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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Submittal of X Energy, LLC (X-energy), Xe-100 Licensing Topical Report: Xe-100 Training Program Methodology

The purpose of this letter is to submit the subject licensing topical report to the U.S. Nuclear Regulatory Commission (NRC) on behalf of X Energy, LLC ("X-energy"). This submission describes the methodology X-energy has developed for the development, implementation, and maintenance of initial and continuing/requalification training programs for Xe-100 plant staff, including the methodologies used by X-energy to conduct a Systems Approach to Training to produce the suite of Xe-100 Training Programs necessary for safe plant operation and maintenance.

It is provided for review by the NRC to establish the acceptability of this approach to meet applicable regulations with respect to training Xe-100 plant staff. X-energy requests NRC approval of this topical report as an acceptable approach to meet applicable regulations with respect to training Xe-100 plant staff and to implementing the Xe-100 Training Programs SAT methodologies. X-energy is not requesting approval of the proposed Safety Analysis Report content contained in Appendix A.

X-energy has determined this report is available for unrestricted release. The specific review schedule will continue to be developed with X-energy's NRC project manager.

This letter contains no commitments. If you have any questions or require additional information, please contact Brandon Hartle at bhartle@x-energy.com or Ingrid Nordby at inordby@x-energy.com.

Sincerely,

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Xe-100 Licensing Topical Report
Xe-100 Training Programs Methodology

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SYNOPSIS

This topical report provides the approach developed by X Energy, LLC (X-energy) for the development, implementation, and maintenance of initial and continuing/requalification training programs for Xe-100 plant staff, including the methodologies used by X-energy to conduct a Systems Approach to Training to produce the suite of Xe-100 Training Programs necessary for safe plant operation and maintenance. It is provided for review by the Nuclear Regulatory Commission (NRC) to establish the acceptability of this approach to meet applicable regulations with respect to training Xe-100 plant staff.

CONFIGURATION CONTROL

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1	28-Oct-2022	D. Williamson	Initial Issuance
2	23-Dec-2022	D. Williamson	Incorporated comments from NRC white paper

Document Approval

Action	Designation	Name	Signature	Date
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Department of Energy Acknowledgement and Disclaimer

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EXECUTIVE SUMMARY

This topical report presents the X Energy, LLC (X-energy) approach and methodologies for developing, implementing, and maintaining the initial and continuing/requalification training programs for Xe-100 plant staff to support the categories of personnel listed in 10 CFR 50.120, as well as control room operations personnel. The approach described in this report focuses on the methodologies used by X-energy to conduct a Systems Approach to Training to produce the suite of Xe-100 Training Programs, train, and qualify personnel as necessary for safe Xe-100 plant operation. It is recognized that the final U.S. Nuclear Regulatory Commission (NRC) approval of compliance with 10 CFR 50.120, as well as the necessary training for control room operations personnel, is ultimately the responsibility of an "applicant" and/or "licensee"; however, the intent of this topical report is to provide the Xe-100 Training Programs as an NRC Staff approved, vendor-supplied, plant personnel training program as referenced by the responsible "applicant" and/or "licensee" in their licensing bases.

The NRC Staff approved approach and methodologies described in this report were developed during pre-application engagement with the NRC. Appendix A of this Topical Report provides the opportunity for NRC Staff review of an example template for this content for use in construction permit, operating license, or other licensing applications. Other interactions with the NRC Staff such as inspections, audits, and observations of training exercises and/or examinations continue to provide implementation oversight.

Xe-100 Training Programs material produced from the application of this methodology, and personnel trained and qualified under this program, will support future site or design-specific licensing applications under Title 10 of the Code of Federal Regulations (10 CFR) in 10 CFR 50, 10 CFR 52, and future 10 CFR 53. X-energy intends to train and qualify personnel for meeting site-specific nuclear power plant personnel categories as required by 10 CFR 50.120, *Training and qualification of nuclear power plant personnel*, as well as control room operations personnel. For example, personnel trained to meet control room operator requirements will also have been utilized as personnel participating as operations subjects in the human factors engineering (HFE) verification and validation (V&V) activities associated with the simulator and operating procedures development. Prospective Licensee's licensing applications for Xe-100 plants will rely on the Xe-100 Training Programs, and personnel being trained and qualified under the Xe-100 Training Programs, to provide control room operators and to meet the requirements of 10 CFR 50.120 for the specific application and license.

In addition to the technical training that is required for each plant staff position, training also addresses the following areas as noted in Nuclear Energy Institute (NEI) 06-13A:

- Physical security,
- Emergency protection,
- Radiological emergency,
- Administrative procedures,
- Radiation protection,
- Fire protection,
- Quality assurance, and
- Fitness for duty.

The Xe-100 Training Programs address initial training as well as continuing training for these areas.

X-energy requests NRC approval of this topical report as an acceptable approach to meet applicable regulations with respect to training Xe-100 plant staff and to implementing the Xe-100 Training Programs SAT methodologies. X-energy is not requesting approval of the proposed Safety Analysis Report content contained in Appendix A.

CONTENTS

TABLES

ABBREVIATIONS

This list contains the abbreviations used in this document.

Abbreviation or Acronym	Definition
AR/VR	Augmented Reality / Virtual Reality
ABWR	Advanced Boiling Water Reactor
ALARA	As Low As Reasonably Achievable
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
DIF	Difficulty, Importance, Frequency
FFD	Fitness for Duty
FOAK	First-of-a-kind
GET	General Employee Training
HFE	Human Factors Engineering
HSI	Human-System-Interfaces
I&C	Instrumentation and Control
JPM	Job Performance Measure
K&A	Knowledge and Abilities
KSA	Knowledge, Skills and Abilities
LWR	Light-Water Reactor
NEI	Nuclear Energy Institute
NPP	Nuclear Power Plant
NRC	(U.S.) Nuclear Regulatory Commission
OE	Operating Experience
PFT	Production Field Technician
PSAR	Preliminary Safety Analysis Report
PWR	Pressurized Water Reactor
RO	Reactor Operator
RG	Regulatory Guide
S&Q	Staffing and Qualifications
SAT	Systems Approach to Training / Systematic Approach to Training
SDD	System Design Description
SME	Subject Matter Expert

Abbreviation or Acronym	Definition
SRO	Senior Reactor Operator
STA	Shift Technical Advisor
TPE	Task Performance Evaluation
X-energy	X Energy, LLC

1. INTRODUCTION

1.1. PURPOSE

The purpose of this report is to:

- Describe the approach and methodologies for the Xe-100 reactor plant staff training and qualification to meet categories of personnel listed in Title 10 of the *Code of Federal Regulations* (CFR) §50.120 (10 CFR 50.120), as well as control room operations personnel, for safe and reliable Xe-100 plant operations in a multi-unit plant configuration across various modes, states, and operating conditions. Personnel trained and qualified by the Xe-100 Training Programs are intended to satisfy subsequent licensee construction permit, operating license, and other licensing application requirements for personnel training and qualifications,
- Describe how the Xe-100 Training Programs satisfy the 10 CFR 50.120(b)(1), *Requirement*, that 18 months prior to fuel load an applicant and/or licensee "shall establish, implement, and maintain a training program that meets the requirements of paragraphs (b)(2) and (b)(3) of this section," and
- Describe the Xe-100 staffing positions that meet the categories of personnel listed in 10 CFR 50.120 as well as control room operations personnel.

