X Energy, LLC
801 Thompson Avenue
Rockville, MD 20852
+1 301.358.5600

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Submittal of X Energy, LLC (X-energy), Xe-100 White Paper: Physical Protection System Approach Revision 2

REFERENCE: Letter from T. Chapman to Nuclear Regulatory Commission (NRC) dated January 4, 2022, "Submittal of X Energy, LLC (X-energy), Xe-100 White Paper: Physical Protection System Approach"

On January 4, 2022, X Energy, LLC (X-energy), submitted the above referenced white paper. After feedback from NRC staff on February 15, 2022, X-energy determined that a revised white paper would be submitted, which is attached as the enclosure to this letter.

This submission describes elements of the approach X-energy is employing to develop a physical security program template for an Xe-100 high temperature, gas-cooled reactor (HTGR) plant. It is provided for NRC review as indicated in the report and is expected to be referenced in future Xe-100 licensing activities. 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 Ingrid Nordby at inordby@x-energy.com.

Sincerely,

Travis Chapman
U.S. Licensing Manager, Xe-100 Program
X Energy, LLC

X Energy, LLC
801 Thompson Avenue
Rockville, MD 20852
+1 301.358.5600

cc:
X Energy, LLC
George Vanderheyden
Martin van Staden
Steve Miller

Nuclear Regulatory Commission
William Kennedy
Lucieann Vechioli-Feliciano
Michael Orenak

Enclosure: Xe-100 White Paper: Physical Protection System Approach Revision 2

X Energy, LLC
801 Thompson Avenue
Rockville, MD 20852
+1 301.358.5600

Enclosure

X Energy, LLC Xe-100 White Paper: Physical Protection Systems Approach
Revision 2
(Unrestricted)

Xe-100 White Paper

Physical Protection System Approach

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SYNOPSIS

This white paper outlines the approach that X Energy, LLC (X-energy) will use to develop the physical security template for future Xe-100 advanced reactor facilities. The template will serve as a framework for applicants to create site-specific Security Plans. X-energy's approach is informed by numerous NRC regulations and guidance documents, NEI guidance (with NRC endorsements), and various Sandia National Laboratory studies including studies and analyses performed specifically for the Xe-100 design. X-energy will continue to evaluate the physical security analysis results to optimize security approaches and staffing levels appropriate to the Xe-100 design.

X-energy and its Advanced Reactor Demonstration Program (ARDP) partner Energy Northwest (EN) are seeking early engagement with NRC in the Xe-100 design and approach to security. X-energy will use this early feedback to inform development of licensing topical reports and the project-specific applications (e.g., Construction Permit (CP) and Operating License (OL) applications under 10 CFR 50) associated with ARDP.

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EXECUTIVE SUMMARY

This white paper addresses the approach that X Energy, LLC (X-energy) will employ to develop a physical security program template for an Xe-100 high temperature, gas-cooled reactor (HTGR) facility. X-energy is submitting this white paper to the U.S. Nuclear Regulatory Commission (NRC) staff to support pre-application discussions and facilitate engagement on the development of an acceptable physical protection program that can be adapted by an applicant for a specific site. The Xe-100 HTGR is a power reactor facility and, as such, is subject to the applicable security requirements contained in Title 10 Code of Federal Regulations (10 CFR) Part 73, "Physical Protection of Plants and Materials." In addition, the NRC has undertaken two rulemakings that will affect the requirements for a physical protection system at a power reactor facility:

- The Alternative Physical Security Requirements for Advanced Reactors Rule [*RIN 3150-AK19*], and
- The Risk-Informed, Technology Inclusive Regulatory Framework for Advanced Reactors Rule [*RIN 3150-AK31*].

X-energy is closely following and participating in the process for both regulatory development activities. We intend to use our knowledge of the draft guidance and proposed rules to inform the approach for developing an Xe-100 physical protection program. X-energy will also consider the results of security-related analyses conducted by several Department of Energy (DOE) National Laboratories to support the development of our security planning approach. This includes work performed at Sandia National Laboratories (PathTrace modeling, Scribe 3D scenario, and Simajin/Vanguard modeling), Oak Ridge National Laboratories (domestic safeguards studies), and Idaho National Laboratories (various blast analyses).

The resultant Xe-100 Physical Security program template will address existing Part 50 and 73.55 regulations and NUREG/CR-7145 guidance and will provide future guidance to applicants to develop site-specific Physical Security Plans and proposed exemptions from applicable regulations. To the degree practical, the Xe-100 security planning approach will be consistent with Part 53 and the Part 73 Security Rulemaking efforts as they develop.

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ABBREVIATIONS

Abbreviation or Acronym	Definition
AA/FFD	Access Authorization/Fitness for Duty
AI	Artificial Intelligence
AR	Advanced Reactor
ARDP	Advanced Reactor Demonstration Program
ARPA-E	Advanced Research Projects Agency - Energy
CAP	Corrective Action Program
CFR	Code of Federal Regulations
CI	Conventional Island
COL	Combined Operating License
CP	Construction Permit
DBA	Design Basis Accident
DBT	Design Basis Threat
DOE	United States Department of Energy
EPG	Externally Powered Gun
GEMINA	Generating Electricity Managed by Intelligent Nuclear Assets
GWd	Gigawatt days
HTGR	High Temperature Gas-cooled Reactor
IAEA	International Atomic Energy Agency
LLEA	Local Law Enforcement Agencies
IDS	Intrusion Detection System
IRP	Integrated Resources Plan
LED	Light Emitting Diode
LRAD	Long Range Acoustic Device
LWR	Light Water Reactor
NPP	Nuclear Power Plant
MWe	Mega Watt Electric
MWt	Mega Watt Thermal

Abbreviation or Acronym	Definition
NEIMA	Nuclear Energy Innovation and Modernization Act of 2019
NI	Nuclear Island
NRC	U.S. Nuclear Regulatory Commission
NIAB	Nuclear Island Auxiliary Building
OCA	Owner Controlled Area
OL	Operating License
PA	Protected Area
PAB	Protected Area Barrier
PPP	Physical Protection Program
PPS	Physical Protection System
PSAR	Preliminary Safety Analysis Report
PSP	Physical Security Plan
RB	Reactor Building
RG	Regulatory Guide
ROWS	Remotely Operated Weapon System
SG	Steam Generator
SMR	Small modular reactor
SNM	Special Nuclear Material
sUAS	Small Unmanned Aerial System
TEDE	Total Effective Dose Equivalent
tHM	Tons of Heavy Metal
US	United States
VA	Vital Area
VBS	Vehicle Barrier System
VTOL	Vertical Take Off and Landing
UCO	Uranium Oxy-Carbide
X-energy	X-energy, LLC

1. INTRODUCTION

1.1. PURPOSE

X-energy is developing the Xe-100 modular high-temperature gas-cooled reactor (HTGR) for commercial deployment in the United States (US), Canada, and internationally. The US deployment of the Xe-100 is funded, in part, through the U.S. Department of Energy's (DOE's) ARDP cooperative agreement with partner Energy Northwest. Successful ARDP awardees committed to work towards commercial demonstration of at least one advanced reactor within 7 years of award through a cooperative agreement with DOE. X-energy is presently completing the preliminary design of the Xe-100 while simultaneously drafting a Preliminary Safety Analysis Report (PSAR) to obtain a CP for the Xe-100 technology-based project to meet the demonstration timeline. Another funding opportunity supporting this work is the Advanced Research Projects Agency - Energy (ARPA-E) Generating Electricity Managed by Intelligent Nuclear Assets (GEMINA) project. The ARPA-E project is focusing on the development of an effective physical security plan with the integration of advanced technologies. Part of that funding was used to develop a physical security philosophy and apply analytical methods to support the development of a robust security plan for the Xe-100. This paper describes the approach developed by X-energy intended to seek early feedback from the NRC staff regarding security-related matters for advanced reactors and specifically the Xe-100 design in the context of the forthcoming rulemaking on Part 73.

1.2. SCOPE

This white paper describes the approach and analysis methods that X-energy will employ in the development of a physical security program template for an Xe-100 HTGR facility. Anticipated regulatory exemptions to certain requirements in 10 CFR Part 73 and the use of alternative measures for protection against radiological sabotage will also be identified. The approach is consistent with direction the NRC staff is pursuing to demonstrate greater technological innovation, flexibility, and regulatory process improvements for licensing advanced reactors.

1.3. RELATIONSHIP TO OTHER DOCUMENTS

This document provides a high-level summary description of design information extracted from various design documents under configuration control at X-energy. The enclosed information is preliminary, pre-decisional, and is subject to change as the design progresses.

2. XE-100 PLANT DESCRIPTION

2.1. OVERVIEW

The Xe-100 is a Generation IV Advanced Reactor (AR) based on pebble bed HTGR technology. It utilizes U.S.-developed Uranium Oxy-Carbide (UCO) TRISO-coated fuel particles embedded in spherical fuel elements referred to as pebbles. The reactor generates 200 MWt and produces high-quality, super-heated steam at 565°C and 16.5 MPa, which is suitable for many different energy applications. Such applications include electricity production, industrial process heat, district heating, desalination, wind/solar power augmentation, or combinations of these in a cogeneration arrangement.

The standard Xe-100 plant consists of four units with some shared infrastructure and integrated plant systems. The nuclear steam supply system is found in the Nuclear Island (NI), arranged with a Reactor Building (RB) and Nuclear Island Auxiliary Building (NIAB) that contain a nuclear reactor and Steam Generator (SG) pair and associated support systems. All safety-related structures, systems, and components (SR-SSCs) are found within the NI. The steam turbine generator and all its associated systems are contained in the Conventional Island (CI), as shown in Figure 1 and Figure 2. The Xe-100 plant is designed such that the CI systems (secondary or non-nuclear side) are commercially available, off-the-shelf systems that can be optimally configured to suit the end user's requirements. The NI, on the other hand, is the standardized part of the design and remains unchanged irrespective of the energy application.

A single 200 MWt unit configured for electricity generation produces 80 MWe net power at a thermal efficiency of 40%, thus providing a combined electrical output of 320 MWe for a four-unit plant. The Xe-100 is highly maneuverable and can ramp power up and down at ~5% per minute within the 100% - 40% - 100% power range. The reactor can also operate at stable power levels as low as 25%, although with limited maneuverability. The reactor is designed to handle a trip from full power to house load conditions without causing a reactor trip. All four units of the Xe-100 plant are controlled from a single control room to realize staffing efficiencies from simplified and largely automated plant control.

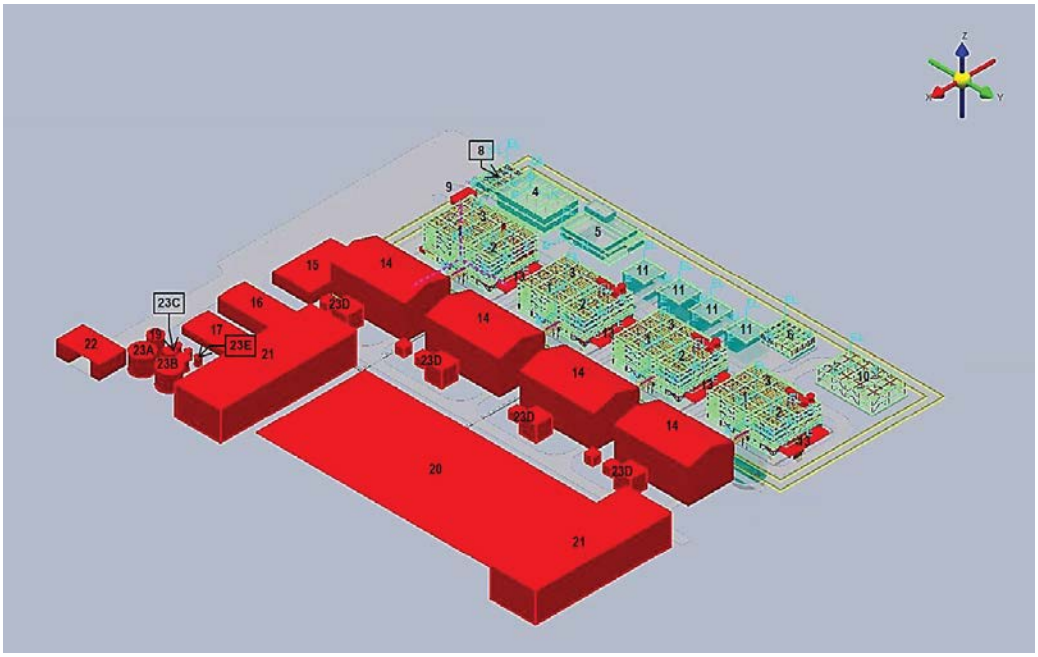

Figure 1: Xe-100 Physical Site Layout

Table 1: Xe-100 Physical Site Layout Legend

BLDG #	BUILDING
1	Reactor Building
2	Nuclear Island Auxiliary Building
3	Fuel Handling Annex Building
4	Controls & Electrical Building
5	Rad-Waste Treatment Building
6	Helium Service Building
7	Inter-Unit Access Tunnel
8	Access & Security Building
9	Sally Port
10	Warehouse
11	ISFSI
12	NI Component Cooling Water Air Cooled Heat Exchangers
13	Startup / Shutdown Air Cooled Heat Exchangers
14	Turbine Building
15	Admin./ Eng./ Training building
16	Maintenance & Storage Building
17	Water Treatment Building
18	Fire Pump House & Fire Water Building
19	Condensate Water Tank
20	Electrical Switchyard
21	Cooling Tower
22	Plant/OCA Entrance
23A.	Fire Water Storage Tank 1
23B.	Fire Water Storage Tank 2
23C.	Miscellaneous Tanks (2)
23D.	Transformer
23E.	Miscellaneous Tanks (3)

