1.2 Power Factor (Section 1640-1.2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for interior electrical systems power factors to comply with appropriate power factor criteria.

Compliance with this regulation will require interior electrical system power factor to comply with DOE 6430.1A, Section 1630-1.2.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

6.2.1.3 Interior Distribution Voltage Levels (Section 1640-1.3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for interior distribution to use standard voltage levels to use standard voltages or to continue the single-phase service provided.

Compliance with this regulation will require standard voltages to comply with MIL HDBK 1004/4 or interior distribution to continue the 240/120 volt single-phase service provided, as applicable.

Estimated effort for compliance with this requirement is Level-1.

6.2.1.4 Power System Reliability (Section 1640-1.4)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for ensuring a continual, reliable power supply to systems and equipment designated as critical.

Compliance with this regulation will require performing a determination of critical (based on cognizant DOE authority) equipment and systems associated with the FCS and providing a reliable continuous power supply in accordance with IEEE 493. Design must also consider the need for multiple transformer-switchgear service equipment, to ensure power supply continuity within the facility during scheduled or emergency equipment outages.

Estimated effort for compliance with this requirement is Level-2.

6.2.1.5 Power Quality Requirements (Section 1640-1.5)14

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need to minimize the adverse effects of voltage level variations, transients, and frequency variations on equipment.

Compliance with this regulation will require providing appropriate protective isolation for sensitive electrical equipment, such as data processing equipment. Uninterruptible power systems, motor-generator sets, or power conditioners may be used for isolation.

Estimated effort for compliance with this requirement is Level-2.

6.2.1.6 System Protection (Section 1640-1.6)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for providing system protection for equipment and systems.

Compliance with this regulation will require providing system protection in accordance with IEEE 242. Additionally, specialized research and development facilities equipment and systems protection must comply with DOE/EV 0051-1.

Estimated effort for compliance with this requirement is Level-2.

6.2.1.7 Ground-Fault Protection (Section 1640-1.7)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for ground-fault protection.

Compliance with this regulation will require ground-fault protection associated with the FCS design to comply with NFPA 70 and DOE 6430.1A, Section 1605-2.3.

Estimated effort for compliance with this requirement is Level-1.

6.2.1.8 Neutral Conductors (Section 1640-1.8)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for sizing the neutral conductor.

Compliance with this regulation will require sizing neutral conductors for electric discharge lightning and data processing in accordance with NFPA 70. Calculations must include harmonic current.

Estimated effort for compliance with this requirement is Level-2.

6.2.2 Service equipment and Facilities (Section 1640-2)

6.2.2.1 General (Section 1640-2.1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses interior electrical and switchgear criteria compliance.

Compliance with this regulation will require the FCS design electrical systems to comply with NFPA 70. Any associated switchgear (if any) must comply with IEEE C37 series.

Estimated effort for compliance with this requirement is Level-2.

6.2.2.2 Transformers (Section 1640-2.3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for interior transformers to satisfy initial and projected

loads, operational continuity, safety, and security criteria.

Compliance with this regulation will require interior service transformer installations to comply with NFPA 70 and FM 5-4/14-8. An adequate number of transformers must be used based on expected loads and anticipated future loads. Transformer protection and appurtenances must comply with IEEE C37-91

Estimated effort for compliance with this requirement is Level-2.

6.2.2.3 Motor Control (Section 1640-2.4)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses motor control equipment requirements including overcurrent devices, reset devices, and automatic control devices.

Compliance with this regulation will require control equipment used for motors (if any used in FCS design) to comply with NEMA ICS standards and UL 508. Motors must be provided with fully coordinated control equipment and other devices based on the type of motor to perform the functions required. Control devices must be of adequate voltage and current ratings for duty to be performed. Other requirements apply.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

6.2.3 Special Facilities (Section 1640-99)

6.2.3.1 Emergency Preparedness Facilities (Section 1640-99.2)

If the FCS provides a formal function of a required emergency preparedness facility (including acting as a required redundant component), this regulation is relevant to the upgrade.

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for electrical distribution systems to provide flexibility for facility work and for personnel safety.