While this topical report is principally focused on prospective applications under Part 50, the Xe-100 Training Programs methodology meets applicable regulatory requirements under Part 52. X-energy is following the development and consensus of approaches and methodologies in Draft Part 53, and the Xe-100 Training Programs methodology maintains alignment with the continued development of Part 53.

1.2. SCOPE

As discussed in Section 3, this report describes the approach and methods X-energy is using to develop the Xe-100 Training Programs (initial and continuing training programs). This includes application of the SAT methodology and an overview of training programs being developed. The approach follows the guidance provided in Nuclear Energy Institute (NEI) 06-13A, "Template for an Industry Training Program Description" [1] and meets ANSI/ANS-3.1-2014, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants," [2] as endorsed with exceptions and clarifications by Regulatory Guide (RG) 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," Revision 4 [3].

1.3. RELATIONSHIP TO OTHER DOCUMENTS

X-energy's Xe-100 Licensing Topical Report Control Room Staffing Analysis Methodology, as well as the associated X-energy Human Factors Engineering (HFE) Program Management and Implementation Plans, [4] provides additional details of interrelated SAT elements, which are consistent with the guidance of NUREG-0711, "Human Factors Engineering Program Review Model" [5].

The Xe-100 Control Room Operator Qualification Methodology [6] topical report and Xe-100 Eligibility Requirements for Control Room Operators [7] topical report provide additional details related to control room operator training and qualifications.

1.4. DOCUMENT LAYOUT

Section 2 lists references used. Section 3 presents an overview of the X-energy approach and methodology for Xe-100 SAT training elements. Section 4 addresses the Xe-100 Training Programs satisfying the 10 CFR 50.120(b)(1), *Requirement*, that 18 months prior to fuel load an applicant and/or licensee "shall establish, implement, and maintain a training program that meets the requirements of paragraphs (b)(2) and (b)(3) of this section." Section 5 presents conclusions. Appendix A presents an example template of content for use in a construction permit application meeting 10 CFR 50.34(a), *Preliminary safety analysis report*, section (6), for training of personnel, and for use in an operating license application meeting 10 CFR 50.34(b), *final safety analysis report*, section (8), for an operator requalification training program description. As such, Appendix A is included for information and not considered part of the approved Xe-100 Training Programs topical report. A separate NRC Staff review and approval will apply to Appendix A content when submitted as part of a licensing application.

2. REFERENCES

The following documents are referenced within this document.

Document Title	Preparer/Author	Document Number	Revision or Date of Issue
[1] Template for an Industry Training Program Description	NEI	NEI 06-13A	Revision 2
[2] Selection, Qualification, and Training of Personnel for Nuclear Power Plants	ANS	ANSI/ANS-3.1	2014
[3] Qualification and Training of Personnel for Nuclear Power Plants	NRC	RG 1.8	Revision 4
[4] Xe-100 Licensing Topical Report: Control Room Staffing Analysis Methodology and Associated HFE Implementation Plans (ML22004A333)	X Energy	000714	Jan 2022
[5] Human Factors Engineering Program Review Model	NRC	NUREG-0711	Revision 3
[6] Xe-100 Control Room Operator Qualification Methodology	X Energy	006048	{tbd}
[7] Xe-100 Eligibility Requirements for Control Room Operators	X-energy	006049	{tbd}
[8] Human-System Interface Design Review Guidelines	NRC	NUREG-0700	Revision 3
[9] Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition	NRC	NUREG-0800	
• Chapter 13.2.1, “Reactor Operating Requalification Program; Reactor Operator Training	NRC	NUREG-0800	Revision 4
• Chapter 13.2.2, “Non-licensed Plant Staff Training”	NRC	NUREG-0800	Revision 4
• Chapter 18, “Human Factors Engineering, Attachment B, “Methodology to Assess the Workload of Challenging Operational Conditions in Support of Minimum Staffing Level Reviews”	NRC	NUREG-0800	Revision 3
[10] Operator Licensing Examination Standards for Power Reactors	NRC	NUREG-1021	Revision 12

Document Title		Preparer/Author	Document Number	Revision or Date of Issue
[11]	Training Review Criteria and Procedures	NRC	NUREG-1220	Revision 1
[12]	Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements	NRC	NUREG-1791	July 2005
[13]	Inspection Manual (Part 52, Review of Training and Qualification Programs)	NRC	IP 41501	June 2019
[14]	Inspection Manual (Nuclear Power Plant Simulation Facilities)	NRC	IP 41502	Oct 2012
[15]	Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Pressurized Water Reactors	NRC	NUREG-1122	Revision 3
[16]	Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Boiling Water Reactors	NRC	NUREG-1123	Revision 3
[17]	Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Westinghouse AP1000 Pressurized Water Reactors	NRC	NUREG-2103	Jan 2021
[18]	Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Advanced Boiling Water Reactor	NRC	NUREG-2104	Dec 2011
[19]	Systematic Approach to Training Process	Nuclear Industry	NISP-TR-01	Revision 3
[20]	On-The-Job Training and Task Performance Evaluation Process	Nuclear Industry	NISP-TR-02	Revision 1
[21]	Engineering Training Program Description	Nuclear Industry	NISP-TR-03	Revision 1
[22]	Nuclear Power Plant Simulators for Use in Operator Training and Examination	ANS	ANSI/ANS-3.5	2009
[23]	Nuclear Power Plant Simulation Facilities for Use in Operator Training, License Examinations, and Applicant Experience Requirements	NRC	RG 1.149	Revision 4
[24]	Monitoring the Effectiveness of Maintenance at Nuclear Power Plants	NRC	RG 1.160	Revision 3