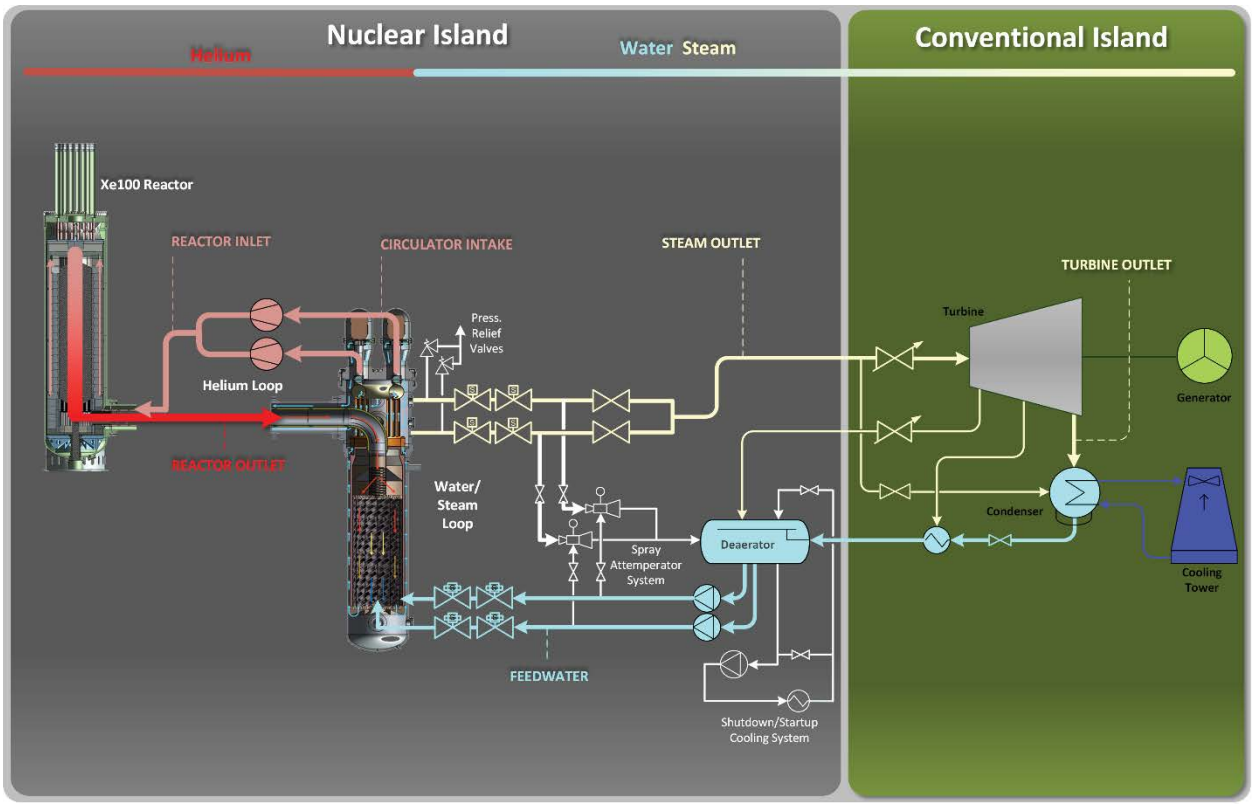

Figure 2: Xe-100 Operating System Design

2.2. REACTOR SAFETY DESIGN

The safety design approach of the Xe-100 design is built upon two characteristic safety features. The first feature is the inherent radionuclide retention capabilities of TRISO fuel, which ensures the confinement of the radionuclides within the fuel under all operating and accident conditions in such a way that there can be no significant release from the fuel particles. The excellent fission product retention capability of U.S.-developed UCO TRISO-coated particle fuel has been demonstrated for temperatures up to 1800°C for long durations, and degradation mechanisms typically require long periods of time to significantly impact the retention function.

The second feature is that the Xe-100 is designed to be intrinsically safe, which means that no operator action or actively powered system is required to ensure that the maximum fuel temperature stabilizes at levels significantly lower than the maximum fuel temperature limit. Like many advanced reactor technologies, the Xe-100's performance is evaluated using a mechanistic source term that is modeled on event sequence-specific phenomena based on the multiple barriers to radionuclide release in the design (i.e., a functional containment), including any circulating activity developed during normal or off-normal operations. A design requirement for the Xe-100 is to ensure that in the event of a release of this circulating activity, estimated dose consequences are maintained well below regulatory limits at a site boundary.

This safety design approach toward intrinsic safety is achieved through selected design features, such as:

• Low excess reactivity (due to continuous fueling),

• Low power density (to ensure that decay heat can be passively removed),

• Optimal core geometry aspect (Height/Diameter) ratio (to match the decay heat generation with the capability of the passive heat removal pathway),

• Optimized moderation ratio,

• Strong negative temperature coefficient over the full operational range of the Xe-100 (passive shut down of the nuclear chain reaction in the event of the core heating up), and

• Passive decay heat removal capability to ensure long-term plant safety without the need for emergency power.

Implementing the above safety features in the Xe-100 design ensures that the off-site dose in the event of all Design Basis Accidents (DBAs) can be maintained below regulatory limits at a site boundary within 400 m of the reactor. As noted above, these features also preclude severe accidents for events that are beyond the design basis.

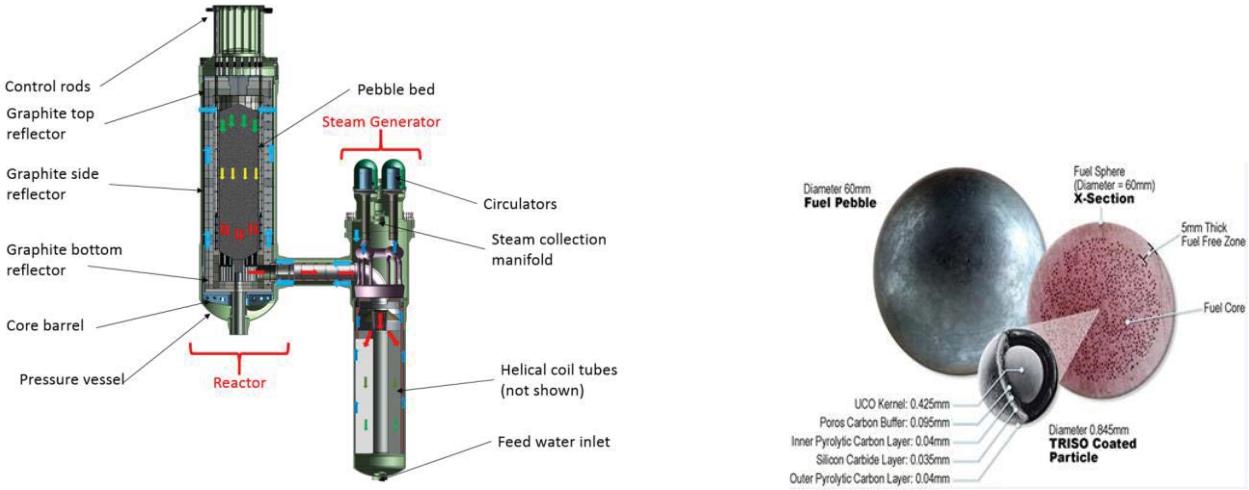

Figure 3: Reactor and TRISO Fuel Assembly

2.3. FUELING OPERATIONS

The spherical fuel form provides the opportunity to perform online refueling, which allows the reactor to operate with very little excess reactivity to compensate for fuel burn-up. In the Xe-100 design the fuel is recirculated continuously during operation. Each fuel pebble makes approximately six passes before being discharged to remain within the acceptable fuel design burn-up limit. Burn-up measurement is accomplished via gamma spectroscopy in the fuel handling system. This fuel recirculation allows the fuel cycle to be optimized to achieve extremely efficient fuel usage. The Xe-100 reactor can attain a burn-up of approximately 165 gigawatt-days per ton of heavy metal (GWd/tHM) through this multi-pass fueling

scheme. Online refueling has a further advantage in that it provides the possibility to increase plant/unit availability beyond 95%.

2.4. XE-100 OPERATIONS

The plant is designed for online fueling, defueling, and recirculation of the fuel while in normal operating condition, Mode 5 [14]. Fresh fuel is introduced into the reactor under gravity using automated systems. A fuel unloading device removes the used fuel spheres from the reactor and sends them to a burn-up measuring device for assessment. Fuel that has reached its burn-up limit is removed and loaded via the charge lock system into spent fuel containers. An automated system will containerize, move and store spent fuel in a spent fuel storage facility shared between the four units of a plant. There is enough capacity for the lifetime storage of all the used fuel produced at the site. The fuel pebbles not at their full burn-up level are re-introduced into the reactor core for a new pass.

The fresh fuel storage capacity inside the reactor building is sufficient for 6 months continued operation at 100% MCR (Mode 5). Approximately 175 new fuel pebbles are loaded into and removed from the reactor per day. The fueling system is capable of batch fueling (fueling for a period at a higher rate) or continuous fueling (spaced through a 24-hour period) if required. This allows for maintenance on the fuel handing system without interrupting reactor operation at power. Accounting systems are implemented to meet international and domestic safeguards requirements for material control and accountability.

The design, operation, and refueling approach of the Xe-100 result in a robust plant resistant to security threats from sabotage or to theft of SNM. This robustness is described in more detail in Section 3.

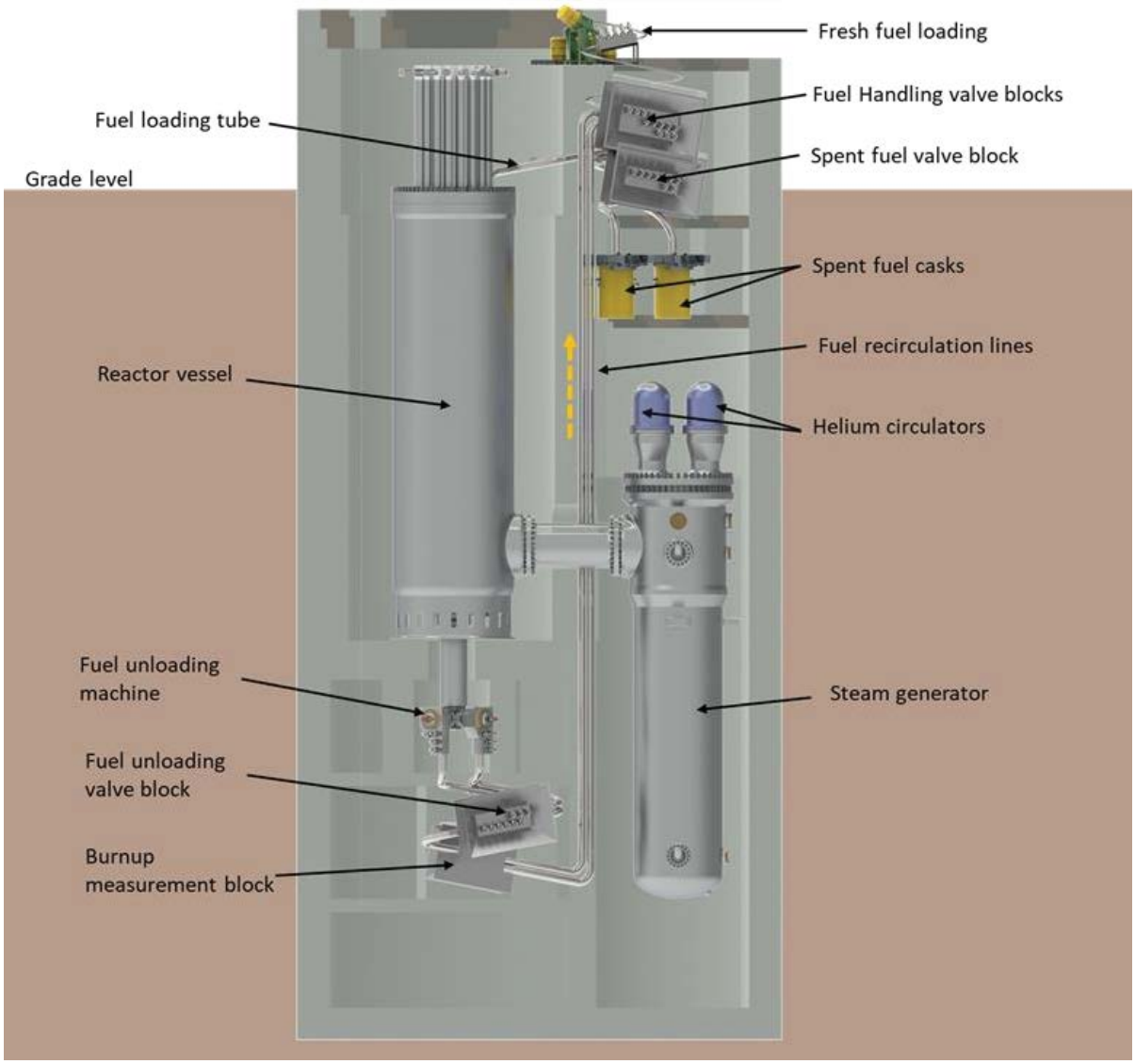

Figure 4: Primary Helium Loop shown with Fuel Handling System

3. XE-100 INHERENT AND PASSIVE SAFETY CHARACTERISTICS

3.1. XE-100 PLANT FEATURES AFFECTING SECURITY APPROACH

The Xe-100 HTGR is a small modular reactor (SMR) that has been designed to incorporate inherent and passive safety features along with the radionuclide retention capabilities of the TRISO fuel. The design of the fuel makes it difficult for a Design Basis Threat (DBT) scenario to disable safety systems and cause a radiological release since the fission product barriers will not be degraded, and the heat transfer from passive cooling is sufficient to prevent fuel degradation. X-energy intends to consider and credit the Xe-100's inherent and passive safety characteristics into the development and implementation of the Physical Protection Program (PPP).

The objective of the security planning and analyses conducted by X-energy is to demonstrate the robust design of the Xe-100 facility and provide a technical and regulatory basis for an alternative approach to establish X-energy's Physical Protection System (PPS) specific to a Xe-100 plant made up of four (or more) 200 MWt reactors.

The existing regulatory framework for the safeguards and security of traditional nuclear power reactors set forth in the U.S. Code of Federal Regulations Part 73 includes the deterministic specifications for security systems and security organizations. The optimization of the overall PPS is a critical component in meeting the overarching initiative for the development of new and better U.S. nuclear energy technologies.

X-energy is evaluating methodologies to determine the overall PPS design strategy and implementation at Xe-100 reactor sites, addressing the requirement to provide high assurance that activities involving special nuclear material (SNM) are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety.

X-energy will evaluate and develop exemptions as needed from existing Code of Federal Regulations (CFR) requirements essential for optimizing the PPS under the existing framework of Nuclear Regulatory Commission (NRC) requirements. X-energy will also evaluate an alternate consequence-based approach for the safeguards and security of Gen IV SMRs that may be implemented as the technical bases for exemptions from current regulations.

The Xe-100 design has no subset of equipment or operational actions that could result in plant level releases above regulated thresholds, demonstrating that radiological sabotage cannot be accomplished by malicious initiation of Nuclear Power Plant (NPP) accident sequences. The design of the fuel, reactor, and facility itself present sufficient protection against elements of malicious actions toward radiological sabotage (ostensibly captured in the DBT).

Xe-100 plant features include inherent reactor and fuel characteristics combined with engineered safety and security features. These features inhibit or mitigate sabotage consequences and support facility recovery if equipment is compromised, destroyed, or rendered nonfunctional. For example, inherent reactivity control and heat removal capability, fuel which is incapable of degradation of fission product barriers from melting and therefore incapable of having a release of radionuclides from the facility would help to defeat the DBT against sabotage. Facility recovery and mitigation strategies may, where feasible, include support from offsite resources and use of onsite remotely operated final denial systems.

3.2. SECURITY BY DESIGN

X-energy is developing a new approach to physical security for the Xe-100 plant design. This "Security by Design" approach will develop the Xe-100 plants' Physical Protection Program based on the enhanced engineering safety and security features of the Xe-100 reactor that significantly reduce the risk to public health and safety associated with a malicious dispersal event (radiological sabotage) and theft of SNM.

Analyses results along with the integration of security systems and the inherent and passive safety design of the Xe-100 reactor may very well re-define the traditional definition of vital areas. Vital areas are related to the radiological release thresholds defined for safety. Based off current and expected analyses, those thresholds cannot be exceeded.