Compliance with this regulation will require the FCS design of electrical distribution systems (if appropriate) to provide the needed degree of flexibility to allow for facility work and personnel safety. Special-purposes receptacles must be identified with respect to voltage, amperage, number of phases, power source, AD or DC, frequency, etc.

Additionally, emergency power provisions in accordance with DOE 64330.1A, Section 1660, Special Systems, must be provided.

Estimated effort for compliance with this requirement is Level-1. No other compliance document is explicitly referenced.

6.2.3.2 Telecommunications, Alarm, and ADP Centers and Radio Repeater Stations (Section 1640-99.8)

General (Section 1640-99.8.1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for an uninterruptible or emergency power source for essential equipment.

Compliance with this regulation will require identifying and connecting the essential equipment associated with the FCS design with an uninterruptible or emergency power. Design must be coordinated with the equipment system specialists and DOE security personnel. Where continuity of service is required for critical cord-connected type of equipment, twist-lock type connectors must be used.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

6.3 Special Systems (Section 1660)

6.3.1 General (Section 1660-1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for providing standby and emergency systems to equipment, components, or systems vital to protection of health, life, property, and safeguards and security systems. All safety class 1 items must also have emergency power.

Compliance with this regulation will require providing standby or emergency systems to serve loads identified in NFPA 110. Additionally, equipment, components, and systems, determined by DOE to be vital (fire and security alarms, etc.), and safety class 1 items must also be provided with emergency or standby systems. Systems and equipment that cannot function during momentary or interrupted power loss must have uninterruptible power in accordance with DOE 6430.1A, Section 1660-3. Protective alarm and

communications systems must also have emergency power (detailed further in DOE 6430.1A, Section 1660-99) and be in accordance with associated annunciator and equipment areas criteria.

Estimated effort for compliance with this requirement is Level-2.

6.3.2 Emergency Power Systems (Section 1660-2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for emergency power systems to be capable of maintaining full operation of emergency loads for the time period required and have built in features to facilitate operational testing to verify readiness.

Compliance with this regulation will require all emergency power systems associated with the FCS design to be capable of maintaining full operation of emergency loads for the period of time specified by the cognizant DOE authority and they must comply with NFPA 37, NFPA 70, NFPA 101, NFPA 110, and IEEE 446. Additionally, emergency power systems must provide for operational testing on a periodic basis to verify their readiness. Emergency generators require specific type of engines and batteries must be rechargeable and maintained fully charged and comply with appropriate other criteria.

Estimated effort for compliance with this requirement is Level-2.

6.3.3 Uninterruptible Power Systems (Section 1660-3)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for providing uninterruptible power supplies to loads requiring guaranteed continuous power.

Compliance with this regulation will require the FCS design to provide uninterruptible power supplies for loads requiring continuous power. UPS installations must comply with IEEE 446 (as modified by cognizant DOE authority), and may be either Safety Class 1 (Seismic Category 1 functional) or standby type based on the loads served.

Estimated effort for compliance with this requirement is Level-2.

6.3.4 Special Facilities (Section 1660-99)

6.3.4.1 Nonreactor Nuclear Facilities General (Section 1660-99.0)

Safety Class (Emergency) Electrical Systems (Section 1660-99.0.1)

This regulation pertains to safety class items only.

This regulation addresses the need for designating electrical power, instrumentation and control systems as safety class electric if they satisfy the safety class criteria in Section 1300-3, General. Safety class electric systems and components are subjected to IEEE 308 standards and higher quality assurance requirements as needed.

Compliance with this regulation will require FCS design to determine the safety class items that require electric power to perform their safety functions, provide them with safety class emergency electric power systems (AC, DC, and their distribution systems), define the type, capacity, performance characteristics and features of the safety class electric systems (including generator and batteries) required to meet safety class system needs.

Safety class electric systems must be provided with suitable **redundancy and separation** to ensure that adequate capacity and capability are available with the addition of a single failure. **Redundant safety class electric systems must be physically protected or separated, according to IEEE 379 and IEEE 384 criteria, to prevent a common external event from causing a failure of the redundant systems.**

Loads that do not require safety class power to safety class buses must be minimized. Where such loads must be connected to a safety class electric power system, the loads must have suitable separation or devices that will prevent failures from affecting the safety class electric system.