3. XE-100 TRAINING PROGRAMS APPROACH AND METHODOLOGY

3.1. REGULATORY BASIS AND APPLICABILITY

3.1.1. Regulations Applicable to X-energy as Vendor Versus Applicant or Licensee

This report describes the X-energy approach to developing a training program using a systems approach to training (SAT) as required by 10 CFR 50.120 and defined in 10 CFR 55.4. By applying the SAT methodology as described in Section 3.2, Xe-100 Training Programs meet the applicable requirements and follows applicable guidance for the Xe-100 staff positions required by 10 CFR 50.120 and for the control room operators. However, 10 CFR 50.120(a), *Applicability*, states (emphasis added):

> The requirements of this section apply to each **applicant for and each holder of an operating license** issued under this part **and each holder of a combined license** issued under part 52 of this chapter for a nuclear power plant of the type specified in § 50.21(b) or § 50.22

Similar references to "applicant" and "license" are used in 10 CFR 50.120(b)(1)(i) and (ii).

X-energy recognizes that compliance with 10 CFR 50.120 is ultimately the responsibility of an "applicant" and/or "licensee" and approved by the NRC staff during review of a plant's operating license application; however, the intent of the Xe-100 Training Programs are to provide NRC Staff approved, vendor-supplied, plant personnel training programs that would be utilized by the responsible "applicant" and/or "licensee." The Xe-100 Training Programs will therefore be referenced by future applicants and implemented by X-energy for operating and/or combined licenses to fulfill the 10 CFR 50.120 requirements for plant staff, as well as control room operations personnel, which satisfies the requirements for training and qualification of nuclear power plant personnel.

3.1.2. Xe-100 Categories of Nuclear Power Plant Personnel

The Xe-100 Training Programs are structured to provide reasonable assurance that personnel have the qualifications commensurate with the performance requirements of their jobs. Xe-100 Training Programs addresses:

- The range of categories of plant personnel shown in Table 1, Xe-100 Equivalent Positions,
- Control Room Operations personnel as described in topical report "Xe-100 Control Room Operator Qualification Methodology" [6],
- The spectrum of plant functions and systems,
- The range of relevant Human System Interface (e.g., main Control Room, remote shutdown panel, and local control stations), and
- The extent of plant conditions including preoperational testing and low-power operation.

Table 1 lists the various 10 CFR 50.120 categories of personnel as well as control room operations personnel that are typical for a traditional commercial light-water reactor (LWR) with a cross reference to the equivalent position for the Xe-100 plant personnel. The Xe-100 plant uses cross-trained, multi-skilled personnel to safely operate and maintain the plant.

Table 1: Xe-100 Equivalent Positions

10 CFR 50.120 and Control Room Operations Personnel Categories	Xe-100 Equivalent Position
Shift Supervisor (or Shift Manager)	Shift Supervisor
Senior Reactor Operator (SRO)	Control Room Operator
Reactor Operator (RO)	
Shift Technical Advisor	
Non-licensed Operator	Production Field Technician (PFT)
Instrumentation and Control Technician	
Electrical Maintenance Personnel	
Mechanical Maintenance Personnel	
Radiological Protection Technician	Chemistry/Radiation Protection Technician
Chemistry Technician	
Engineering Support Personnel	Engineering Support Personnel

3.2. SYSTEMS APPROACH TO TRAINING

The X-energy approach to training development includes applying the SAT methodology as required by 10 CFR 50.120 and defined in 10 CFR 55.4. The main activities carried out in each of the element phases are detailed in the subsections to follow, as well as the key factors considered in each of them in accordance with RG 1.8, (which endorses with exceptions and clarifications ANSI/ANS-3.1-2014) using five interrelated elements: analysis, design, development, implementation, and evaluation. This methodology provides the workers with the knowledge and skills necessary to correctly and safely perform the tasks associated with their job position.

The Xe-100 Training Programs are developed using the following regulatory guidance documents as applicable to Xe-100 plant personnel (including the control room operator) to demonstrate compliance with 10 CFR 50.120 and in accordance with topical report “Xe-100 Control Room Operator Qualification Methodology” [6]:

- NUREG-0700, “Human-System Interface Design Review Guidelines” [8]
- NUREG-0711, “Human Factors Engineering Program Review Model”[5]
- NUREG-0800, “Standard Review Plan” [9]
  - Chapter 13.2.1, “Reactor Operating Requalification Program; Reactor Operator Training”
  - Chapter 13.2.2, Non-licensed Plant Staff Training”
  - Chapter 18, Human Factors Engineering, Attachment B, “Methodology to Assess the Workload of Challenging Operational Conditions in Support of Minimum Staffing Level Reviews”
- NUREG-1021, “Operator Licensing Examination Standards for Power Reactors” [10]
- NUREG-1220, “Training Review Criteria and Procedures” [11]

- NUREG-1791, “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements” [12]
- NRC Inspection Manual, Inspection Procedure 41501, “Part 52, Review of Training and Qualification Programs” [13]
- NRC Inspection Manual, Inspection Procedure 41502, “Nuclear Power Plant Simulation Facilities” [14]

Supporting the control room operator training, previously available knowledge and abilities (K&A) catalogs are based on LWR designs. However, since the Xe-100 is not a LWR design, an Xe-100 specific K&A catalog is developed to address the design that supports the Xe-100 Training Programs. For this effort, existing K&A catalogs, such as those listed below, are considered.

- NUREG-1122, “Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Pressurized Water Reactors (PWR)” [15]
- NUREG-1123, “Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Boiling Water Reactors (BWR)” [16]
- NUREG-2103, “Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Westinghouse AP1000 Pressurized Water Reactors” [17]
- NUREG-2104, “Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Advanced Boiling Water Reactors (ABWR)” [18]

Various guidance documents outline training programs development and content. To the extent that these documents align with the specific Xe-100 design and the X-energy staffing approaches (e.g., control room operator versus SRO or RO) the Xe-100 Training Programs utilize the following as applicable:

- Regulatory Guide 1.8, Qualification and Training of Personnel for Nuclear Power Plants, Rev. 4
- ANSI/ANS-3.1-2014, Selection, Qualification, and Training of Personnel for Nuclear Power Plants
- NEI 06-13A, Template for an Industry Training Program Description, Rev. 2
- NISP-TR-01, Systematic Approach to Training Process [19]
- NISP-TR-02, On-The-Job Training and Task Performance Evaluation Process [20]
- NISP-TR-03, Engineering Training Program Description [21]

Furthermore, the SAT elements are interrelated with elements of the HFE Program Management Plan (and referenced HFE Implementation Plans), which is consistent with the guidance of NUREG-0711. The HFE Program’s support for the Control Room staffing approach provides proper correspondence between the Xe-100 Training Programs development and the HFE Program by following the SAT process and using the HFE Task Analysis as input for the knowledge, skills, and abilities (KSA) list and job definition.