Additional planned evaluations of the reactor, its fuel lifecycle flow, event-sequence-specific source terms, and engineered safety and security features will be conducted before determining Xe-100 plants' vital areas.

3.3. CONSEQUENCE-BASED PERFORMANCE OBJECTIVE

The requirements for the physical protection of a power reactor are contained in 10 CFR 73.55, "Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors Against Radiological Sabotage." These requirements were initially developed, and have evolved over time, to protect the public from a radiological sabotage event directed against a large light water reactor (LWR) facility. The Physical Protection System (PPS) for an Xe-100 facility will generally meet these requirements; however, X-energy anticipates seeking regulatory exemptions to certain requirements and using alternative measures to meet others.

X-energy acknowledges the physical protection performance objectives in 10 CFR 73.55 and will conduct analyses to develop methods and design safeguards systems to protect against acts of radiological sabotage, spent fuel sabotage, and the theft or diversion of special nuclear material commensurate with the design of the Xe-100 reactor. Adversary actions to achieve significant core damage and spent fuel sabotage are expected to be prevented, in part, through the Xe-100 reactor's safe and passive design feature. The design has no anticipated subset of equipment or operational actions that could result in plant level radiological releases above regulated thresholds, demonstrating that radiological sabotage cannot be accomplished by malicious initiation.

As discussed above, the PPS for an Xe-100 HTGR facility will be based on the performance objective (demonstrated by analysis results) that no act or set of acts by the Design Basis Threat of Radiological Sabotage (the DBT) will result in offsite dose consequences that exceed the limits specified in §§ 50.34(a)(1)(ii)(D) and 52.79(a)(1)(vi). Those limits are:

> (1) An individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 25 rem total effective dose equivalent (TEDE), and

(2) An individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a radiation dose in excess of 25 rem total effective dose equivalent (TEDE).

The PPS methodology proposed by X-energy will address the guidance needed to perform analyses that demonstrates compliance with the above performance objective. Key topics/analyses will include but not limited to:

Consequence Analysis Hazards Analysis PathTrace Analysis Proliferation Resistance Analysis Probability Risk Analysis	Breakpoint Analysis Fresh/Spent Fuel Plume Analysis Blast Analysis Radiological Material Dispersal Analysis

4. XE-100 PLANT SECURITY STRATEGY

The Xe-100 plant security strategy involves the integration of various security elements to execute functions and achieve security objectives. The elements include a plant security organization and integration of local law enforcement at each plant site, a security program, physical security plan (PSP), on-going performance evaluation for each site, and the Physical Protection System (PPS) implemented in the site and plant design.

The principal security objective for the Xe-100 plant is the protection of the plant personnel and facility and the prevention of sabotage that could result in offsite doses above 25 rem total effective dose equivalent (TEDE) in 2 hours at the site boundary. The primary function of the PPS is to assure that an adversary would not be able to gain access to identified target set equipment, spent fuel containers, or to the discrete spent fuel pebbles to cause such consequences. Due to the large fuel-to-nuclear material volume and mass ratios for TRISO-based fuel pebbles, theft of a goal quantity of nuclear material would require a significant logistical effort by an adversary; however, this threat is still considered and analyzed when designing the Xe-100 PPS. To optimize security staffing while mitigating this risk, security technologies will be assessed for inclusion in the Xe-100 site design to facilitate the security functions of early adversary detection, assessment, interdiction, and neutralization with the integration of final denial systems.

X-energy is evaluating protection system innovations that integrate advances in technologies such as, but not limited to, artificial intelligence (AI), robotics/remote systems, and LED optical links for data, voice, and video communications. These innovations allow for increased work efficiencies, support a robust PPS, and optimize the security organization and on-site security program. 10 CFR Part 73.55 Appendix B and Appendix C requirements will be met through the design and methodology discussed within this white paper and can be reviewed in Appendix A of this white paper (§73.55 Comparison Matrix). Appendix A in this white paper will be further developed and populated as the security analysis progresses for the Xe-100 design.

4.1. PHYSICAL PROTECTION PROGRAM

Xe-100 plants will establish and maintain a Physical Protection Program which will include a security organization and agreements with Local Law Enforcement Agencies (LLEA) for support as needed. The security program objective is to provide high assurance that activities involving special nuclear material are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety.

Xe-100 plants' PPP will be designed to protect against the design basis threat of radiological sabotage.

Xe-100 plants' physical protection program will be designed to:

- Prevent significant core damage and spent fuel sabotage;
- Ensure capabilities to detect, assess, interdict, and neutralize DBT threats; and
- Provide defense-in-depth through the integration of systems, technologies, programs, equipment, supporting process, and implementing procedures.

4.2. PLANT SECURITY ORGANIZATION

The Xe-100 plant security organization will be staffed with trained, qualified, and equipped members consisting of a chain of command structure. The staff will be directed to perform their duties through administrative controls, security implementing procedures, and the physical security plan (PSP) to provide the necessary actions and levels of protection to meet regulatory requirements.

The *Security Manager* will be responsible for ensuring the security organization maintains qualifications and that the PSP effectiveness complies with applicable regulatory requirements. The Security Manager will oversee the training and qualification program, Access Authorization/Fitness for Duty (AA/FFD) program, inspections, maintenance and testing of security systems and will be qualified in accordance with Appendix B to Part 73—General Criteria for Security Personnel.

The *Security Shift Supervisor* will be responsible for ensuring there are sufficient numbers of qualified personnel to effectively perform the necessary duties and responsibilities to implement the PSP and will be qualified in accordance Appendix B to Part 73—General Criteria for Security Personnel to support the operations of the Xe-100 facility.

The *Training Instructor* will develop lesson plans and conduct continuing security force training necessary to maintain qualifications and will be trained and qualified for their assigned duties.

The security force *Responder* will be trained and qualified for their assigned duties and will be available at all times to implement the protective strategy.

The *Alarm Station Operator* will be responsible for monitoring alarms assessments, making on and off-site notifications, and initiating response to a security event.

4.3. LOCAL LAW ENFORCEMENT INTEGRATION

Xe-100 plants will establish, document, and maintain liaison with Local Law Enforcement Agencies and State and/or Federal resources as applicable. Xe-100 plants will develop an integrated plan with LLEA that documents the amount of response support necessary to ensure PSP effectiveness. The integrated response plan will address:

- Communication Protocols,
- Command and Control Structure,
- Response Locations, and
- Equipment Necessary for LLEA to Identify, Respond, Interdict, and Neutralize threats.

4.4. SECURITY PROGRAM PERFORMANCE EVALUATION

X-energy will support owner/operators in establishing a performance evaluation process to assess the effectiveness of the security program and the physical protection system with the development of a drill and exercise evaluation program. Once established, the security program and PSP will be tested through the conduct of table-top exercises, drills, and other performance-based (limited-scope) exercises as a means for a continual effectiveness review. Drills and exercises will be outlined in the Training and Qualification Plan and will execute the complete PPS capabilities and security personnel responsibilities. A Xe-100 plant Corrective Action Program (CAP) will be utilized to track, evaluate, and correct deficiencies

and/or findings identified from the drill and exercise evaluations that affect all Xe-100 plants. The Owner/Operator may maintain a plant-specific CAP to track deficiencies specific to a specific plant or plant site.

4.5. PHYSICAL PROTECTION SYSTEM DESIGN PRINCIPLES

4.5.1. Owner Controlled Area Design

X-energy's Xe-100 standard plant site design, and associated project-specific site layouts, are arranged to provide a defense-in-depth protective strategy as part of the PPS. These arrangements also identify positions and areas of responsibilities for the security organization to provide an appropriate response to interdict and neutralize the threat. Defense in depth is achieved through the use of multiple physical barriers in order to maximize the time available from detection to interdiction. Examples of physical barriers and security features under consideration in the Xe-100 security analyses include Metalith VBS and Mandall Blast Doors/Walls, active delays with smoke and slippery agents, redundant alarm and detection devices, interdiction by Remotely Operated Weapons Stations (ROWS lethal/less-than-lethal) and supporting LLEA.

The PPS will originate at the Owner Controlled Area (OCA) boundary where plant employee vehicles will be directed through an automated vehicle checkpoint. Physical barriers are located within the OCA to prevent malicious intent and design to protect to meet/exceed regulatory requirements. The OCA will be monitored using advanced monitoring systems that provide a live 360˚ Thermal Panoramic Image for complete site surveillance with detection capabilities out to 600 m with thermal and visual assessment camera capability for early detection and assessment of unauthorized activities within the OCA. OCA detection and assessment systems capabilities may include: Geo-Referenced Map Displaying Geo-Located Targets, a slew to cue peripheral alarms, and the capability to mitigate intrusions with an integrated LRAD (Long-Range Acoustic Device), high-powered spotlights and class III lasers to track and deter.

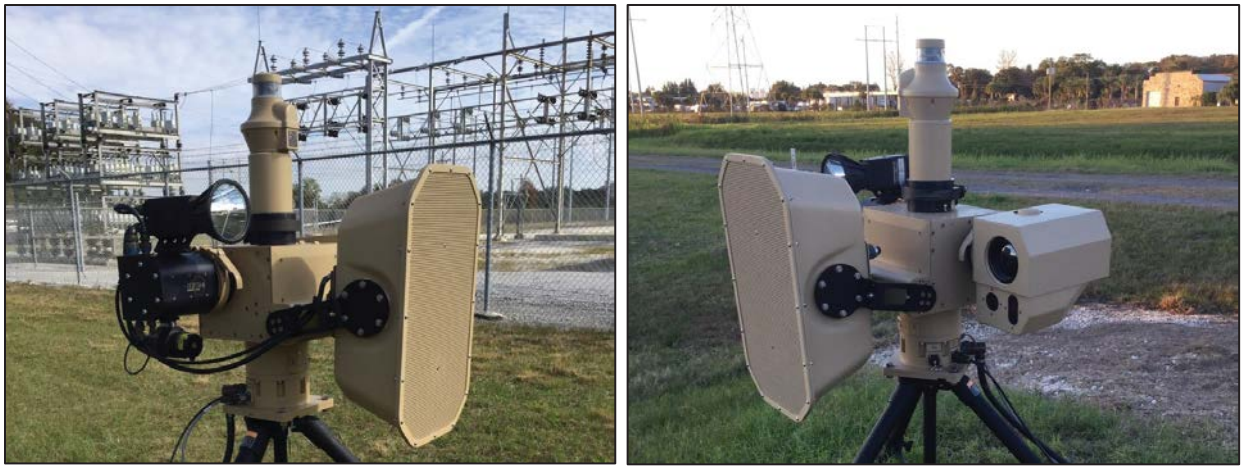

Figure 5: Live 360˚ Thermal Panoramic Image

4.5.2. Protected Area Design

Xe-100 plant sites' Protected Area (PA) boundaries will be designed similar to current nuclear power plant sites with vehicle barriers, delay barriers, Intrusion Detection Systems (IDS), and assessment capabilities within the PA isolation zone in order to meet regulatory requirements and security system design guidance. In addition, X-energy continues to evaluate other IDS and assessment technologies for integration that will increase PSP effectiveness and provide opportunities to implement advanced technologies to address nuisance alarms and other human error associated with current nuclear power plant sites. OCA and PA surveillance of unauthorized personnel could be further integrated using tethered Vertical Take-Off and Landing (VTOL) small Unmanned Aerial Surveillance (sUAS) Systems. As an example, the LiveSky sUAS is capable of sustaining 1500-hours of continuous flight or being rapidly deployed upon detection of unauthorized activity within the security network.

Figure 6: Mil Spec LiveSky vScenario sUAS System

4.5.3. Vital Area Design

X-energy may determine that some areas within the PA require restricted access control measures because restricted access is required for effective implementation of the protective strategy. Designated Vital Areas (VA) will be designed to meet all regulatory requirements. Where advantageous to the protective strategy, X-energy will evaluate additional barriers for visual deterrence and eliminate access to vital areas by unauthorized personnel. The barriers will be evaluated for design and constructed of material and placement such that the delay time provided will allow for effective implementation of the protective strategy to include LLEA responding to the incident. VA barriers and doors/walls may be designed for blast protection and provide total denial to vital areas locations. An example of such a design feature is the Metalith infrastructure defense barrier shown in Figure 7.

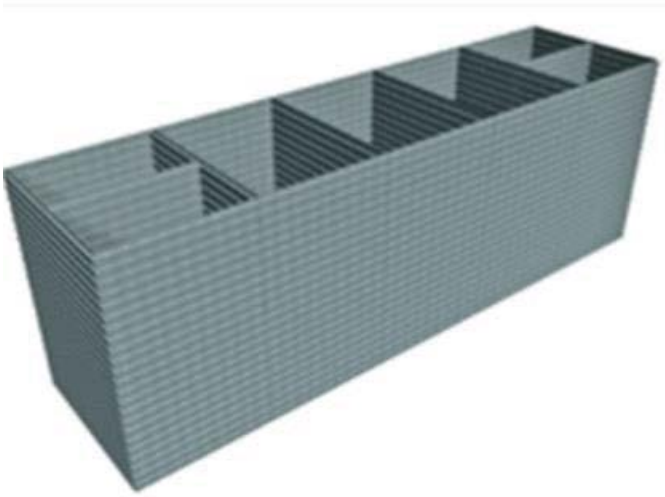

Figure 7: Metalith Infrastructure Defense Barrier

4.6. RESPONSE AGAINST THEFT/SABOTAGE

Security response to threats against a Xe-100 plant site will be provided by an integrated response force made up of both on-site security capabilities and off-site LLEA and will be designed to defend the facility against the Design Basis Threat (DBT). The principal objectives of security response are to stop adversary progress by interposing security capabilities between high valued areas and the adversary to prevent radiological sabotage or theft of special nuclear material (SNM) and/or intercept any person exiting with SNM.

Security response begins upon early detection and assessment of unauthorized activities within the OCA using advanced surveillance technology and initiation of an integrated response plan. In addition to the multi-layered deterrence provided in the PPS, the use of less than lethal force technology will impede or stop adversary movement and allow time for the integrated response plan to eliminate or divert the threat and control the situation until it is resolved, and site operations can continue.

X-energy is also in the process of evaluating final denial capabilities with the deployment of Remotely Operated Weapons Systems (ROWS), as an example using Externally Powered Gun (EPG) technology, that provide the choice to use both lethal and/or less-than lethal ammunition. Remote weapon stations are an established force multiplier and increases the PPS and PSP effectiveness.