Safety class electric systems must be qualified to the requirements in Section 1300-3.4, Equipment Environment Considerations.

Testing or a combination of testing and analysis will be the preferred method of demonstrating the operability of instrumentation and electrical equipment that are required to operate during and following a DBE. Seismic experience data may be used as an alternative to testing or dynamic analysis where such data have been documented and validated.

The capability to periodically test safety class electric systems to verify system performance must be provided.

Estimated effort for compliance with this requirement is Level-3.

Protection System and Instrumentation and Controls (Section 1660-99.0.2)

This regulation pertains to safety class items only.

This regulation addresses the need for providing safety class protection systems and instrumentation and control systems for nonreactor nuclear facilities.

Compliance with this regulation will require providing safety class protection systems and safety class instrumentation and control systems to minimize risk associated with facility operation.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Protection Systems

This regulation pertains safety class items only.

This regulation addresses the need for protection systems designs such that they sense potentially hazardous conditions and automatically initiate actions to ensure that specific acceptable designs limits are not exceeded as a result of anticipated operational occurrences.

Compliance with this regulation will require providing protection systems (those that initiate corrective actions such as fire detection/Halon release, ups, etc) that automatically initiate protective actions requiring rapid response and automatic control of interlocks that prevent unsafe operator actions. Protection systems for safety class systems and components must activate automatically with audible and visual indication of system status to ensure the safety of operating personnel and public. All automatically initiated protective actions must have a manually initiated backup. Suitable redundancy and diversity must be provided such the safety functions can be completed when required and no single failure results in the loss of the protective function. Additionally protection system must be designed to fail in a safe state following a component or channel failure or loss of power (e.g., control air or electric power).

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Safety Class Instrumentation and Controls

This regulation pertains to safety class items only.

This regulation addresses the need for safety class instrumentation and control systems to provide audible and visual alarms such that the operator can take timely corrective actions to ensure the safety of operating personnel and the public.

Compliance with this regulation will require the FCS design of safety class instrumentation to sense abnormal conditions affecting safety and provide subsequent audible and visual alarms (e.g., low differential pressure between HVAC zones, criticality monitoring) such that appropriate corrective action can be taken. Safety class instrumentation must be capable of monitoring safety-related variables and safety class systems over expected ranges for normal operation, anticipated operational occurrences, DBA conditions, and providing appropriate controls for safe shutdown. Typical systems requiring safety class instrumentation and controls include safety-related process systems, safety class confinement systems and cooling systems. Suitable redundancy and diversity to ensure that safety functions can be completed when required and no single failure results in the loss of the protective functions must be provided. Safety class instrumentation and controls must fail in a safe state following a component or channel failure or loss of power (e.g., control air, electric power).

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Qualification (Section 1660-99.0.3)

This regulation pertains to safety class items only.

This regulation addresses the need for providing environmental qualification of the protection systems and safety class instrumentation and control equipment.

Compliance with this regulation will require providing an environmental qualification of the protection systems and safety class instrumentation and control equipment in accordance with DOE 6430.1A, Section 1300-3.4, Equipment Environment Considerations.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Separation and Physical Protection (Section 1660-99.0.4)

This regulation pertains to safety class items only.

This regulation addresses the need for physical protection or separation of redundant protection systems and safety class instrument channels.

Compliance with this regulation will require providing physical protection or separation of redundant protection systems and safety class instrument channels to prevent a common external event or failure of one channel from causing a failure in the redundant channel. The separation or isolation from other instrumentation and control systems must be such that a failure (e.g., electrical, control air) in these other systems will not degrade the safety class systems such that they can not perform their necessary safety functions.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

Test and Calibration (Section 1660-99.0.5)

This regulation pertains to safety class items only.

This regulation addresses the need for periodic in-place testing and calibration of instrument channels and interlocks to determine whether failure or loss of redundancy has occurred.

Compliance with this regulation will require the providing for periodic in-place testing and calibration of instrument channels and interlocks associated with the protection system and safety class instrumentation and control systems.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

Power Sources (Section 1660-99.0.6)

This regulation pertains to safety class items only.