Additionally, NUREG-0700 Appendix B, contains additional guidance for selected HSI topics that address important training program development elements, which are also addressed in the Xe-100 Training Programs.

The Control Room Operator Training Program includes training on the Xe-100 simulator, which is designed using Xe-100 applicable guidance of ANSI/ANS-3.5-2009, “Nuclear Power Plant Simulators for Use in Operator Training and Examination” [22], as endorsed by the NRC in Regulatory Guide 1.149, “Nuclear Power Plant Simulation Facilities for Use in Operator Training, License Examinations, and Applicant Experience Requirements” [23]. The simulator training provides operations personnel with sufficient knowledge and experience required for control room operator eligibility to perform their required duties

during the unique conditions of new plant construction and initial operation. Xe-100 control room operator candidates are also trained to the curriculum normally found in a traditional Shift Technical Advisor (STA) Training Program, as applicable to the Xe-100. Shift Supervisors are also trained as control room operators and receive additional training that addresses higher-level management skills and behaviors and provides a broader perspective of plant operations.

The X-energy maintenance strategy includes a population of tasks. Each task requires qualified personnel, appropriate level of work instructions, time, and materials to be allocated in the schedule to execute each task in accordance with the maintenance strategy. These tasks are reviewed in developing the Xe-100 Training Programs to implement training on the knowledge and skills necessary to qualify the personnel performing the tasks. In this way, the Xe-100 Training Programs support compliance with 10 CFR 50.65 and conformance to the guidance of RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants” [24].

In addition to the technical training that is required for each plant staff position, Xe-100 Training Programs also addresses the following areas as noted in NEI 06-13A:

- Physical security,
- Emergency protection,
- Radiological emergency,
- Administrative procedures,
- Radiation protection,
- Fire protection,
- Quality assurance, and
- Fitness for duty.

The Xe-100 Training Programs encompass initial training as well as continuing training for these areas.

The Xe-100 Training Programs are structured to provide reasonable assurance that personnel have the qualifications commensurate with the performance requirements of their jobs. The Xe-100 Training Programs address:

- The range of positions of plant personnel (including control room operator) listed in Table 1,
- The spectrum of plant functions and systems,
- The range of relevant HSI (e.g., main Control Room, remote shutdown panel, and local control stations), and
- The extent of plant conditions.

Sufficient records are maintained and kept available for NRC inspection to verify adequacy of the Xe-100 Training Programs.

3.2.1. Analysis

Analyses are conducted to identify those job performance requirements that are best improved through training. Additionally, candidate eligibility requirements are described in the Xe-100 Eligibility Requirements for Control Room Operators topical report [7] with consideration given to the unique

circumstances of a first-of-a-kind (FOAK) Xe-100 plant based on these analyses. This topical report is forthcoming, and the technical content is still under development.

Main activities:

- Perform a job analysis by reviewing existing station or industry job data and procedures, tabletop analyses, interviews, and/or job survey questionnaires to select job tasks for which training is required.
- Conduct task analyses to determine methods of task performance and associated KSAs, using a tabletop approach, questionnaires, or interviews.
- Use technical documentation, subject matter experts (SMEs), and management to define proper task performance and the underlying KSA required for new tasks.
- Use SMEs and existing station or industry training program products to identify which portions of the tasks have changed for modified tasks.

A job is a group of tasks and functions necessary to precisely define the qualifications KSAs with the tasks that an individual must perform. This element of the SAT process follows the HFE Task Analysis as input. The HFE Staffing & Qualifications (S&Q) activities describe and define the scope and impacts on the roles, responsibilities, and qualifications of Control Room personnel. By following the SAT process for the Xe-100 Training Programs material development, alignment between the KSAs task list, job definition, and staffing & qualifications is provided.

To perform the job analysis, X-energy is following these steps:

- Assemble a specific task list for each Xe-100 position by reviewing plant information including Xe-100 system design descriptions (SDDs), procedures, and other design and technical documentation,
- Assemble a generic task list originating from the Xe-100 plant design, safety analysis, and operating practices and procedures for each Xe-100 position by referencing the existing generic task lists for PWR, BWR, ABWR, and AP1000 nuclear power plants (NPPs), as applicable, and reviewing the industry data available,
- Compile both task lists to obtain a unique specific matrix,
- Hold table-top meetings and workshops with X-energy engineers to review plant systems, and
- Apply Difficulty, Importance, Frequency (DIF) Analysis to determine which tasks require training, considering candidate eligibility requirements are described in Xe-100 Eligibility Requirements for Control Room Operators topical report [7]. The DIF process includes participation from SMEs, design engineers, and personnel with prior nuclear or instructor experience. Participants' knowledge, competencies, and experiences influence their role in the DIF process, and results are reviewed and approved by the Xe-100 Training Manager.

In performing the job analysis, X-energy uses the aforementioned task list and DIF results to identify task conditions and standards for each task that requires training.

The needs and performance analyses are the processes of identifying causes and solutions for a new task, modified task, or performance issues, identifying training and non-training solutions, and selecting a solution that best fits the needs of the organization. Defining the specific process to be accomplished includes the use of a training committee, training requests, and corrective action program.

This analysis element and its various activities, including its relation to the HFE Program Management Plan, are subject to an iterative revision process to update the Xe-100 Training Programs as the Xe-100 design matures, and new needs are identified. The analysis element results serve as the basis for the next element of the SAT methodology, the design element.

3.2.2. Design

The identified job tasks are used to specify the knowledge and skills that the trainee needs to develop during training.