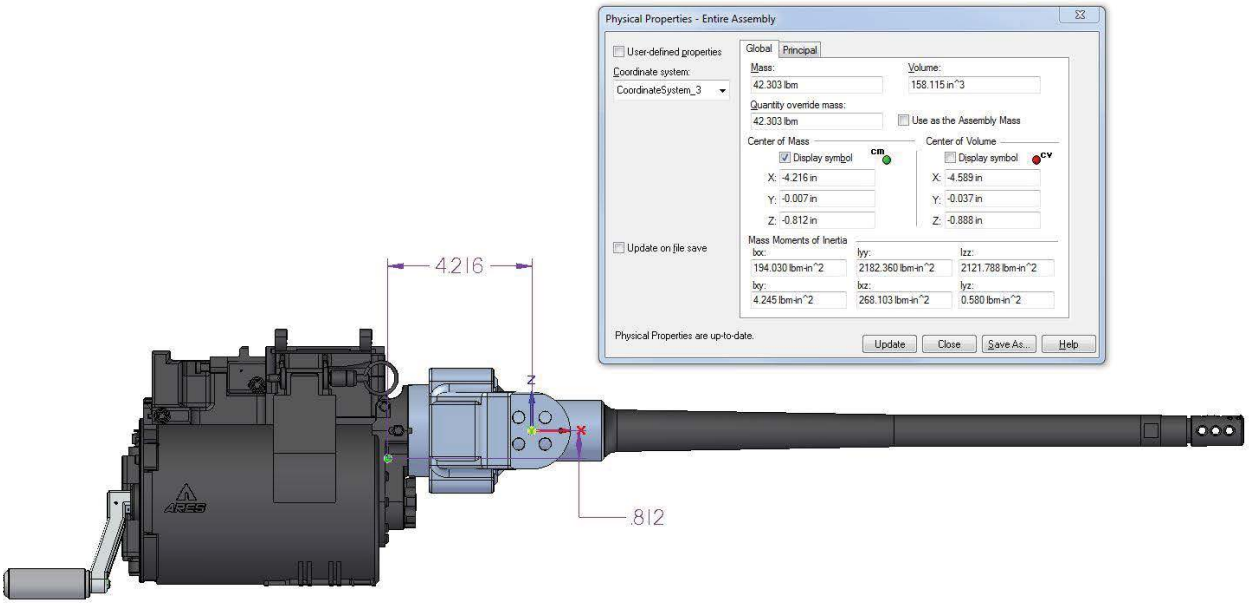

Figure 8: 7.62mm Cam Operated Chain Gun with Dual Feed Tray

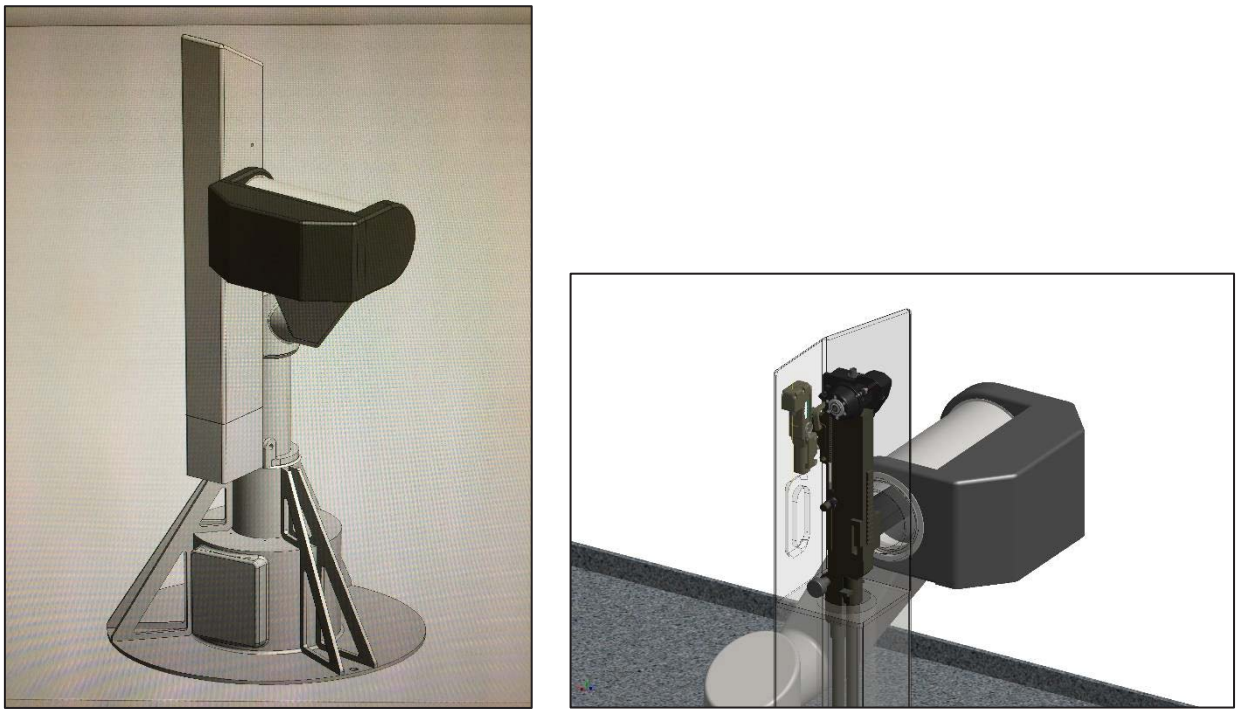

Figure 9: Armored Protected Remotely Operated Weapons System

5. LICENSING APPROACH

5.1. OVERVIEW OF US REGULATORY REQUIREMENTS

Current US NRC regulatory requirements have evolved in response to the commercial large Light Water Reactors (LWR) commonly used in the United States and associated potential consequences of incidents based on that technology (e.g., dose consequences from significant core damage events that challenge containment structures). The ARDP project licensing approach follows 10 CFR Part 50 and 10 CFR Part 73 for the preparation of a construction permit and operating license application for the planned Xe-100 plant. This section discusses requirements relevant to the physical protection system design and Xe-100 plant security strategy. It also describes consideration of the draft guidance in NEI 20-05 and the progress as of late 2021 with the ongoing NRC security rulemakings.

5.1.1. Anticipated Exemptions

This white paper describes the developmental methods considered for the Xe-100 PPS (i.e., a consequence-based approach) that will be further developed as the technical basis for exemptions to certain 10 CFR 73 regulatory requirements associated with security features and the security organization. The following requirements are highlighted as examples of anticipated exemption requests for Xe-100 plants. A matrix comparing existing 73.55 requirements, revised 73.55 language proposed in the on-going Part 73 rulemaking, and a preliminary assessment of the impact of those requirements on the Xe-100 is provided in Appendix A to this white paper.

10 CFR 73.2(a)(3) *Armed response personnel means persons, not necessarily uniformed, whose primary duty in the event of attempted theft of special nuclear material or radiological sabotage shall be to respond, armed and equipped, to prevent or delay such actions.*

10 CFR 73.55(d)(2)(ii) *At least one member, onsite and available at all times, who has the authority to direct the activities of the security organization and who is assigned no other duties that would interfere with this individual's ability to perform these duties in accordance with the security plans and the licensee protective strategy.*

10 CFR 73.55 (e) *Physical barriers. Each licensee shall identify and analyze sites specific conditions to determine the specific use, type, function, and placement of physical barriers needed to satisfy the physical protection program design requirements of § 73.55(b)… (8) Protected area…(v) All exterior areas within the protected area, except for areas that must be excluded for safety reasons, must be periodically checked to detect and deter unauthorized personnel, vehicles, and materials.*

10 CFR 73.55(e)(8)(v) *All exterior areas within the protected area, except for areas that must be excluded for safety reasons, must be periodically checked to detect and deter unauthorized personnel, vehicles, and materials.*

10 CFR 73.55(g)(4)(ii) *Vital Areas….(ii) In response to a site-specific credible threat or other credible information implements a two-person (line-of-sight) rule for all personnel in vital areas so that no one individual is permitted access to a vital area.*

10 CFR 73.55(i)(5) *Surveillance, observation, and monitoring…(ii) The licensee shall provide continuous surveillance, observation, and monitoring of the owner-controlled area as described in the security plans to detect and deter intruders and ensure the integrity of physical barriers or other components and functions of the onsite physical protection program. Continuous surveillance, observation, and monitoring responsibilities may be performed by security personnel during continuous patrols, through use of video technology, or by a combination of both. (iii) Unattended openings that intersect a security boundary such as underground pathways must be protected by a physical barrier and monitored by intrusion detection equipment or observed by security personnel at a frequency sufficient to detect exploitation.*

(iv) Armed security patrols shall periodically check external areas of the protected area to include physical barriers and vital area portals.

(v) Armed security patrols shall periodically inspect vital areas to include the physical barriers used at all vital area portals. (vi) The licensee shall provide random patrols of all accessible areas containing target set equipment.

(vii) Security personnel shall be trained to recognize obvious indications of tampering consistent with their assigned duties and responsibilities.

10 CFR 73.55(k) *Response requirements. (1) The licensee shall establish and maintain, at all times, properly trained, qualified and equipped personnel required to interdict and neutralize threats up to and including the design basis threat of radiological sabotage as defined in § 73.1, to prevent significant core damage and spent fuel sabotage (3) The licensee shall train each armed member of the security organization to prevent or impede attempted acts of radiological sabotage by using force sufficient to counter the force directed at that person, including the use of deadly force when the armed member of the security organization has a reasonable belief that the use of deadly force is necessary in self-defense or in the defense of others, or any other circumstances as authorized by applicable State or Federal law.*

Exemptions are anticipated for the overarching staffing requirements in 10 CFR 73.55(k)(5)(ii) for 10 personnel to be available to respond at all times and requirements associated with this response force. A detailed security staffing analysis and approach that relies on the combination of the inherent and passive safety features of the Xe-100 and the results of analyses of Design Basis Threats against the Xe-100 PPS is under development for inclusion in future licensing submittals.

6. CONCLUSION

The NRC staff has undertaken a rulemaking to establish physical security requirements appropriate for advanced reactors, as directed by the staff requirements memorandum for SECY-18-0076, “Options and Recommendations for Physical Security for Advanced Reactors.” X-energy supports the use of the performance-based, technology-neutral, and consequence-oriented approach for the physical security regulatory framework for advanced reactors.

X-energy continues to implement a systematic approach to physical protection in design, the use of consequence-based performance evaluation of the PPS for the Xe-100, and integration of innovative technologies to enhance the effectiveness of the PPS, PSP, and other elements of the standard Xe-100 security program for use by applicants at specific sites. Informed by ongoing analyses, X-energy will work to provide appropriate level of protection to meet existing regulations while developing justifiable exemptions where identified as appropriate based on the advanced reactor characteristics of the Xe-100 design.

X-energy anticipates that the design basis threat would result in offsite doses below the reference values defined in 10 CFR 50.34 and 52.79. X-energy is developing analyses to demonstrate that the health and safety of the public are adequately protected from postulated plant events initiated by DBTs. This result will be the principal basis for any associated exemption requests.

The Atomic Energy Act has requirements for security response evaluations and the design basis threat (Sections 170D and 170E) and grants the NRC discretion to determine the classes of reactors to which requirements should apply. The Xe-100 reactor has very low radionuclide inventories as compared to large LWRs and does not have to rely on active safety functions or human actions to protect the public health and safety. The potential consequences of security incidents at the Xe-100 are expected to be closer to those associated with research and test reactors than from the large LWR fleet. The Xe-100 is also designed to operate so that material is not easily handled or dispersed and is protected against potential radiological theft or exposure.

This white paper is intended to provide an initial overview of the Xe-100 security-by-design approach, consequence-based security performance evaluation, a description of the overall security strategy for Xe-100 plants, and to initiate a dialogue with the NRC staff on this subject. As DBT analysis results are finalized, X-energy intends to initiate further pre-application engagements with the NRC staff to provide analysis results and additional information on security planning for the Xe-100. This pre-application engagement is expected to continue in 2022 in the form of closed meetings, updates to this white paper, the development of additional white papers and/or a licensing topical report.

7. BACKGROUND RESEARCH

[1] [XE00-Y-S2ZZ-ZZZ-M-000904] Sandia Report: SAND2020-14324 Xe-100 Physical Security System: Security Staffing Analysis Approach

[2] [Sandia Report] SAND2020-13146, Xe-100 Safeguards and Security Analysis Approach

[3] [XE00-P-G1ZZ-RDZZ-D-001118] Xe-100 Technology Report: Technology Description

[4] [NEI Technical Report] NEI 20-05 (Methodological Approach and Considerations for a

[5] [Sandia Report] SAND2021-13122R, U.S. Domestic Pebble Bed Reactor: Security-By-Design

[6] [Sandia Report] SAND2021-13779R, U.S. Domestic Microreactor: Security-By-Design

[7] [NRC Regulatory Guide 5.56] PROTECTION AGAINST MALEVOLENT USE OF VEHICLES AT NUCLEAR POWER PLANTS

[8] [NRC 10 CFR Part 73] Physical Protection of Plants and Materials

[9] [NRC 10 CFR Part 73.55] Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage

[10] [NRC Memorandum] Staff Requirements-SECY-18-0076-Options and Recommendations for Physical Security for Advanced Reactors

[11] [NRC 10 CFR Part 73.60] Additional requirements for physical protection at nonpower reactors

[12] [NRC 10 CFR Part 73.67] Licensee fixed site and in-transit requirement for the physical protection of special nuclear material of moderate and low strategic significance

[13] [DOE 0 470.1] Safeguards and Security Program

[14] [XE01-P-X-Z-D-000077] Xe-100 Plant Staffing Report, Revision 3

8. APPENDIX A (§73.55 COMPARISON MATRIX)

This §73.55 COMPARISON MATRIX will be reviewed and updated as the Xe-100 design develops and corresponding security analyses are completed. This matrix will inform the content of the PSP, which will be considered Safeguards Information (SGI). As the Xe-100 design and PSP template develops, additional regulatory submittals will be completed.