This regulation addresses the need for determining from analysis power requirements for safe shutdown of processes.

Compliance with this regulation will require performing a power requirements analysis to determine safe shutdown criteria power needs. Safety class electric power or a safety-class control air system must be provided unless adequate system performance including fail-safe shutdown can be demonstrated when only the conventional power sources are used.

Estimated effort for compliance with requirement is Level-3. No other compliance document is explicitly referenced.

Control Areas (Section 1660-99.0.7)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for control room/control area design to allow for occupancy where actions can be taken to operate and if necessary shutdown the facility safely under normal, anticipated operational occurrences, and DBA conditions.

Compliance with this regulation will require the control room area associated with the FCS upgrade to allow for occupancy such that actions can be taken to operate the facility safely under normal and anticipated operational occurrences, and to place and maintain the facility in a safe shutdown condition during DBA conditions including remote (if used) manual initiation and control of safety functions. In the event that a control area or control room is disabled, sufficient redundancy and capability to allow the facility to be placed in a safe shutdown condition, must be provided.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

6.4 Energy Conservation (Section 1694)

6.4.1 General (Section 1694-1)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for maximizing efficient energy usage and minimizing energy losses within the electrical system.

Compliance with this regulation will require planning and selecting equipment based on maximizing efficient energy usage and minimizing energy losses within the electrical system based on an LCC-effectiveness. DOE 6430.1A, Section 0110-12, Energy Conservation provides criteria on LCC for energy conservation. Industrial systems must comply with IEEE 739 and Commercial systems must comply with ASHRAE Standard 90.

Estimated effort for compliance with this requirement is Level-3. No other compliance document is explicitly referenced.

6.4.2 Energy Management System and Devices (Section 1694-2)

This regulation pertains to both safety class and non-safety class items.

This regulation addresses the need for considering energy management system and devices in the planning and designing of new systems or alterations or additions to existing systems.

Compliance with this regulation will require consideration of the EMSs and devices in the design and planning of the FCS system based on potential benefits as per DOE 6430.1A, Section 1595, Controls.

Estimated effort for compliance with this requirement is Level-2. No other compliance document is explicitly referenced.

7.0 CONCLUSIONS

7.1 General Overview

The FCS system components and modifications proposed for the FCS upgrade located in the TA-55 Facility Operations Center, are subject to DOE 6430.1A requirements. It is important to note that the proposed FCS design modifications will not interface with direct process equipment or functions. The control/monitoring functions of the FCS are associated with equipment and systems surrounding the process itself. Therefore it does not provide any functions associated with materials accountability and surveillance, or plutonium processing. DOE 6430.1A, Sections 1, 13, 16, and selected parts of 15 are applicable to the FCS modification.

In Section 1.0, a 4-Phase approach was presented to achieve compliance for the FCS design. Phase I of the plan is complete (Sections 3-6) and lists the regulatory requirements of DOE 6430.1A that are relevant to the FCS design at the PPHF Facility.

Phases II, III, and IV will encompass, additional investigation into explicitly referenced documents for applicable Phase I regulations to determine specific requirements, incorporation of requirements into design, fabrication, testing, and provide final documentation stipulating how compliance with the criteria was actually met.

A determination as to what components and equipment associated with the FCS design are safety class items must be clearly identified. Safety Class components and systems are subjected to higher standards including design, fabrication, testing, as well as codes and requirements therein. These systems will require additional studies, documentation, testing, demonstrations, etc. to ensure that they have adequately complied with the requirements.

7.2 Recommendations

A systems definition document should be prepared which details the systems functionality. This document should provide a detailed system description from the sensor level to the applicable control and interlock functions. The system definition should be performed for all components associated with the proposed FCS design and provide a final determination as to actual formal function of specific FCS component.

A formal determination needs to be made whether FCS components are to be classified and treated as safety class items. When demonstrating compliance to DOE 6430.1A, the definition of safety class item is that provided in Section 1300-3, and designates that certain systems engaged in worker protection, criticality alarm and monitoring, and radionuclide monitoring are safety class items. The SAR when completed will provide the basis for safety class determination. It should be remembered that any signals,

components or systems that provide required redundant signal functions or paths for a safety class item are themselves designated as a safety class item.