Main activities:

- Develop learning objectives. These written objectives define exactly what, when, and how the trainee must perform during and after training. They are classified as either knowledge or skill - related, and attributes of the relevant dimensions of the trainee's job, such as interactions with the plant, the HSI, and other personnel, as identified during the analysis element to determine what is to be learned in terms of measurable trainee performance.
- Prepare performance tests. These are prepared at the task level to measure the adequacy of the trainee's task performance. They define the cue that initiates task performance, identifies the task performance conditions, and establishes standards of successful task performance.
- Determine methods to observe and measure trainee performance for evaluating the overall effectiveness of the Xe-100 Training Programs and trainee mastery of training objectives. Examples of methods considered include written and oral tests, laboratory evaluations, job performance measures (JPMs), task performance evaluations (TPEs), on-the-job evaluations, simulator evaluations, and simulated environment evaluations using mock-ups or augmented reality / virtual reality (AR/VR) technology. Test items and examination banks are developed to objectively measure how well trainees achieve the learning objectives.
- Determine the setting in which training is conducted. The training environment is determined based on the knowledge and skill requirements identified during the analysis element.

The design element defines how to select training settings, which evaluation methods are most appropriate, and the success (passing) criteria. Additionally, question banks are developed for each initial training objective.

The design element is in lockstep with the analysis element allowing further learning objectives to be developed as soon as their supporting data from the analysis element is available. To this extent, as the analysis element progresses so does the design element.

Like the analysis element, the design element and its relation to the HFE Program Management Plan is subject to an iterative revision process to update the Xe-100 Training Programs as the Xe-100 design matures, and the analysis element produces further results and data.

3.2.3. Development

Instructional materials (e.g., lesson plans, trainee texts, simulator scenarios, test questions, performance test items) are selected, developed, and modified based on the learning objectives, training setting, and testing setting.

Main activities:

- Identify learning activities for each learning objective. This is accomplished by classifying learning objectives as either knowledge or skill -related (as discussed in Section 3.2.2) and then developing or adapting existing learning activities to support the objective.
- Select training methods. These are techniques that are employed to enhance the learning process, such as: lecture, walk-through, demonstration or practice, discussion, role-playing, case study, and other similar techniques.
- Develop, modify, or obtain training materials such as written texts, computer software, equipment, audiovisual materials, models, simulation devices, examinations, and performance tests, based on the method of instruction. Then, the means of using these materials are specified.
- Sequencing the training material into an organized curriculum for implementation.

The development element is undertaken progressively as the steps of the previous elements are completed.

In this element, X-energy develops the training materials necessary for training implementation. The selected training methods are based on the training setting decided in the design element, with consideration given to optimizing the training process wherever possible. This approach sets the following priorities: face-to-face training for defined high cognitive level learning objectives, blended learning for intermediate cognitive level learning objectives, and self-study for low cognitive level learning objectives. Xe-100 Training Programs material development includes items such as lesson plans, electronic learning material, simulator scenarios, recordings, etc. Xe-100 Training Programs material development activities prioritizes inclusion of those persons involved in the previous processes such as SMEs, design engineers, etc.

For the main activities of the development element, X-energy generates standard training materials for the generic fundamentals, including components, reactor theory, and thermodynamics. These materials are reviewed to confirm the specific scope for an Xe-100 is fully covered and are integrated into the Xe-100 Training Programs

Like the previous elements, the development element and its various activities are subject to an iterative revision process to update the Xe-100 Training Programs as the Xe-100 design matures, and the previous elements produce further outputs.

3.2.4. Implementation

Training programs and activities are implemented to achieve the performance objectives identified in the analysis and design phase.

Main activities:

- Select and train instructors and subject matter experts and confirm the availability of trainees and facilities.
- Collect feedback on training content and delivery. This includes information from the following sources: the effects of training on personnel and plant performance, reinforcement of management expectations, trainee test and evaluation performance, and instructor, trainee, and management critiques of training.
- Maintain records of training attendance, content, results, and feedback to support management information needs and to document trainee and instructor performance.
- Define and implement an observation program during this element.
- Document training, including preparing, distributing, storing, controlling, and recording information that addresses the training program and trainee participation.
- Establish Xe-100 exam security processes for all Xe-100 plant staff.
- Establish Xe-100 remediation standards for all Xe-100 plant staff.

The inaugural class for the Control Room Operator Training Program is taught by personnel directly involved in developing the Xe-100 Training Programs who have prior instructor/operator experience and are knowledgeable of the Xe-100. The trainees in this inaugural class include control room operator candidates and future instructor candidates. Since this inaugural class serves the FOAK Xe-100 plant, training is tailored to meet experience eligibility specific to the unique design of the Xe-100. As described in Section 4, this inaugural class will be prepared to commence at least 18 months prior to the initial fuel load for the first Xe-100 deployment.

Similarly, the inaugural class for the Production Field Technician (PFT) Training Program is taught by personnel directly involved in developing the Xe-100 Training Programs who have prior instructor/operator experience and are knowledgeable of the Xe-100 and the specific discipline being taught. Training is tailored specific to the unique role of the PFT as the combination of a traditional non-licensed operator and a “fix-it-now” technician requiring cross-training in multiple disciplines. As described in Section 4, this inaugural class will be prepared to commence at least 18 months prior to initial fuel load for the first Xe-100 deployment.

The implementation element addresses the inaugural iteration for a FOAK plant, including FOAK experience requirements where there is no prior experience to reference, as well as n^{th} iterations where existing experience on operating Xe-100 unit(s) may exist.

The Xe-100 Instructor Training Program for instructor candidates (train-the-trainer/instructor certification guide) includes pedagogical and methodological skills. Completion of the instructor certification guide is in addition to the initial Instructor Training Program completion discussed above for instructor candidates. Instructor candidate eligibility requirements are defined, and candidate selection prioritizes personnel involved in SAT activities for the related Xe-100 Training Programs, instructor experience, operator experience, and knowledge of Xe-100 design, operation, maintenance, and procedures.

Student evaluation examinations are carried out, and training feedback is collected from students and instructors for subsequent analysis to improve the training process.

The Xe-100 Training Programs also address the periodic continuing training and requalification of plant personnel, including the control room operator requalification requirements. Continuing training reinforces initial training by reiterating selected portions of the material. Continuing training also addresses new and modified procedures and plant design changes. Additionally, fundamentals are integrated into the training programs such that they are taught and examined routinely throughout both the initial and the requalification Xe-100 Training Programs. This approach reinforces fundamentals with plant-specific and design-specific topics over the entirety of the Xe-100 Training Programs.

Operating Experience (OE) is included in continuing training, providing personnel with actual examples of good practices and lessons learned. OE topics are selected from Licensee Event Reports, corrective action databases, industry groups, and other sources.

Applicants and/or licensees committing to implementation of the Xe-100 Training Programs also commit to interfacing with X-energy to update and maintain the training materials with new and modified procedures and plant changes.