The 73.55 matrix shown below consists of 3 columns:

1. The Current Rule Language column lists the current NRC requirements in 10 CFR 73.55.
2. The Proposed Rule Language column lists changes (in red text) that is currently under review by the industry and the NRC as it pertains to advance reactors. Blank cells in the Proposed Rule Language column indicate that the proposed rule language has not yet addressed the current rule language.
3. The Preliminary Xe-100 Analysis column lists the on-going actions X-energy is taking to meet the requirements in the design of the Xe-100 plant. Blank cells in the Xe-100 Analysis column indicate areas where X-energy analysis is on-going and/or planned to be done. This column will be updated and included in future regulatory submittals as the Xe-100 design and security analyses are further developed.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
§73.55 Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage.	**§73.55 Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage.**	
(a) Introduction		
(a)(1) By March 31, 2010, each nuclear power reactor licensee, licensed under 10 CFR part 50, shall implement the requirements of this section through its Commission-approved		Xe-100 plants will implement the requirements through a Physical Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Cyber Security Plan.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
Physical Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Cyber Security Plan referred to collectively hereafter as "security plans." Current applicants for an operating license under 10 CFR part 50, or combined license under 10 CFR part 52 who have submitted their applications to the Commission prior to the effective date of this rule must amend their applications to include a cyber security plan consistent with this section.		
(a)(2) The security plans must identify, describe, and account for site-specific conditions that affect the licensee's capability to satisfy the requirements of this section.		The PSP will identify, describe, and account for site-specific conditions that affect the Xe-100 plant's capability to satisfy the requirements.
(a)(3) The licensee is responsible for maintaining the onsite physical protection program in accordance with Commission regulations through the implementation of security plans and written security implementing procedures.		Xe-100 plants will maintain an onsite physical protection program that will be implemented through the PSP and written security implementing procedures.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(a)(4) Applicants for an operating license under the provisions of part 50 of this chapter or holders of a combined license under the provisions of part 52 of this chapter, shall implement the requirements of this section before fuel is allowed onsite (protected area).		The Xe-100 licensing approach will follow 10 CFR Part 50 and 10 CFR Part 73 for the preparation of a construction permit and operating license application for the Xe-100 plant planned for ARDP.
(a)(5) The Tennessee Valley Authority Watts Bar Nuclear Plant, Unit 2, holding a current construction permit under the provisions of part 50 of this chapter, shall meet the revised requirements in paragraphs (a) through (r) of this section as applicable to operating nuclear power reactor facilities.	(5) [Reserved] The Tennessee Valley Authority Watts Bar Nuclear Plant, Unit 2, holding a current construction permit under the provisions of part 50 of this chapter, shall meet the revised requirements in paragraphs (a) through (r) of this section as applicable to operating nuclear power reactor facilities.	
(a)(6) Applicants for an operating license under the provisions of part 50 of this chapter, or holders of a combined license under the provisions of part 52 of this chapter that do not reference a standard design certification or reference a standard design certification issued		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
after May 26, 2009 shall meet the requirement of §73.55(i)(4)(iii).		
(b) General performance objective and requirements.		
(b)(1) The licensee shall establish and maintain a physical protection program, to include a security organization, which will have as its objective to provide high assurance that activities involving special nuclear material are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety.		Xe-100 plants will develop and maintain a physical protection program, to include a security organization to provide high assurance that activities involving special nuclear material are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety.
(b)(2) To satisfy the general performance objective of paragraph (b)(1) of this section, the physical protection program must protect against the design basis threat of radiological sabotage as stated in §73.1.		The Xe-100 plants physical protection program will be designed to protect against the design basis threat of radiological sabotage.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(b)(3) The physical protection program must be designed to prevent significant core damage and spent fuel sabotage. Specifically, the program must: (b)(3)(i) Ensure that the capabilities to detect, assess, interdict, and neutralize threats up to and including the design basis threat of radiological sabotage as stated in §73.1, are maintained at all times. (b)(3)(ii) Provide defense-in-depth through the integration of systems, technologies, programs, equipment, supporting processes, and implementing procedures as needed to ensure the effectiveness of the physical protection program.	(3) For a licensee holding an operating license under the provisions of part 50 of this chapter or a combined license under the provisions of part 52 of this chapter for a light water reactor, other than a small modular reactor, as defined in § 171.5 of this chapter, the physical protection program must be designed to prevent significant core damage and spent fuel sabotage. For a small modular reactor licensee or a non-light-water reactor licensee licensed under part 50 of this chapter or part 52 of this chapter, the physical protection program must be designed to prevent a significant release of radionuclides from any source. Specifically, the program must: (i) Ensure that the capabilities to detect, assess, interdict, and neutralize threats up to and including the design basis threat of radiological sabotage as stated in §73.1, are maintained at all times. (ii) Provide defense-in-depth through the integration of systems, technologies, programs, equipment, supporting processes, and	**§ 171.5 Definitions** *Small modular reactor (SMR) for the purposes of calculating fees, means the class of light-water power reactors having a licensed thermal power rating less than or equal to 1,000 MWt per module. This rating is based on the thermal power equivalent of a light-water SMR with an electrical power generating capacity of 300 MWe or less per module.* The Xe-100 reactor has very low radionuclide inventories as compared to large LWRs and does not have to rely on active safety functions or human actions to protect the public health and safety. The potential consequences of the Xe-100 reactor are expected to be similar to research and test reactors. The Xe-100 is also designed to operate so that material is not easily handled or dispersed and is protected against potential radiological theft or exposure.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	implementing procedures as needed to ensure the effectiveness of the physical protection program.	X-energy will continue to conduct technical analysis to determine bounding source terms with constraints provided by the DBT to identify a bounding case for sabotage. Determine the material at risk (MaR) Quantify the explosive blast effects based on shock physics modeling Model the atmospheric dispersal based on blast effects attributes Determine the dose to a human receptor at set distances from the sabotage event Compare these dose rates to those set forth in 10 CFR 100.11 (1) (25 rem in two hours) as the determination of the exclusion area [10].
(b)(4) The licensee shall analyze and identify site-specific conditions, including target sets, that may affect the specific measures needed to implement the requirements of this section and shall account for these conditions in the design of the physical protection program.		The Xe-100 HTGR is a small modular reactor (SMR) that has been designed to incorporate a safety-by-design structure, resulting in inherent and passive safety features with the radionuclide retention capabilities of the TRISO fuel. The design of the fuel makes it difficult for a Design Basis Threat (DBT) scenario to disable safety systems and cause a radiological release since the fission product barriers will not be

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
		degraded, and the heat transfer from passive cooling is insufficient to result in fuel degradation.
(b)(5) Upon the request of an authorized representative of the Commission, the licensee shall demonstrate the ability to meet Commission requirements through the implementation of the physical protection program, including the ability of armed and unarmed personnel to perform assigned duties and responsibilities required by the security plans and licensee procedures.		Xe-100 reactor facilities will develop a Physical Security Plan with security procedures that outline the requirements for the establishment and maintenance of an onsite physical protection system, organization, and integrated response capability.
(b)(6) The licensee shall establish, maintain, and implement a performance evaluation program in accordance with appendix B to this part, to demonstrate and assess the effectiveness of armed responders and armed security officers to implement the licensee's protective strategy.		Xe-100 reactor facilities will develop a security program performance evaluation process to assess the effectiveness of the physical protection system. The program will include drill and exercises to satisfy requirements in Appendix B of the Training and Qualification Plan.
(b)(7) The licensee shall establish, maintain, and implement an access authorization program in		Access Authorization, Behavioral Observation, and Fitness for Duty programs will be

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
accordance with §73.56 and shall describe the program in the Physical Security Plan.		established and followed by licensees to meet the requirements of §73.56.
(b)(8) The licensee shall establish, maintain, and implement a cyber security program in accordance with §73.54.		
(b)(9) The licensee shall establish, maintain, and implement an insider mitigation program and shall describe the program in the Physical Security Plan.		
(b)(9)(i) The insider mitigation program must monitor the initial and continuing trustworthiness and reliability of individuals granted or retaining unescorted access authorization to a protected or vital area, and implement defense-in-depth methodologies to minimize the potential for an insider to adversely affect, either directly or indirectly, the		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
licensee's capability to prevent significant core damage and spent fuel sabotage. (b)(9)(ii) The insider mitigation program must contain elements from: (b)(9)(ii)(A) The access authorization program described in §73.56; (b)(9)(ii)(B) The fitness-for-duty program described in part 26 of this chapter; (b)(9)(ii)(C) The cyber security program described in §73.54; and (b)(9)(ii)(D) The physical protection program described in this section.	(A) For light-water reactors, other than small modular reactors, as defined in § 171.5 of this chapter, significant core damage and spent fuel sabotage. (B) For small modular reactors, as defined in § 171.5 of this chapter, or for non-light water reactors, a significant release of radionuclides from any source.	Insider Mitigation Program will be established by licensees utilizing the provisions in NEI-03-01 (Nuclear Power Plant Access Authorization Program) and will include provisions with: §73.56 Access Authorization Program §26 Fitness for Duty Program §73.54 Cyber Security Program Physical Protection Program Analyses continue to evaluate various courses of action and determining the best strategy with a defense-in-depth requirement so that the loss of any one component does not cause the failure of the entire physical protection program.
(b)(10) The licensee shall use the site corrective action program to track, trend, correct and		X-energy has an established Corrective Action Program (CAP) and will integrate the CAP process into the Performance Evaluation Program. For cases where X-energy is not the

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
prevent recurrence of failures and deficiencies in the physical protection program.		licensee, the licensee will establish a CAP and integrate it into the Performance Evaluation Program.
(b)(11) Implementation of security plans and associated procedures must be coordinated with other onsite plans and procedures to preclude conflict during both normal and emergency conditions.		Xe-100 plants will initiate a "Security/Safety Interface procedure to preclude conflict with other onsite plans and procedures for both normal and emergency conditions.
(c) Security plans.		
(c)(1) Licensee security plans must describe:		Xe-100 plants' physical security plan templates will be developed to meet the requirements in 10 CFR 73.55 listed in this comparison matrix or as identified, application for exemption to specific requirements will be submitted.
(c)(1)(i) How the licensee will implement requirements of this section through the establishment and maintenance of a security organization, the use of security equipment and technology, the training and qualification of		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
security personnel, the implementation of predetermined response plans and strategies, and the protection of digital computer and communication systems and networks.		
(c)(1)(ii) Site-specific conditions that affect how the licensee implements Commission requirements.		
(c)(2) Protection of Security Plans. The licensee shall protect the security plans and other security-related information against unauthorized disclosure in accordance with the requirements of §73.21.		X-energy is in the process to establish a Safeguards Information (SGI) program to protect security related information in accordance with the requirements of §73.21.
(c)(3) Physical Security Plan. The licensee shall establish, maintain, and implement a Physical Security Plan which describes how the performance objective and requirements set forth in this section will be implemented.		Xe-100 plants will establish, maintain, and implement a PSP.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
§73.55(c)(4) Training and Qualification Plan. The licensee shall establish, maintain, and implement, and follow a Training and Qualification Plan that describes how the criteria set forth in appendix B, to this part, “General Criteria for Security Personnel,” will be implemented.		Xe-100 plants will establish, maintain, and implement a Training and Qualification Plan and follow a Training and Qualification Plan that describes how the criteria set forth in appendix B, §73.55 will be implemented.
(c)(5) Safeguards Contingency Plan. The licensee shall establish, maintain, and implement a Safeguards Contingency Plan that describes how the criteria set forth in appendix C, to this part, "Licensee Safeguards Contingency Plans," will be implemented.		Xe-100 plants will establish, maintain, and implement a Safeguards Contingency Plan

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(c)(6) Cyber Security Plan. The licensee shall establish, maintain, and implement a Cyber Security Plan that describes how the criteria set forth in §73.54, "Protection of Digital Computer and Communication Systems and Networks," of this part will be implemented.		Xe-100 plants will establish, maintain, and implement a Cyber Security Plan.
(c)(7) Security implementing procedures.		Xe-100 plants will develop Security Implementing Procedures.
(c)(7)(i) The licensee shall have a management system to provide for the development, implementation, revision, and oversight of security procedures that implement Commission requirements and the security plans.		
(c)(7)(ii) Implementing procedures must document the structure of the security organization and detail the types of duties, responsibilities, actions, and decisions to be		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
performed or made by each position of the security organization.		
(c)(7)(iii) The licensee shall: (c)(7)(iii)(A) Provide a process for the written approval of implementing procedures and revisions by the individual with overall responsibility for the security program.		
(c)(7)(iii)(B) Ensure that revisions to security implementing procedures satisfy the requirements of this section.		
(c)(7)(iv) Implementing procedures need not be submitted to the Commission for approval, but are subject to inspection by the Commission.		

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(d) Security organization.		
(d)(1) The licensee shall establish and maintain a security organization that is designed, staffed, trained, qualified, and equipped to implement the physical protection program in accordance with the requirements of this section.		Xe-100 plants will establish and maintain a security organization. The security organization will be outlined in the Xe-100 plant's physical security plan.
(d)(2) The security organization must include:		
(d)(2)(i) A management system that provides oversight of the onsite physical protection program.		
(d)(2)(ii) At least one member, onsite and available at all times, who has the authority to direct the activities of the security organization and who is assigned no other duties that would interfere with this individual's ability to perform		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
these duties in accordance with the security plans and the licensee protective strategy.		
(d)(3) The licensee may not permit any individual to implement any part of the physical protection program unless the individual has been trained, equipped, and qualified to perform their assigned duties and responsibilities in accordance with appendix B to this part and the Training and Qualification Plan. Non-security personnel may be assigned duties and responsibilities required to implement the physical protection program and shall:		
(d)(3)(i) Be trained through established licensee training programs to ensure each individual is trained, qualified, and periodically re-qualified to perform assigned duties.		

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(d)(3)(ii) Be properly equipped to perform assigned duties.		
(d)(3)(iii) Possess the knowledge, skills, and abilities, to include physical attributes such as sight and hearing, required to perform their assigned duties and responsibilities.		
(e) Physical barriers. Each licensee shall identify and analyze site-specific conditions to determine the specific use, type, function, and placement of physical barriers needed to satisfy the physical protection program design requirements of §73.55(b).		
(e)(1) The licensee shall:		Site design and facility layout will be evaluated to identify and account for site-specific conditions that necessitate the use of physical

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(1)(i) Design, construct, install and maintain physical barriers as necessary to control access into facility areas for which access must be controlled or denied to satisfy the physical protection program design requirements of paragraph (b) of this section. (e)(1)(ii) Describe in the security plan, physical barriers, barrier systems, and their functions within the physical protection program.		barriers in the OCA. Xe-100 reactor facilities will implement security measures in the OCA as needed to ensure the physical protection program is effective. Xe-100 plants' PSP will describe physical barriers, barrier systems, and their functions.
(e)(2) The licensee shall retain, in accordance with §73.70, all analyses and descriptions of the physical barriers and barrier systems used to satisfy the requirements of this section, and shall protect these records in accordance with the requirements of §73.21.		
(e)(3) Physical barriers must: (e)(3)(i) Be designed and constructed to:		The physical barriers at Xe-100 reactor facilities will include vehicle barriers, personnel barriers, delay barriers, channeling barriers, and barriers to provide cover for response personnel. The Physical Security Plan will describe each barrier

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(3)(i)(A) Protect against the design basis threat of radiological sabotage; (e)(3)(i)(B) Account for site-specific conditions; and (e)(3)(i)(C) Perform their required function in support of the licensee physical protection program (e)(3)(ii) Provide deterrence, delay, or support access control. (e)(3)(iii) Support effective implementation of the licensee's protective strategy.		function within the physical protection program.
(e)(4) Consistent with the stated function to be performed, openings in any barrier or barrier system established to meet the requirements of this section must be secured and monitored to prevent exploitation of the opening.		