A determination should be made regarding the facility designations for which compliance will ultimately be achieved. The determination should consider the DOE and Laboratory mission and potentially complex future research capability. Additional facility designations could be included in the current compliance plan with considerably little additional effort since a significant amount of regulatory overlap is anticipated. It is also easier to provide compliance for additional facility designations in the original effort rather than as a stand alone fixup at a future time.

APPENDIX A

REGULATORY REQUIREMENTS (Section 0106)

This section lists the regulatory requirements cited in these criteria. **Only those applicable to the proposed modification are cited.**

CFR	Code of Federal Regulations Superintendent of Documents Government Printing Office Washington, DC 20402 202/783-3238
10 CFR 20,	Standards for Protection Against Radiation
29 CFR 1910,	Occupational Safety and Health Standards
29 CFR 1926,	Safety and Health Regulations for Construction
40 CFR 61,	National Emission Standard for Radionuclide Emissions from Department of Energy Facilities
DOE	U.S. Department of Energy 1000 Independence Ave, SW Washington, DC 20585 202/586-9642
DOE 4330.2C,	In-House Energy Management
DOE 4700.1,	Project Management System
DOE 5400 SERIES on:	
<ul style="list-style-type: none">• Radiation Protection of the Public and the Environment• Radiological Effluent Monitoring and Environmental Surveillance	
DOE 5400.1,	General Environmental Protection Program Requirements
DOE 5440.1C,	National Environmental Policy Act

DOE 5480.1B,	Environmental, Safety and Health Program for DOE Operations
DOE 5480.4,	Environmental Protection, Safety, and Health Protection Standards
DOE 5480.5,	Safety of Nuclear Facilities
DOE 5480.7,	Fire Protection
DOE 5480.11,	Radiation Protection for Occupational Workers
DOE 5481.1B,	Safety Analysis and Review Systems (SARS)
DOE 5500.1A,	Emergency Management System
DOE 5500.3,	Reactor and Nonreactor Nuclear Facility Emergency Planning, Preparedness, and Response Program for DOE Operations
DOE 5700.6B,	Quality Assurance
DOE 5820.2A,	Radioactive Waste Management
DOE 6430.1A,	General Design Criteria

APPENDIX B

REFERENCE STANDARDS AND GUIDES (Section 0109)

This section lists the reference standards and guides cited in these criteria. The latest edition of standards and guides shall be used. **Only those applicable to the proposed modification are listed.**

- ANS American Nuclear Society**
555 North Kensington Avenue
LaGrange Park, IL 60525
312/352-6611
- ANS 8.3 Criticality Accident Alarm Systems**
- ANS 8.1 Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors**
- ANS 8.10 Criteria for Nuclear Criticality Controls in Operations Where Shielding Protects Personnel**
- ANS 8.12 Nuclear Criticality Control and Safety of Homogeneous Plutonium-Uranium Fuel Mixtures Outside Reactors**
- ANSI American National Standards Institute (Note: Generally, references cross-listed as ANSI/ASME, ANSI/IEEE, etc, are listed only once - under their originating organization rather than under ANSI.)**

1430 Broadway
New York, NY 10018
212/354-3300
- ANSI C2, National Electrical Safety Code**
- ANSI C84.1, Electric Power Systems and Equipment - Voltage Ratings (60 Hz)**
- ANSI N2.3, Immediate Evacuation Signal for Use in Industrial Installations**
- ANSI N13.1, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities**

ANSI N42.18,	Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactive Effluents
ASHRAE	American Society of Heating Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle Atlanta, GA 30329 404/636-8400
ASHRAE 90	Energy Conservation in New Building Design
ASME	American Society of Mechanical Engineers 22 Law Drive Box 2300 Fairfield, NJ 07007 201/882-1167, 800/843-2763
ASME NQA-1,	Quality Assurance Program Requirements for Nuclear Facilities
DOD	U.S. Department of Defense Attention: NPFC Code 1052 Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120-5099 215/697-4374
MIL-HDBK-419	Grounding, Bonding, and Shielding for Electronic Equipment and Facilities
MIL-STD-1472C	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
Van Cott and Kincade Editors,	Human Engineering Guide to Equipment Design Joint Army-Navy-Air Force Steering Committee, 1972, U.S. Government Printing Office, Washington, DC
DOE	U.S. Department of Energy (DOE Orders listed in Section 0106, Regulatory Requirements)