3.2.5. Evaluation

The adequacy of the training programs to develop the trainee's skills to meet job performance requirements are evaluated.

Main activities:

- Analyze and trend feedback collected during training (implementation element), such as trainee evaluation results, instructor observations, management observations, and student feedback.
- Analyze job performance feedback and other information collected to determine training effectiveness to identify Xe-100 Training Programs improvement opportunities.
- Perform periodic training self-assessments.
- When evaluating results, determine if a desired performance improvement was achieved.
- When evaluation results confirm Xe-100 Training Programs gaps, processes initiate corrective actions and track them to completion using a corrective action program.
- Periodically review corrective actions for effectiveness.

The evaluation element includes a process that determines training effectiveness using job performance, self-assessments, observations, and feedback to determine systematic improvements to the programs as well as the implementation of these improvements. Applicants and/or licensees committing to implementation of the Xe-100 Training Programs also commit to interfacing with X-energy to provide job performance, self-assessments, observations, and feedback and maintain the training materials with new and modified procedures and plant changes. In this way the evaluation element supports maintaining the Xe-100 Training Programs as required by 10 CFR 50.120(b)(1).

Well maintained Xe-100 Training Programs provide the basis for continued (i.e., requalification) training, which provides the opportunity to correct performance gaps identified on shift, train on changes to the plant and procedures, as well as including OE providing personnel with actual examples of good practices and lessons learned.

4. XE-100 TRAINING PROGRAMS 10 CFR 50.120(b)(1) ESTABLISH, IMPLEMENT, AND MAINTAIN REQUIREMENT

The Xe-100 Training Programs satisfy the 10 CFR 50.120(b)(1), *Requirement*, that 18 months prior to fuel load an applicant and/or licensee "shall establish, implement, and maintain a training program that meets the requirements of paragraphs (b)(2) and (b)(3) of this section," by being prepared to commence the inaugural Xe-100 training classes, utilizing established Xe-100 Training Programs, at least 18 months prior to the initial fuel load for the first Xe-100 deployment.

Additionally, the Xe-100 Training Programs material is maintained as outlined in Section 3.2.5, and plant staff training is considered maintained with each site-specific staff member completing an initial requalification module prior to the issuance of an operating or combined license where those members are part of the qualified staff. The Xe-100 Requalification Programs content is determined using a systems approach to training methodology. This methodology also establishes the program's content and its frequency (duration of each class and how often classes are conducted).

5. CONCLUSIONS

X-energy has reviewed, identified, and assessed relevant NRC regulations and guidance applicable to the Xe-100 Training Programs for prospective licensees. This Xe-100 Training Programs topical report provides the details applicable to implementing the Xe-100 Training Programs approach and methodology applicable for each Xe-100 site. The SAT methodologies follow industry best practices and long-standing precedent in the nuclear training community and will result in the establishment and implementation of the necessary training programs in support of X-energy's initial project and target fuel load date.

To aid in the development of safety analysis report content for construction permit and operating license applications that commit to utilizing the Xe-100 Training Programs, Appendix A provides a template for use in those applications.

X-energy requests NRC approval of this topical report as an acceptable approach to meet applicable regulations with respect to training Xe-100 plant staff and to implementing the Xe-100 Training Programs SAT methodologies. X-energy is not requesting approval of the proposed Safety Analysis Report content contained in Appendix A.

6. APPENDIX: CONTENT TEMPLATE FOR APPLICANT OR LICENSEE SAFETY ANALYSIS REPORT TRAINING SECTIONS

---------- NOTE ----------

Section numbering reflects potential Preliminary Safety Analysis Report (PSAR)
Section numbering for an Xe-100 applicant for construction permit or operating license based on NEI 21-07 "Technology Inclusive Guidance for Non-Light Water Reactors: Safety Analysis Report Content for Applicants Using the NEI 18-04 Methodology".

11.4 Training Programs Description

Xe-100 Training Programs incorporate instructional requirements to qualify personnel to operate and maintain the facility in a safe manner in all modes of operation as described in the X-energy licensing topical report "Xe-100 Training Programs Methodology" [X-energy Document #006012] (Reference 11.4-1). The programs are developed and maintained in compliance with the facility license and applicable regulations. Xe-100 Training Programs are periodically evaluated and revised to reflect industry experience and to incorporate changes to the facility, procedures, regulations, and quality assurance requirements, and are periodically reviewed by management for effectiveness. These Xe-100 Training Programs are further described in X-energy procedures, site, and/or corporate procedures, as appropriate. Sufficient records are maintained and kept available for NRC inspection to verify adequacy of the programs.

The Xe-100 Training Department provides the required training based on individual employee experience, the intended position, and previous training and education. Xe-100 Training Department personnel may be supplemented by other personnel such as subject matter experts, other contract staff, and utility representatives. Formal instruction may be presented through a combination of classroom lectures, e-learning, assigned reading, simulator training and evaluations, and other delivery techniques.

For control room operators, fuel handlers, fire protection personnel, and positions specified in 10 CFR 50.120, programs are developed, established, implemented and maintained using a systems approach to training (SAT) as defined in 10 CFR 55.4 and ANSI/ANS-3.1-2014, as endorsed by Regulatory Guide 1.8.

Initial and continuing Xe-100 Training Programs are developed to provide personnel with the skills and knowledge to perform assigned tasks. These Xe-100 Training Programs include the following:

- Control room operator (including Shift Technical Advisor knowledge and abilities)
- Shift Supervisor
- Continuing training for control room operators
- Production Field Technician
- Chemistry/Radiation Protection Technician
- Engineering support personnel
- Continuing Training for Other Personnel Listed in 10 CFR 50.120

The results of reviews of operating experience are incorporated into Xe-100 Training and Retraining Programs. Xe-100 Training Programs encompass all phases of plant operation including preoperational testing and low-power operation. Before initial fuel loading, sufficient plant staff will be trained to provide for safe plant operations. Milestones for training implementation are discussed in Sections 11.4.1.4 and 11.4.2.

11.4.1 Control Room Operator Training

The Control Room Operator Training Programs, including initial and requalification training, provide the means to train individuals in the knowledge, skills, and abilities needed to perform control room operator duties. The Control Room Operator Training Program includes the requalification program. Before initial fuel loading, the number of persons trained in preparation for control room operator examinations will be sufficient to meet regulatory requirements, with allowances for examination contingencies and without the need for planned overtime.

Control room operator training also employs the use of a simulator. This simulator is used for training and for the administration of the exams.