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(e)(5) Bullet Resisting Physical Barriers. The reactor control room, the central alarm station, and the location within which the last access control function for access to the protected area is performed, must be bullet-resisting.		
(e)(6) Owner controlled area. The licensee shall establish and maintain physical barriers in the owner-controlled area as needed to satisfy the physical protection program design requirements of §73.55(b).		Xe-100 plants will establish and maintain physical barriers in the owner-controlled areas as needed.
(e)(7) Isolation zone.		
(e)(7)(i) An isolation zone must be maintained in outdoor areas adjacent to the protected area perimeter barrier. The isolation zone shall be:		

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(e)(7)(i)(A) Designed and of sufficient size to permit observation and assessment of activities on either side of the protected area barrier;		Isolation Zones (IZ) will be designed to ensure activities can be observed on either side of the PA perimeter. Xe-100 reactor facilities will account for obstacles that would prevent this observation and design the IZ to ensure timely and accurate observation or assessment of activities can be made.
(e)(7)(i)(B) Monitored with intrusion detection equipment designed to satisfy the requirements of §§73.55(i) and be capable of detecting both attempted and actual penetration of the protected area perimeter barrier before completed penetration of the protected area perimeter barrier; and		Intrusion Detection Systems will be designed within the IZ to ensure detection will occur before the PA perimeter is penetrated and that the use of video-capture technology will allow Xe-100 reactor facilities to assess the cause of the alarm for the period of time preceding the penetration.
(e)(7)(i)(C) Monitored with assessment equipment designed to satisfy the requirements of §§73.55(i) and provide real-time and play-back/recorded video images of the detected activities before and after each alarm annunciation.		Monitoring technology with assessment equipment will be deployed.

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(e)(7)(ii) Obstructions that could prevent the licensee's capability to meet the observation and assessment requirements of this section must be located outside of the isolation zone.		
(e)(8) Protected area.		
(e)(8)(i) The protected area perimeter must be protected by physical barriers that are designed and constructed to: (e)(8)(i)(A) Limit access into the protected area to only those personnel, vehicles, and materials required to perform official duties; (e)(8)(i)(B) Channel personnel, vehicles, and materials to designated access control portals; and		Protected Area Barriers at Xe-100 plants will be designed to control and limit access to the protected area and channel personnel, vehicles, and materials to designated access control portals.

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(e)(8)(i)(C) Be separated from any other barrier designated as a vital area physical barrier, unless otherwise identified in the Physical Security Plan.		
(e)(8)(ii) Penetrations through the protected area barrier must be secured and monitored in a manner that prevents or delays, and detects the exploitation of any penetration.		
(e)(8)(iii) All emergency exits in the protected area must be alarmed and secured by locking devices that allow prompt egress during an emergency and satisfy the requirements of this section for access control into the protected area.		
(e)(8)(iv) Where building walls or roofs comprise a portion of the protected area perimeter barrier, an isolation zone is not		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
necessary provided that the detection and, assessment requirements of this section are met, appropriate barriers are installed, and the area is described in the security plans.		
(e)(8)(v) All exterior areas within the protected area, except for areas that must be excluded for safety reasons, must be periodically checked to detect and deter unauthorized personnel, vehicles, and materials.		
(e)(9) Vital areas.		
(e)(9)(i) Vital equipment must be located only within vital areas, which must be located within a protected area so that access to vital equipment requires passage through at least two physical barriers, except as otherwise approved by the Commission and identified in the security plans.		Xe-100 plants will ensure that access to vital area equipment requires passage through at least two physical barriers.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(9)(ii) The licensee shall protect all vital area access portals and vital area emergency exits with intrusion detection equipment and locking devices that allow rapid egress during an emergency and satisfy the vital area entry control requirements of this section.		
(e)(9)(iii) Unoccupied vital areas must be locked and alarmed.		
(e)(9)(iv) More than one vital area may be located within a single protected area.		
(e)(9)(v) At a minimum, the following shall be considered vital areas: (e)(9)(v)(A) The reactor control room; (e)(9)(v)(B) The spent fuel pool; (e)(9)(v)(C) The central alarm station; and		X-energy will evaluate and identify potential vital areas to be included in the Physical Security Plan. Analyses will include the integration of security systems with the inherent and passive safety systems of theXe-100 reactor.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(9)(v)(D) The secondary alarm station in accordance with §73.55(i)(4)(iii).		
(e)(9)(vi) At a minimum, the following shall be located within a vital area: (e)(9)(vi)(A) The secondary power supply systems for alarm annunciation equipment; and (e)(9)(vi)(B) The secondary power supply systems for non-portable communications equipment.		
(e)(10) Vehicle control measures. Consistent with the physical protection program design requirements of §73.55(b), and in accordance with the site-specific analysis, the licensee shall establish and maintain vehicle control measures, as necessary, to protect against the design basis threat of radiological sabotage vehicle bomb assault.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(10)(i) Land vehicles. Licensees shall: (e)(10)(i) (A) Design, construct, install, and maintain a vehicle barrier system, to include passive and active barriers, at a stand-off distance adequate to protect personnel, equipment, and systems necessary to prevent significant core damage and spent fuel sabotage against the effects of the design basis threat of radiological sabotage land vehicle bomb assault.	(A) Design, construct, install, and maintain a vehicle barrier system, to include passive and active barriers, at a stand-off distance adequate to protect personnel, equipment, and systems necessary to prevent significant core damage and spent fuel sabotage against the effects of the design basis threat of radiological sabotage land vehicle bomb assault: (1) For light-water reactors, other than small modular reactors, as defined in § 171.5 of this chapter, significant core damage and spent fuel sabotage against the effects of the design basis threat of radiological sabotage land vehicle bomb assault. (2) For small modular reactors, as defined in § 171.5 of this chapter, or for nonlight-water reactors, a significant release of radionuclides from any source against the effects of the design basis threat of radiological sabotage land vehicle bomb assault.	X-energy is analyzing Vehicle Barrier System (VBS) design and placement to prevent a vehicle bomb attack from reaching an area where it could cause radiological sabotage and prevent other types of vehicles from transporting adversaries or materials to areas of the facility from which the adversary or material could disable the capability to protect against radiological sabotage.
(e)(10)(i)(B) Periodically check the operation of active vehicle barriers and provide a secondary		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
power source, or a means of mechanical or manual operation in the event of a power failure, to ensure that the active barrier can be placed in the denial position to prevent unauthorized vehicle access beyond the required standoff distance.		
(e)(10)(i)(C) Provide periodic surveillance and observation of vehicle barriers and barrier systems adequate to detect indications of tampering and degradation or to otherwise ensure that each vehicle barrier and barrier system is able to satisfy the intended function. (e)(10)(i)(D) Where a site has rail access to the protected area, install a train derailer, remove a section of track, or restrict access to railroad sidings and provide periodic surveillance of these measures.		
(e)(10)(ii) Waterways. The licensee shall:		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(e)(10)(ii)(A) Identify areas from which a waterborne vehicle must be restricted, and where possible, in coordination with local, State, and Federal agencies having jurisdiction over waterway approaches, deploy buoys, markers, or other equipment.		
(e)(11)(iii)(B) In accordance with the site-specific analysis, provide periodic surveillance and observation of waterway approaches and adjacent areas.		
(f) <u>Target sets</u>.		X-energy is in the process of evaluating Xe-100 plant equipment, systems, structures, and components (including the use of probabilistic risk assessment) that prevent significant core damage to create possible target sets.
(f)(1) The licensee shall document and maintain the process used to develop and identify target sets, to include the site-specific analyses and		

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methodologies used to determine and group the target set equipment or elements.		
(f)(2) The licensee shall consider cyber-attacks in the development and identification of target sets.		
(f)(3) Target set equipment or elements that are not contained within a protected or vital area must be identified and documented consistent with the requirements in §73.55(f)(1) and be accounted for in the licensee's protective strategy.		
(f)(4) The licensee shall implement a process for the oversight of target set equipment and systems to ensure that changes to the configuration of the identified equipment and		

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systems are considered in the licensee's protective strategy. Where appropriate, changes must be made to documented target sets.		
(g) <u>Access controls</u>.		X-energy is in the process of evaluating access control measures for OCA, PA, and possible VAs for the development of a Xe-100 plant physical security plans
(g)(1) Consistent with the function of each barrier or barrier system, the licensee shall control personnel, vehicle, and material access, as applicable, at each access control point in accordance with the physical protection program design requirements of §73.55(b).		
(g)(1)(i) To accomplish this, the licensee shall:		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(g)(1)(i)(A) Locate access control portals outside of, or concurrent with, the physical barrier system through which it controls access.		
(g)(1)(i)(B) Equip access control portals with locking devices, intrusion detection equipment, and surveillance equipment consistent with the intended function.		
(g)(1)(i)(C) Provide supervision and control over the badging process to prevent unauthorized bypass of access control equipment located at or outside of the protected area.		
(g)(1)(i)(D) Limit unescorted access to the protected area and vital areas, during non emergency conditions, to only those individuals who require unescorted access to perform assigned duties and responsibilities.		

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(g)(1)(i)(E) The licensee shall assign an individual the responsibility for the last access control function (controlling admission to the protected area) and shall isolate the individual within a bullet-resisting structure to assure the ability of the individual to respond or summon assistance.		
(g)(1)(ii) Where vehicle barriers are established, the licensee shall: (g)(1)(ii)(A) Physically control vehicle barrier portals to ensure only authorized vehicles are granted access through the barrier.		
(g)(1)(ii)(B) Search vehicles and materials for contraband or other items which could be used to commit radiological sabotage in accordance with paragraph (h) of this section.		

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(g)(1)(ii)(C) Observe search functions to ensure a response can be initiated if needed.		
(g)(2) Before granting access into the protected area, the licensee shall: (g)(2)(i) Confirm the identity of individuals. (g)(2)(ii) Verify the authorization for access of individuals, vehicles, and materials. (g)(2)(iii) Confirm, in accordance with industry shared lists and databases that individuals are not currently denied access to another licensed facility.		
(g)(2)(iv) Search individuals, vehicles, and materials in accordance with paragraph (h) of this section.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(g)(3) Vehicles in the protected area. (g)(3)(i) The licensee shall exercise control over all vehicles inside the protected area to ensure that they are used only by authorized persons and for authorized purposes.		
(g)(3)(ii) Vehicles inside the protected area must be operated by an individual authorized unescorted access to the area, or must be escorted by an individual as required by paragraph (g)(8) of this section.		
(g)(3)(iii) Vehicle use inside the protected area must be limited to plant functions or emergencies, and keys must be removed or the vehicle otherwise disabled when not in use.		

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(g)(3)(iv) Vehicles transporting hazardous materials inside the protected area must be escorted by an armed member of the security organization.		
(g)(4) Vital Areas. (g)(4)(i) Licensees shall control access into vital areas consistent with access authorization lists. (g)(4)(ii) In response to a site-specific credible threat or other credible information, implement a two-person (line-of-sight) rule for all personnel in vital areas so that no one individual is permitted access to a vital area.		
(g)(5) Emergency conditions. (g)(5)(i) The licensee shall design the access control system to accommodate the potential		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
need for rapid ingress or egress of authorized individuals during emergency conditions or situations that could lead to emergency conditions. (g)(5)(ii) To satisfy the design criteria of paragraph (g)(5)(i) of this section during emergency conditions, the licensee shall implement security procedures to ensure that authorized emergency personnel are provided prompt access to affected areas and equipment.		
(g)(6) Access control devices. (g)(6)(i) The licensee shall control all keys, locks, combinations, passwords and related access control devices used to control access to protected areas, vital areas and security systems to reduce the probability of compromise. To accomplish this, the licensee shall:		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(g)(6)(i)(A) Issue access control devices only to individuals who have unescorted access authorization and require access to perform official duties and responsibilities.		
(g)(6)(i)(B) Maintain a record, to include name and affiliation, of all individuals to whom access control devices have been issued and implement a process to account for access control devices at least annually.		
(g)(6)(i)(C) Implement compensatory measures upon discovery or suspicion that any access control device may have been compromised. Compensatory measures must remain in effect until the compromise is corrected.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(g)(6)(i)(D) Retrieve, change, rotate, deactivate, or otherwise disable access control devices that have been or may have been compromised or when a person with access to control devices has been terminated under less than favorable conditions.		
(g)(6)(ii) The licensee shall implement a numbered photo identification badge system for all individuals authorized unescorted access to the protected area and vital areas.		
(g)(6)(ii)(A) Identification badges may be removed from the protected area only when measures are in place to confirm the true identity and authorization for unescorted access of the badge holder before allowing unescorted access to the protected area.		
(g)(6)(ii)(B) Except where operational safety concerns require otherwise, identification		

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badges must be clearly displayed by all individuals while inside the protected area and vital areas.		
(g)(6)(ii)(C) The licensee shall maintain a record, to include the name and areas to which unescorted access is granted, of all individuals to whom photo identification badges have been issued.		
(g)(6)(iii) Access authorization program personnel shall be issued passwords and combinations to perform their assigned duties and may be excepted from the requirement of paragraph (g)(6)(i)(A) of this section provided they meet the background requirements of §73.56.		
(g)(7) Visitors.		

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(g)(7)(i) The licensee may permit escorted access to protected and vital areas to individuals who have not been granted unescorted access in accordance with the requirements of §73.56 and part 26 of this chapter. The licensee shall:		
(g)(7)(i)(A) Implement procedures for processing, escorting, and controlling visitors.		
(g)(7)(i)(B) Confirm the identity of each visitor through physical presentation of a recognized identification card issued by a local, State, or Federal government agency that includes a photo or contains physical characteristics of the individual requesting escorted access.		
(g)(7)(i)(C) Maintain a visitor control register in which all visitors shall register their name, date, time, purpose of visit, employment affiliation,		

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citizenship, and name of the individual to be visited before being escorted into any protected or vital area.		
(g)(7)(i)(D) Issue a visitor badge to all visitors that clearly indicates an escort is required.		
(g)(7)(i)(E) Escort all visitors, at all times, while inside the protected area and vital areas.		
(g)(7)(i)(F) Deny escorted access to any individual who is currently denied access in industry shared data bases.		
(g)(7)(ii) Individuals not employed by the licensee but who require frequent or extended		

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unescorted access to the protected area and/or vital areas to perform duties and responsibilities required by the licensee at irregular or intermittent intervals, shall satisfy the access authorization requirements of §73.56 and part 26 of this chapter, and shall be issued a non-employee photo identification badge that is easily distinguished from other identification badges before being allowed unescorted access to the protected and vital areas. Non-employee photo identification badges must visually reflect that the individual is a non-employee and that no escort is required.		
(g)(8) Escorts. The licensee shall ensure that all escorts are trained to perform escort duties in accordance with the requirements of this section and site training requirements.		
(g)(8)(i) Escorts shall be authorized unescorted access to all areas in which they will perform escort duties.		

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(g)(8)(ii) Individuals assigned to visitor escort duties shall be provided a means of timely communication with security personnel to summon assistance when needed. (g)(8)(iii) Individuals assigned to vehicle escort duties shall be trained and qualified in accordance with appendix B of this part and provided a means of continuous communication with security personnel to ensure the ability to summon assistance when needed. (g)(8)(iv) When visitors are performing work, escorts shall be generally knowledgeable of the activities to be performed by the visitor and report behaviors or activities that may constitute an unreasonable risk to the health and safety of the public and common defense and security, including a potential threat to commit radiological sabotage, consistent with §73.56(f)(1).		