DOE/EV 0051-1, (DOE/EH-332)	Electrical Safety Criteria for Research and Development Activities
DOE/TIC 11603 REV,1.(NTIS),	Nonreactor Nuclear Facilities: Standards and Criteria Guide
EPA	Environmental Protection Agency 401 M. Street, SW Washington, DC 20460 202/829-3535
EPA	Radiation Protection Guidance to the Federal Agencies for Occupational Exposure, Federal Register, Vol 52, No. 17, 1987.
EPRI	Electric Power Research Institute P.O. Box 10412, Palo Alto, CA 94303 415/855-2000
EPRI NP-3659,	Human Factors Guide for Nuclear Power Plant Control Room
FM	Factory Mutual Engineering and Research 1151 Boston Providence Turnpike Norwood, MA 02062 617/7624300
FM 5-4/14-8	Loss Prevention Data Sheet on Transformers
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017 212/705-7960
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commerical Power Systems

- IEEE 308,** Standard Criteria for Class IE Power System for Nuclear Power Generating Stations
- IEEE 379,** Standard Application of the Single Failure Criterion to Nuclear Power Generating Station Class IE Systems
- IEEE 384,** Standard Criteria for Independence of Class IE Equipment and Circuits
- IEEE 399,** Recommended Practice for Power system Analysis
- IEEE 446,** Recommended Practice for Emergency and Standby Power for Industrial and Commercial Applications
- IEEE 493,** Recommended Practice for Design of Reliable Industrial and Commercial Power Systems
- IEEE 739,** Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities
- IEEE C37,** Series, Circuit Breakers, Switchgear, Relays, Substations and Fuses.
- IEEE C37.91,** Guide for Protective Relay Applications to Power Transformers

LLNL **Lawrence Livermore National Laboratory**
 Livermore, CA 94550
 415/422-4599

UCRL 15673, Human Factors Design Guidelines for Maintainability of DOE Nuclear Facilities (available from NTIS)

NBS **National Bureau of Standards (currently National Institute of Standards and Technology)**
 Gaithersburg, MD
 301/975-2000

Handbook 135, Life Cycle Cost Manual for Federal Energy Management Programs

NEMA GUIDES	National Electrical Manufacturers Association 2101 L Street, NW, Suite 300 Washington, DC 20037 202/457-8400
NEMA ICS,	Industrial Controls and Systems
NFPA	National Fire Protection Association Batterymarch Park Quincy, MA 02269 800/344-3555
NFPA 70,	National Electrical Code (NEC)
NFPA 75,	Protection of Electronic Computer/Data Processing Equipment
NFPA 90A,	Air Conditioning and Ventilation systems
NFPA 91,	Blower and Exhaust Systems
NFPA 101,	Life Safety Code
NFPA 110,	Standard for Emergency and Standby Power Systems
NFPA 496,	Purged and Pressurized Enclosures for Electrical Equipment
NRC	U.S. Nuclear Regulatory Commission Publications Division Washington, DC 20555 202/492-9508
NUREG-0700,	Guidelines for Control Room Design Reviews
NUREG-CR-2496,	Human Engineering Design Considerations for Cathode Ray Tubes (CRT) Generated Displays
NUREG CR-3331,	A Methodology for Allocating Nuclear Power Plant Control Functions to Human or Automatic Control

REG. GUIDES (R.G.s)

- R.G. 3.18,** Confinement Barriers and Systems for Fuel Reprocessing Plants
- R.G. 3.20,** Process Off-Gas Systems for Fuel Reprocessing Plants
- R.G. 3.32,** General Design Guide for Ventilation Systems for Fuel Reprocessing Plants
- R.G. 8.8,** Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Reasonably Achievable

UL GUIDES

Underwriters Laboratories
333 Pfingsten Road
Northbrook, IL 60062
312/272-8800

- UL 508,** Industrial Control Equipment