11.4.1.1 Shift Supervisor Initial Training

Shift supervisors have been trained as control room operators and receive additional training that addresses higher-level management skills and behaviors, and provides a broader perspective of plant operations. Initial training includes such topics as:

- Application of Operating Experience
- Problem-solving skills
- Planning and managing evolutions
- Maintaining a broad view of plant operations
- Application of observation skills
- Operating philosophy
- Shift team management
- Application of design bases to plant operations
- Emergency Plan and Reportability
- Transient and Accident Analysis
- Systematic Approach to Training
- Work controls

11.4.1.2 Shift Technical Advisor Training

Shift technical advisor training for control room operators provides for appropriate engineering expertise on-shift. Training provides them with the skill and knowledge to monitor equipment and system operation, and assess plant conditions during abnormal and emergency events. Control room operator training includes instruction in the following areas:

- Responses to accidents and analyses of plant transients
- Application of engineering principles to protection of the core
- Mitigation of plant accidents
- Basis of plant and systems design
- Reactor theory, thermodynamics, heat transfer, and fluid flow
- General Operating Procedures, Technical Specifications, and Administrative Controls
- Operational transient and accident analysis
- Simulator response, including exercises in the following situations:
  - Plant or reactor startups to include a range such that reactivity feedback from nuclear heat addition is noticeable and heatup rate is established
  - Plant shutdown
  - Manual control of feedwater during startup or shutdown.
  - Significant (10 percent) power changes.
- Accident response

11.4.1.3 Continuing Training for Control Room Operator Personnel

Continuing training for control room operator personnel consists of regularly scheduled formal instruction, evaluation, and on-the-job training. Training material is developed using the SAT process, and includes Operational Experience (OE). Control room operator trained personnel participate in continuing training.

Program content, course schedules and examination schedules are addressed in administrative procedures. Continuing training for control room operator trained personnel is conducted in accordance with administrative procedures.

11.4.1.4 Xe-100 Control Room Operator Training Program Implementation

Xe-100 Training Programs implementation is met with being prepared to commence the inaugural Xe-100 training classes at least 18 months prior to initial fuel load for the first Xe-100 deployment. Additionally, the Xe-100 Training Programs are maintained by each control room operator completing an initial requalification module prior to the issuance of an operating or combined license where those members are part of the qualified staff.

The requalification program's content is determined using a systems approach to training methodology. This methodology also establishes the program's content and its frequency (duration of each class and how often classes are conducted).

11.4.2 Training for Positions Listed in 10 CFR 50.120

This section addresses Xe-100 Training Programs for the positions listed in 10 CFR 50.120 not addressed in Section 11.4.1. The systematic approach to training (SAT) process is used to establish and maintain training programs. Course duration and content are determined by the SAT process and by administrative procedure. These Xe-100 Training Programs will also commence no later than eighteen months prior to initial fuel loading.

For the Xe-100, the Production Field Technician (PFT) functions as the combination of a traditional non-licensed operator as well as a multi-trained technician. The PFT consistently uses operations and maintenance skills together on-shift reporting to the Shift Supervisor and working with the control room operators. When on shift, a PFT is responsible for tasks associated with the following 10 CFR 50.120 nuclear power plant personnel roles described in Sections 11.4.2.1 through 11.4.2.4:

11.4.2.1 Production Field Technician (PFT) Initial Training (Non-Licensed Operator Role)

Personnel employed as PFTs receive instruction on operation of plant equipment and components under normal and emergency conditions. This program is a combination of formal instruction and on-the-job training. Training is given in:

- Fundamentals of mechanical and electrical components
- Operation of equipment and systems
- Operating procedures
- Surveillance requirements
- Operation of systems important to plant safety

In-plant training includes system walk downs, which emphasize the use of procedures, the proper operation of equipment, and safe operating practices.

11.4.2.2 Production Field Technician (PFT) Initial Training (Instrumentation and Control [I&C] Role)

Initial training for PFT includes instruction in the following areas:

- Fundamentals of instrumentation and control
- Pneumatic systems and equipment
- Electronics
- Fundamental systems training
- I&C and other job related procedures
- Surveillance requirements
- Mitigating core damage training commensurate with their responsibilities during accidents that involve severe core damage
- On-the-job training

On-the-job training allows PFTs to practice the skills learned in the classroom under the guidance of experienced and qualified I&C (or PFT) personnel.

11.4.2.3 Production Field Technician (PFT) Initial Training (Electrical Maintenance Role)

Initial training for PFTs includes instruction in the following areas:

- Print reading
- Use of electrical tools and test equipment
- Fundamental systems training
- Electrical components and equipment
- Electrical maintenance practices
- Maintenance procedures
- On-the-job training

On-the-job training allows PFTs to practice the skills learned in the classroom under the guidance of experienced and qualified electrical maintenance (or PFT) personnel.

11.4.2.4 Production Field Technician (PFT) Initial Training (Mechanical Maintenance Role)

Initial training for mechanical maintenance technicians includes instruction in the following areas:

- Print reading
- Use of hand tools, power tools, and measurement devices
- Fundamental systems training
- Mechanical components and equipment
- Mechanical maintenance practices
- Maintenance procedures
- On-the-job training

On-the-job training allows PFTs to practice the skills learned in the classroom under the guidance of experienced and qualified mechanical maintenance (or PFT) personnel.

11.4.2.5 Chemistry/Radiological Protection Technician Initial Training

Initial training for chemistry/radiological protection technicians includes instruction in the following areas:

- Chemistry procedures
- Laboratory practices
- Conduct of analytical tests
- Operation of laboratory equipment
- Fundamental systems training
- On-the-job training to include actual operation of analytical equipment and the use of procedures
- Mitigating core damage training commensurate with their responsibilities during accidents that involve severe core damage
- Power plant chemistry
- Principles of radiation
- Radiation protection and safety
- Use of survey instruments
- Use of analytical equipment
- Radiation Protection procedures
- Emergency Plan procedures
- ALARA practices and procedures
- Fundamental systems training
- Mitigating core damage training commensurate with their responsibilities during accidents that involve severe core damage

On-the-job training provides the trainee opportunities to practice actual operation of analytical equipment, radiation protection equipment, and use of procedures under the guidance of experienced technicians.