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(g)(8)(v) Each licensee shall describe visitor to escort ratios for the protected area and vital areas in physical security plans. Implementing procedures shall provide necessary observation and control requirements for all visitor activities.		
(h) Search programs.		Xe-100 plants will ensure appropriate searches of vehicles passing beyond the OCA and personnel, vehicles and materials entering the protected area are searched to prevent the introduction of all identified contraband. Xe-100 plants will develop specific site security implementing procedures for each search and ensure that the physical security plan outlines each process, e.g., vehicle checkpoint, active barrier system, packages and materials.
(h)(1) The objective of the search program is to detect, deter, and prevent the introduction of firearms, explosives, incendiary devices, or other items which could be used to commit radiological sabotage. To accomplish this the licensee shall search individuals, vehicles, and materials consistent with the physical		

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protection program design requirements in paragraph (b) of this section, and the function to be performed at each access control point or portal before granting access.		
(h)(2) Owner controlled area searches. (h)(2)(i) Where the licensee has established physical barriers in the owner-controlled area, the licensee shall implement search procedures for access control points in the barrier. (h)(2)(ii) For each vehicle access control point, the licensee shall describe in implementing procedures areas of a vehicle to be searched, and the items for which the search is intended to detect and prevent access. Areas of the vehicle to be searched must include, but is not limited to, the cab, engine compartment, undercarriage, and cargo area. (h)(2)(iii) Vehicle searches must be performed by at least two (2) trained and equipped		

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security personnel, one of which must be armed. The armed individual shall be positioned to observe the search process and provide immediate response. (h)(2)(iv) Vehicle searches must be accomplished through the use of equipment capable of detecting firearms, explosives, incendiary devices, or other items which could be used to commit radiological sabotage, or through visual and physical searches, or both, to ensure that all items are identified before granting access. (h)(2)(v) Vehicle access control points must be equipped with video surveillance equipment that is monitored by an individual capable of initiating a response.		

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(h)(3) Protected area searches. Licensees shall search all personnel, vehicles and materials requesting access to protected areas.		
(h)(3)(i) The search for firearms, explosives, incendiary devices, or other items which could be used to commit radiological sabotage shall be accomplished through the use of equipment capable of detecting these items, or through visual and physical searches, or both, to ensure that all items are clearly identified before granting access to protected areas. The licensee shall subject all persons except official Federal, state, and local law enforcement personnel on official duty to these searches upon entry to the protected area. Armed security officers who are on duty and have exited the protected area may re-enter the protected area without being searched for firearms.		
(h)(3)(ii) Whenever search equipment is out of service, is not operating satisfactorily, or cannot be used effectively to search individuals,		

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vehicles, or materials, a visual and physical search shall be conducted.		
(h)(3)(iii) When an attempt to introduce firearms, explosives, incendiary devices, or other items which could be used to commit radiological sabotage has occurred or is suspected, the licensee shall implement actions to ensure that the suspect individuals, vehicles, and materials are denied access and shall perform a visual and physical search to determine the absence or existence of a threat.		
(h)(3)(iv) For each vehicle access portal, the licensee shall describe in implementing procedures areas of a vehicle to be searched before access is granted. Areas of the vehicle to be searched must include, but is not limited to, the cab, engine compartment, undercarriage, and cargo area.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(h)(3)(v) Exceptions to the protected area search requirements for materials may be granted for safety or operational reasons provided the design criteria of §§73.55(b) are satisfied, the materials are clearly identified, the types of exceptions to be granted are described in the security plans, and the specific security measures to be implemented for excepted items are detailed in site procedures.		
(h)(3)(vi) To the extent practicable, excepted materials must be positively controlled, stored in a locked area, and opened at the final destination by an individual familiar with the items.		
(h)(3)(vii) Bulk material excepted from the protected area search requirements must be escorted by an armed member of the security organization to its final destination or to a receiving area where the excepted items are offloaded and verified.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(h)(3)(viii) To the extent practicable, bulk materials excepted from search shall not be offloaded adjacent to a vital area.		
(i) Detection and assessment systems.		X-energy is currently evaluating surveillance and intrusion alarm technologies for the integration to establish and maintain intrusion detection and assessment systems that will meet the requirements of §73.55(b). Developments will be addressed in future submittals.
(i)(1) The licensee shall establish and maintain intrusion detection and assessment systems that satisfy the design requirements of §73.55(b) and provide, at all times, the capability to detect and assess unauthorized persons and facilitate the effective implementation of the licensee's protective strategy.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(2) Intrusion detection equipment must annunciate and video assessment equipment shall display concurrently, in at least two continuously staffed onsite alarm stations, at least one of which must be protected in accordance with the requirements of the central alarm station within this section.		
(i)(3) The licensee's intrusion detection and assessment systems must be designed to: (i)(3)(i) Provide visual and audible annunciation of the alarm. (i)(3)(ii) Provide a visual display from which assessment of the detected activity can be made. (i)(3)(iii) Ensure that annunciation of an alarm indicates the type and location of the alarm.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(3)(iv) Ensure that alarm devices to include transmission lines to annunciators are tamper indicating and self-checking. (i)(3)(v) Provide an automatic indication when the alarm system or a component of the alarm system fails, or when the system is operating on the backup power supply. (i)(3)(vi) Support the initiation of a timely response in accordance with the security plans, licensee protective strategy, and associated implementing procedures. (i)(3)(vii) Ensure intrusion detection and assessment equipment at the protected area perimeter remains operable from an uninterruptible power supply in the event of the loss of normal power.		
(i)(4) Alarm stations.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(4)(i) Both alarm stations required by paragraph (i)(2) of this section must be designed and equipped to ensure that a single act, in accordance with the design basis threat of radiological sabotage defined in §73.1(a)(1), cannot disable both alarm stations. The licensee shall ensure the survivability of at least one alarm station to maintain the ability to perform the following functions: (i)(4)(i)(A) Detect and assess alarms. (i)(4)(i)(B) Initiate and coordinate an adequate response to an alarm. (i)(4)(i)(C) Summon offsite assistance. (i)(4)(i) (D) Provide command and control.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(4)(ii) Licensees shall: (i)(4)(ii)(A) Locate the central alarm station inside a protected area. The interior of the central alarm station must not be visible from the perimeter of the protected area.		
(i)(4)(ii)(B) Continuously staff each alarm station with at least one trained and qualified alarm station operator. The alarm station operator must not be assigned other duties or responsibilities which would interfere with the ability to execute the functions described in §73.55(i)(4)(i) of this section.		
(i)(4)(ii)(C) Not permit any activities to be performed within either alarm station that would interfere with an alarm station operator's ability to execute assigned duties and responsibilities.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(4)(ii)(D) Assess and initiate response to all alarms in accordance with the security plans and implementing procedures.		
(i)(4)(ii)(E) Assess and initiate response to other events as appropriate.		
(i)(4)(ii)(F) Ensure that an alarm station operator cannot change the status of a detection point or deactivate a locking or access control device at a protected or vital area portal, without the knowledge and concurrence of the alarm station operator in the other alarm station.		
(i)(4)(ii)(G) Ensure that operators in both alarm stations are knowledgeable of final disposition of all alarms.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(4)(ii)(H) Maintain a record of all alarm annunciations, the cause of each alarm, and the disposition of each alarm.		
(i)(4)(iii) Applicants for an operating license under the provisions of part 50 of this chapter, or holders of a combined license under the provisions of part 52 of this chapter, shall construct, locate, protect, and equip both the central and secondary alarm stations to the standards for the central alarm station contained in this section. Both alarm stations shall be equal and redundant, such that all functions needed to satisfy the requirements of this section can be performed in both alarm stations.		
(i)(5) Surveillance, observation, and monitoring.		
(i)(5)(i) The physical protection program must include surveillance, observation, and		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
monitoring as needed to satisfy the design requirements of §§73.55(b), identify indications of tampering, or otherwise implement the site protective strategy. (i)(5)(ii) The licensee shall provide continuous surveillance, observation, and monitoring of the owner-controlled area as described in the security plans to detect and deter intruders and ensure the integrity of physical barriers or other components and functions of the onsite physical protection program. Continuous surveillance, observation, and monitoring responsibilities may be performed by security personnel during continuous patrols, through use of video technology, or by a combination of both. (i)(5)(iii) Unattended openings that intersect a security boundary such as underground pathways must be protected by a physical barrier and monitored by intrusion detection equipment or observed by security personnel at a frequency sufficient to detect exploitation.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(5)(iv) Armed security patrols shall periodically check external areas of the protected area to include physical barriers and vital area portals. (i)(5)(v) Armed security patrols shall periodically inspect vital areas to include the physical barriers used at all vital area portals. (i)(5)(vi) The licensee shall provide random patrols of all accessible areas containing target set equipment. (i)(5)(vii) Security personnel shall be trained to recognize obvious indications of tampering consistent with their assigned duties and responsibilities. (i)(5)(viii) Upon detection of tampering, or other threats, the licensee shall initiate response in accordance with the security plans and implementing procedures.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(i)(6) Illumination.		
(i)(6) (i) The licensee shall ensure that all areas of the facility are provided with illumination necessary to satisfy the design requirements of §73.55(b) and implement the protective strategy.		
(i)(6)(ii) The licensee shall provide a minimum illumination level of 0.2 foot-candles, measured horizontally at ground level, in the isolation zones and appropriate exterior areas within the protected area. Alternatively, the licensee may augment the facility illumination system by means of low-light technology to meet the requirements of this section or otherwise implement the protective strategy.		
(i)(6)(iii) The licensee shall describe in the security plans how the lighting requirements of		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
this section are met and, if used, the type(s) and application of low-light technology.		
(j) Communication requirements.		X-energy will establish and maintain continuous security communications capabilities that will provide an effective method to transfer information needed for an integrated security response.
(j)(1) The licensee shall establish and maintain continuous communication capability with onsite and offsite resources to ensure effective command and control during both normal and emergency situations.		
(j)(2) Individuals assigned to each alarm station shall be capable of calling for assistance in accordance with the security plans and the licensee's procedures.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(j)(3) All on-duty security force personnel shall be capable of maintaining continuous communication with an individual in each alarm station, and vehicles escorts shall maintain continuous communication with security personnel. All personnel escorts shall maintain timely communication with the security personnel.		
(j)(4) The following continuous communication capabilities must terminate in both alarm stations required by this section: (j)(4)(i) Radio or microwave transmitted two-way voice communication, either directly or through an intermediary, in addition to conventional telephone service between local law enforcement authorities and the site. (j)(4)(ii) A system for communication with the control room.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(j)(5) Non-portable communications equipment must remain operable from independent power sources in the event of the loss of normal power.		
(j)(6) The licensee shall identify site areas where communication could be interrupted or cannot be maintained, and shall establish alternative communication measures or otherwise account for these areas in implementing procedures.		
(k) Response requirements.		Xe-100 plants will establish and maintain a physical response to threats with both on-site and off-site organizations and will be outlined in the Xe-100 plant's Appendix C safeguards contingency plan and will be designed to defend the plant against all aspects of the Design Basis Threat.
(k)(1) The licensee shall establish and maintain, at all times, properly trained, qualified and equipped personnel required to interdict and neutralize threats up to and including the	(1) The licensee shall establish and maintain, at all times, properly trained, qualified and equipped personnel required to interdict and neutralize threats up to and including the	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
design basis threat of radiological sabotage as defined in §73.1, to prevent significant core damage and spent fuel sabotage.	design basis threat of radiological sabotage as defined in § 73.1, to prevent significant core damage and spent fuel sabotage: (i) For light-water reactors, other than small modular reactors, as defined in § 171.5 of this chapter, significant core damage and spent fuel sabotage. (ii) For small modular reactors, as defined in § 171.5 of this chapter, or for non-light water reactors, a significant release of radionuclides from any source.	
(k)(2) The licensee shall ensure that all firearms, ammunition and equipment necessary to implement the site security plans and protective strategy are in sufficient supply, are in working condition, and are readily available for use.		
(k)(3) The licensee shall train each armed member of the security organization to prevent or impede attempted acts of theft or radiological sabotage by using force sufficient to counter the force directed at that person,		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
including the use of deadly force when the armed member of the security organization has a reasonable belief that the use of deadly force is necessary in self-defense or in the defense of others, or any other circumstances as authorized by applicable State or Federal law.		
(k)(4) The licensee shall provide armed response personnel consisting of armed responders which may be augmented with armed security officers to carry out armed response duties within predetermined time lines specified by the site protective strategy.		
(k)(5) Armed responders. (k)(5)(i) The licensee shall determine the minimum number of armed responders necessary to satisfy the design requirements of §73.55(b) and implement the protective strategy. The licensee shall document this number in the security plans.		Analyses will be conducted to assess the combination of required armed response or protective systems and strategies necessary to satisfy the design requirements.

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(k)(5)(ii) The number of armed responders shall not be less than ten (10).		
(k)(5)(iii) Armed responders shall be available at all times inside the protected area and may not be assigned other duties or responsibilities that could interfere with their assigned response duties.		
(k)(6) Armed security officers. (k)(6)(i) Armed security officers, designated to strengthen onsite response capabilities, shall be onsite and available at all times to carry out their assigned response duties.		
(k)(6)(ii) The minimum number of armed security officers designated to strengthen		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
onsite response capabilities must be documented in the security plans.		
(k)(7) The licensee shall have procedures to reconstitute the documented number of available armed response personnel required to implement the protect strategy.		
(k)(8) Protective strategy. The licensee shall establish, maintain, and implement a written protective strategy in accordance with the requirements of this section and part §73, appendix C, Section II. Upon receipt of an alarm or other indication of a threat, the licensee shall:		
(k)(8)(i) Determine the existence and level of a threat in accordance with pre-established assessment methodologies and procedures.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(k)(8)(ii) Initiate response actions to interdict and neutralize the threat in accordance with the requirements of part §73, appendix C, section II, the safeguards contingency plan, and the licensee's response strategy.		
(k)(8)(iii) Notify law enforcement agencies (local, State, and Federal law enforcement agencies (LLEA)), in accordance with site procedures.		
(k)(9) Law enforcement liaison. To the extent practicable, licensees shall document and maintain current agreements with applicable law enforcement agencies to include estimated response times and capabilities.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(k)(10) Heightened security. Licensees shall establish, maintain, and implement a threat warning system which identifies specific graduated protective measures and actions to be taken to increase licensee preparedness against a heightened security threat. (k)(10)(i) Licensees shall ensure that the specific protective measures and actions identified for each threat level are consistent with the security plans and other emergency plans and procedures. (k)(10)(ii) Upon notification by an authorized representative of the Commission, licensees shall implement the specific threat level indicated by the Commission representative.		
(l) Facilities using mixed-oxide (MOX) fuel assemblies containing up to 20 weight percent plutonium dioxide (PuO2).		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(l)(1) Commercial nuclear power reactors licensed under 10 CFR parts 50 or 52 and authorized to use special nuclear material in the form of MOX fuel assemblies containing up to 20 weight percent PuO2 shall, in addition to meeting the requirements of this section, protect unirradiated MOX fuel assemblies against theft or diversion as described in this paragraph. (l)(2) Commercial nuclear power reactors authorized to used MOX fuel assemblies containing up to 20 weight percent PuO2 are exempt from the requirements of §§73.20, §73.45, and §73.46 for the onsite physical protection of un-irradiated MOX fuel assemblies. (l)(3) Administrative controls. (l)(3)(i) The licensee shall describe in the security plans the operational and administrative controls to be implemented for the receipt, inspection, movement, storage,		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
and protection of unirradiated MOX fuel assemblies. (l)(3)(ii) The licensee shall implement the use of tamper-indicating devices for un-irradiated MOX fuel assembly transport and shall verify their use and integrity before receipt. (l)(3)(iii) Upon receipt of un-irradiated MOX fuel assemblies, the licensee shall: (l)(3)(iii)(A) Inspect un-irradiated MOX fuel assemblies for damage. (l)(3)(iii)(B) Search un-irradiated MOX fuel assemblies for unauthorized materials. (l)(3)(iv) The licensee may conduct the required inspection and search functions simultaneously. (l)(3)(v) The licensee shall ensure the proper placement and control of un-irradiated MOX		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
fuel assemblies as follows: (l)(3)(v)(A) At least one armed security officer shall be present during the receipt and inspection of un-irradiated MOX fuel assemblies. This armed security officer shall not be an armed responder as required by paragraph (k) of this section. (l)(3)(v)(B) The licensee shall store un-irradiated MOX fuel assemblies only within a spent fuel pool, located within a vital area, so that access to the un-irradiated MOX fuel assemblies requires passage through at least two physical barriers and the water barrier combined with the additional measures detailed in this section. (l)(3)(vi) The licensee shall implement a material control and accountability program that includes a predetermined and documented storage location for each un-irradiated MOX fuel assembly. (l)(4) Physical controls.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(l)(4)(i) The licensee shall lock, lockout, or disable all equipment and power supplies to equipment required for the movement and handling of un-irradiated MOX fuel assemblies when movement activities are not authorized. (l)(4)(ii) The licensee shall implement a two-person, line-of-sight rule within the spent fuel pool area whenever control systems or equipment required for the movement or handling of un-irradiated MOX fuel assemblies must be accessed. (l)(4)(iii) The licensee shall conduct random patrols of areas containing un-irradiated MOX fuel assemblies to identify indications of tampering and ensure the integrity of barriers and locks. (l)(4)(iv) Locks, keys, and any other access control device used to secure equipment and power sources required for the movement of un-irradiated MOX fuel assemblies, or openings to areas containing un-irradiated MOX fuel		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
assemblies, must be controlled by the security organization. (l)(4)(v) Removal of locks used to secure equipment and power sources required for the movement of un-irradiated MOX fuel assemblies or openings to areas containing un-irradiated MOX fuel assemblies must require approval by both the on-duty security shift supervisor and the operations shift manager. (l)(4)(v)(A) At least one armed security officer shall be present to observe activities involving the movement of un-irradiated MOX fuel assemblies before the removal of the locks and providing power to equipment required for the movement or handling of un-irradiated MOX fuel assemblies. (l)(4)(v)(B) At least one armed security officer shall be present at all times until power is removed from equipment and locks are secured.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(l)(4)(v)(C) Security officers shall be knowledgeable of authorized and unauthorized activities involving un-irradiated MOX fuel assemblies. (l)(5) At least one armed security officer shall be present and shall maintain constant surveillance of un-irradiated MOX fuel assemblies when the assemblies are not located in the spent fuel pool or reactor. (l)(6) The licensee shall maintain at all times the capability to detect, assess, interdict and neutralize threats to un-irradiated MOX fuel assemblies in accordance with the requirements of this section. (l)(7) MOX fuel assemblies containing greater than 20 weight percent PuO2. (l)(7)(i) Requests for the use of MOX fuel assemblies containing greater than 20 weight percent PuO2 shall be reviewed and approved by the Commission before receipt of MOX fuel assemblies.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(l)(7)(ii) Additional measures for the physical protection of un-irradiated MOX fuel assemblies containing greater than 20 weight percent PuO2 shall be determined by the Commission on a case-by-case basis and documented through license amendment in accordance with 10 CFR 50.90.		
(m) Security program reviews.		Xe-100 plants will develop a security program performance evaluation process to assess the effectiveness of programs outlined within the plant's physical security plan.
(m)(1) As a minimum the licensee shall review each element of the physical protection program at least every 24 months. Reviews shall be conducted: (m)(1)(i) Within 12 months following initial implementation of the physical protection program or a change to personnel, procedures, equipment, or facilities that potentially could adversely affect security.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(m)(1)(ii) As necessary based upon site-specific analyses, assessments, or other performance indicators.		
(m)(1)(iii) By individuals independent of those personnel responsible for program management and any individual who has direct responsibility for implementing the onsite physical protection program.		
(m)(2) Reviews of the security program must include, but not be limited to, an audit of the effectiveness of the physical security program, security plans, implementing procedures, cyber security programs, safety/security interface, activities, testing, maintenance, and calibration program, and response commitments by local, State, and Federal law enforcement authorities.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(m)(3) The results and recommendations of the onsite physical protection program reviews, management's findings regarding program effectiveness, and any actions taken as a result of recommendations from prior program reviews, must be documented in a report to the licensee's plant manager and to corporate management at least one level higher than that having responsibility for day-to-day plant operation. These reports must be maintained in an auditable form, available for inspection.		
(m)(4) Findings from onsite physical protection program reviews must be entered into the site corrective action program.		
(n) Maintenance, testing, and calibration.		
(n)(1) The licensee shall:		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(n)(1)(i) Establish, maintain, and implement a maintenance, testing and calibration program to ensure that security systems and equipment, including secondary and uninterruptible power supplies, are tested for operability and performance at predetermined intervals, maintained in operable condition, and are capable of performing their intended functions.		
(n)(1)(ii) Describe the maintenance, testing and calibration program in the physical security plan. Implementing procedures must specify operational and technical details required to perform maintenance, testing, and calibration activities to include, but not limited to, purpose of activity, actions to be taken, acceptance criteria, and the intervals or frequency at which the activity will be performed.		
(n)(1)(iii) Identify in procedures the criteria for determining when problems, failures, deficiencies, and other findings are		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
documented in the site corrective action program for resolution.		
(n)(1)(iv) Ensure that information documented in the site corrective action program is written in a manner that does not constitute safeguards information as defined in 10 CFR §73.21.		
(n)(1)(v) Implement compensatory measures that ensure the effectiveness of the onsite physical protection program when there is a failure or degraded operation of security-related component or equipment.		
(n)(2) The licensee shall test each intrusion alarm for operability at the beginning and end of any period that it is used for security, or if the period of continuous use exceeds seven (7) days. The intrusion alarm must be tested at least once every seven (7) days.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(n)(3) Intrusion detection and access control equipment must be performance tested in accordance with the security plans and implementing procedures.		
(n)(4) Equipment required for communications onsite must be tested for operability not less frequently than once at the beginning of each security personnel work shift.		
(n)(5) Communication systems between the alarm stations and each control room, and between the alarm stations and local law enforcement agencies, to include backup communication equipment, must be tested for operability at least once each day.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(n)(6) Search equipment must be tested for operability at least once each day and tested for performance at least once during each seven (7) day period.		
(n)(7) A program for testing or verifying the operability of devices or equipment located in hazardous areas must be specified in the implementing procedures and must define alternate measures to be taken to ensure the timely completion of testing or maintenance when the hazardous condition or other restrictions are no longer applicable.		
(n)(8) Security equipment or systems shall be tested in accordance with the site maintenance, testing and calibration procedures before being placed back in service after each repair or inoperable state.		
(o) Compensatory measures.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(o)(1) The licensee shall identify criteria and measures to compensate for degraded or inoperable equipment, systems, and components to meet the requirements of this section. (o)(2) Compensatory measures must provide a level of protection that is equivalent to the protection that was provided by the degraded or inoperable, equipment, system, or components. (o)(3) Compensatory measures must be implemented within specific time frames necessary to meet the requirements stated in paragraph (b) of this section and described in the security plans.		
(p) Suspension of security measures.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(p)(1) The licensee may suspend implementation of affected requirements of this section under the following conditions:		
(p)(1)(i) In accordance with §§ 50.54(x) and 50.54(y) of this chapter, the licensee may suspend any security measures under this section in an emergency when this action is immediately needed to protect the public health and safety and no action consistent with license conditions and technical specifications that can provide adequate or equivalent protection is immediately apparent. This suspension of security measures must be approved as a minimum by a licensed senior operator before taking this action.		
(p)(1)(ii) During severe weather when the suspension of affected security measures is immediately needed to protect the personal health and safety of security force personnel and no other immediately apparent action consistent with the license conditions and technical specifications can provide adequate		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
or equivalent protection. This suspension of security measures must be approved, as a minimum, by a licensed senior operator, with input from the security supervisor or manager, before taking this action.		
(p)(2) Suspended security measures must be reinstated as soon as conditions permit.		
(p)(3) The suspension of security measures must be reported and documented in accordance with the provisions of §73.71.		
(q) Records. (q)(1) The Commission may inspect, copy, retain, and remove all reports, records, and documents required to be kept by Commission		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
regulations, orders, or license conditions, whether the reports, records, and documents are kept by the licensee or a contractor.		
(q)(2) The licensee shall maintain all records required to be kept by Commission regulations, orders, or license conditions, until the Commission terminates the license for which the records were developed, and shall maintain superseded portions of these records for at least three (3) years after the record is superseded, unless otherwise specified by the Commission.		
(q)(3) If a contracted security force is used to implement the onsite physical protection program, the licensee's written agreement with the contractor must be retained by the licensee as a record for the duration of the contract.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(q)(4) Review and audit reports must be maintained and available for inspection, for a period of three (3) years.		
(r) Alternative measures.		X-energy to evaluate current NRC requirements to ensure Xe-100 plants will meet §73.55 and identify specific regulatory requirements that may possibly need an exemption request submittal.
(r)(1) The Commission may authorize an applicant or licensee to provide a measure for protection against radiological sabotage other than one required by this section if the applicant or licensee demonstrates that: (r)(1)(i) The measure meets the same performance objectives and requirements specified in paragraph (b) of this section; and (r)(1)(ii) The proposed alternative measure provides protection against radiological sabotage or theft of un-irradiated MOX fuel		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
assemblies, equivalent to that which would be provided by the specific requirement for which it would substitute.		
(r)(2) The licensee shall submit proposed alternative measure(s) to the Commission for review and approval in accordance with §§ 50.4 and 50.90 of this chapter before to implementation.		
(r)(3) In addition to fully describing the desired changes, the licensee shall submit a technical basis for each proposed alternative measure. The basis must include an analysis or assessment that demonstrates how the proposed alternative measure provides a level of protection that is at least equal to that which would otherwise be provided by the specific requirement of this section.		

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
(r)(4) Alternative vehicle barrier systems. In the case of vehicle barrier systems required by §73.55(e)(10), the licensee shall demonstrate that: (r)(4)(i) The alternative measure provides protection against the use of a vehicle as a means of transportation to gain proximity to vital areas; (r)(4)(ii) The alternative measure provides protection against the use of a vehicle as a vehicle bomb; and (r)(4)(iii) Based on comparison of the costs of the alternative measures to the costs of meeting the Commission's requirements using the essential elements of 10 CFR 50.109, the costs of fully meeting the Commission's requirements are not justified by the protection that would be provided.		
	(s) ***Alternative physical security requirements.***	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	(1) ***General requirements.***	X-energy to evaluate evolving alternative physical security requirements to ensure Xe-100 plants will meet §73.55 and identify specific regulatory requirements that may possibly need an exemption request submittal.
	(i) ***Applicability.*** An applicant or licensee of a small modular reactor, as defined in § 171.5 of this chapter, or non-light-water reactor that is licensed under part 50 of this chapter or part 52 of this chapter may elect one or more of the specific alternative physical security requirements in § 73.55(s)(2) provided that the applicant or licensee meets the requirements in § 73.55(s)(1)(ii) and (iii).	
	(ii) ***Identification.*** The applicant or licensee must identify the specific alternative physical security requirement(s) it intends to implement as part of its physical protection program.	
	(iii) ***Analysis.*** The applicant or licensee must perform a site-specific analysis to evaluate the potential offsite radiological consequences and demonstrate how the performance requirements set forth in § 73.55(b)(3) are met when selected alternatives are used.	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	The licensee must maintain the analysis until the certifications required by § 50.82(a)(1) of this chapter or § 52.110(a) of this chapter have been docketed by the NRC.	
	(2) ***Specific alternative physical security requirements.*** (i) ***Alternative requirement for armed responders.*** A licensee that meets § 73.55(s)(1)(i) is relieved from the requirement for the minimum number of armed responders in § 73.55(k)(5)(ii).	
	(ii) ***Alternative requirements for interdiction and neutralization.*** A licensee that meets § 73.55(s)(1)(i) and has no armed response personnel onsite whose primary duty is to respond to, interdict, and neutralize acts of radiological sabotage: (A) May rely on law enforcement or other offsite responders to fulfill the interdiction and neutralization functions required by § 73.55(b)(3)(i).	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	(1) The licensee must maintain the capability to detect and assess threats required by § 73.55(b)(3)(i).	
	(2) The licensee must provide adequate delay to enable law enforcement or other offsite responders to fulfill the interdiction and neutralization functions for threats up to and including the DBT of radiological sabotage.	
	(3) The licensee must provide necessary information about the facility and make available periodic training to law enforcement or other offsite responders to fulfill the interdiction and neutralization functions for threats up to and including the DBT of radiological sabotage.	
	(4) The licensee must fully describe in the safeguards contingency plan the role that law enforcement or other offsite responders will play in the licensee's protective strategy when relied upon to fulfill the interdiction and neutralization capabilities required by § 73.55(b)(3)(i). The description must provide sufficient detail to enable the NRC to determine	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	that the licensee's physical protection program provides high assurance of protection against threats up to and including the DBT of radiological sabotage.	
	(5) The licensee must identify criteria and measures to compensate for the degradation or absence of law enforcement or other offsite responders and propose suitable compensatory measures that meet the requirements of § 73.55(o)(2) and (3) to address this degradation.	
	(B) Is relieved from:	
	(1) Applying the requirements in § 73.55(k)(3) through (7) and the requirement in § 73.55(k)(8)(ii) to law enforcement responders.	
	(2) The training and qualification requirements related to armed response personnel in 10 CFR part 73, appendix B, section VI, for law enforcement responders, except for the performance evaluation program requirements related to armed response personnel in 10 CFR part 73, appendix B, section VI.C.3, which the	

CURRENT RULE LANGUAGE	PROPOSED RULE LANGUAGE 10 CFR PART §73	PRELIMINARY Xe-100 ANALYSIS
	licensee shall continue to satisfy for all armed response personnel, including law enforcement.	
	(3) The requirement in 10 CFR part 73, appendix C, section II.B.3.c.(iv) related to armed responders.	
	(iii) ***Alternative requirements for physical barriers.*** A licensee that meets § 73.55(s)(1)(i) may utilize means other than physical barriers and barrier systems to satisfy the physical protection program design requirements of § 73.55(e). Acceptable means can be any method(s) that accomplishes the delay and access control functions necessary to allow the licensee to implement its physical protection program.	