11.4.2.6 Engineering Support Personnel Initial Training

Engineering support personnel complete orientation training on topics such as those listed below. The topics are chosen to familiarize engineering support personnel with various aspects of nuclear technology in an operating plant environment. Training topics include:

- Records management and document control
- Applicable industrial and nuclear regulations, codes, and standards
- Procedures and drawings
- Applicable programs such as corrective action, configuration management, work control, and the QA program
- Technical Specifications
- Plant systems, instrumentation, and components
- Plant operations
- Introductory review of accidents
- Design processes

11.4.2.7 Continuing Training for Other Personnel Listed in 10 CFR 50.120

Plant personnel specified in Subsection 11.4.2 [i.e., other than Shift Supervisor and Shift Technical Advisor (i.e., control room operator) personnel listed in 10 CFR 50.120] receive continuing training to maintain qualifications and enhance proficiency. Continuing training reinforces initial training by reiterating selected portions of the material. Continuing training also addresses new and modified procedures and plant design changes.

Operating Experience (OE) is included in continuing training, providing personnel with actual examples of good practices and lessons learned. OE topics are selected from Licensee Event Reports, corrective action databases, industry groups, and other sources.

Continuing training material is developed in accordance with the systematic approach to training and is conducted in accordance with X-energy procedures, site, and/or corporate procedures, as appropriate.

11.4.2.8 Plant Staff Training Programs implementation

Xe-100 Training Programs implementation satisfies the 10 CFR 50.120(b)(1), Requirement, that 18 months prior to fuel load an applicant and/or licensee "shall establish, implement, and maintain a training program that meets the requirements of paragraphs (b)(2) and (b)(3) of this section," by being prepared to commence the inaugural Xe-100 training classes at least 18 months prior to initial fuel load for the first Xe-100 deployment. Additionally, the Xe-100 Training Programs are maintained by each site-specific staff member completing an initial requalification module prior to the issuance of an operating or combined license where those members are part of the qualified staff.

The requalification program's content is determined using a systems approach to training methodology. This methodology also establishes the program's content and its frequency (duration of each class and how often classes are conducted).

11.4.3 General Employee Training (GET) Program

11.4.3.1 Plant Access Training

As part of the GET program, members of the station staff, contractor workers, and unescorted visitors participate in Plant Access Training, which consists of the following topics, prior to being granted unescorted access to the plant:

- Station organization
- Station facilities and layout
- Station administration
- Nuclear plant overview
- Industrial safety
- Fire protection
- Quality assurance and quality control
- Plant security
- Emergency planning
- Radiological orientation
- Appropriate portions of 10 CFR 26
- Appropriate portions of 10 CFR 19

11.4.3.2 Radiation Worker Training Program

Personnel whose job duties require them to have unescorted access to radiologically controlled areas of the plant receive instruction in the applicable aspects of radiation protection. Topics include the following:

- Sources of radiation
- Types and measurement of radiation
- Biological effects
- Limits and guidelines, including RG 8.13
- Concept of As Low As Reasonably Achievable (ALARA)
- Radiation dosimetry

- Contamination
- Internal exposure
- Radiation work permits
- Radiological postings
- Radiological alarms
- Radioactive waste
- Rights and responsibilities
- Protective clothing

11.4.3.3 General Employee Requalification Training

Personnel with unescorted access to the plant participate in requalification training as specified in administrative procedures. Requalification training includes those topics in 11.4.3.1 and 11.4.3.2, as applicable to access requirements. Emphasis is placed on significant changes to the plant, plant procedures, government regulations regarding the operation of the plant, and quality assurance requirements. As applicable, training is conducted on industry operating experiences, Licensee Event Reports, and personnel errors.

11.4.4 Selected Other Training Programs

This subsection addresses training for positions not specified by 10 CFR 50.120.

11.4.4.1 Fire Protection Training

Initial fire protection training is completed prior to receipt of fuel at the site. Personnel assigned as fire brigade members receive formal training prior to assuming brigade duties, and regularly scheduled retraining. Fire brigade training complies with NFPA Standard 600.

Training appropriate to the assigned work is also provided for the fire protection staff, fire watch personnel, and the general employee. Subsection 8.6 includes additional information regarding fire protection training.

11.4.4.2 Emergency Plan Training Program

Emergency Plan training meets the requirements of 10 CFR 50 Appendix E Section IV.F and the standards of 10 CFR 50.47(b)(15). Further details of the Emergency Plan training program can be found in the Emergency Plan, which is a separate document.

11.4.4.3 Physical Security Training Program

Training of security personnel is discussed in Section 11.7 and in the Physical Security Plan, which is a separate document.

11.4.4.4 Station Management Training Program

Station supervisors receive Fitness for Duty (FFD) supervisory training in accordance with 10 CFR 26.29. The remaining definitions and recommendations in this subsection are taken from ANSI/ANS-3.1-2014 as endorsed by Regulatory Guide 1.8.

The qualification requirements for managers and middle managers include training or experience in supervision or management. Training for supervisors develops their skills in the following areas:

- Leadership
- Interpersonal communications
- Management responsibilities and limits
- Motivation of personnel
- Problem analysis and decision making
- Administrative policies and procedures
- Observation skills
- Coaching

11.4.5 Training Effectiveness Evaluation Program

The program to evaluate the effectiveness of Xe-100 Training Programs is based on three independent inputs or perspectives: the supervisor of the trainee, the trainee, and an educational content evaluation. Each of these reviews is discussed below.

11.4.5.1 Supervisory Review for Training Effectiveness

The purpose of this review is to monitor the content and effectiveness of Xe-100 Training Programs as related to the duties and job responsibilities of the trainees. Reviews may be performed by supervisors of employees meeting with appropriate Training personnel, by designated oversight personnel, or by observing subsequent job performance. Observations are discussed to determine topics that may require additional training or subjects that may be removed from the Xe-100 Training Programs.

11.4.5.2 Trainee Review of Training Effectiveness

Following selected courses, or training cycles, trainees have the opportunity to provide comments regarding the effectiveness of the instructional methods and content relevancy to their jobs. These comments are used in the evaluation of both instruction and content of the Xe-100 Training Programs.

11.4.5.3 Review for Effectiveness of Instructional Techniques and Materials

Training material and instructional aids are assessed for clarity and applicability. Observations of instructors in the teaching environment are conducted by this qualified individual to monitor classroom performance. Full time instructors receive basic indoctrination in instructional techniques as soon as practicable after assuming instructional duties. The educational specialist conducts periodic seminars in instructional techniques, discussing areas where group performance could be improved and recommends innovative techniques observed at this or other power stations.

11.4.6 References

11.4-1 [X-energy Document #006012] “Xe-100 Licensing Topical Report: Xe-100 Training Programs Methodology”