

UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20555-0001

#### NRC (DRAFT) Readiness Assessment Regarding X Energy Draft Licensing Topical Report: Xe-100 Licensing Topical Report, Xe-100 Training Programs Methodology, Control Room Operator Licensing, and Staff Qualifications

### BACKGROUND

X-energy requested NRC staff feedback and observations on the information discussed in draft Xe-100 Licensing Topical Report (LTR), "Xe-100 Training Programs Methodology, Control Room Operator Licensing, and Staff Qualifications," and requested a readiness review from the NRC. The NRC staff issued its readiness assessment plan on September 1, 2023 (ML23244A222). The NRC staff completed the assessment of the LTR and is providing the feedback and observations below for X-energy's consideration.

### FEEDBACK AND OBSERVATIONS

The feedback and observations are preliminary and subject to change. The feedback and observations are not regulatory findings on any specific licensing matter and are not official agency positions.

### **High-level Feedback and General Observations**

- 1. The staff notes that the intended purpose of the draft topical report is not clear. It seems to request approval of the Xe-100 Training Program while simultaneously stating that NRC approval will be subsequently requested. Therefore, clarification on the intended purpose of this topical report would be needed.
- 2. The LTR appears to ask for Commission-approval of the plant staff (10 CFR 50.120) and licensed operator (10 CFR Part 55) training programs based on the contents of the LTR. While the LTR discusses methods, it does not provide specific details about the training programs nor does it appear to the staff that the training programs have been developed. For example, the staff would expect to audit procedures, task analyses, learning objectives, and training lesson plans as part of the process for reviewing training program for Commission-approval. This type of material is not provided in the LTR.
- 3. The staff would like to understand if there will be a second submittal of material for review in conjunction with the LTR in support of Commission-approval of the training programs. For example, does this LTR provide the methods and processes to be used for development of actual training programs that will be submitted to the staff for review in the future?
- 4. The LTR indicates that the vendor would provide the Commission-approved training program to the facility licensee for use. The staff would like to understand more about

this plan. For example, would X-energy staff, as the vendor, continue to provide all of the training covered by the LTR, or would the licensee staff administer the training under the program supplied by X-energy? The systems approach to training (SAT) includes training program implementation, which is the responsibility of the organization providing the training.

- 5. The LTR includes information to support three requests: (1) approval of the vendor-supplied 50.120 training programs, (2) approval of the vendor-supplied licensed operator training program, and (3) approval of the technical basis for multiple Part 55 exemption requests. The staff notes that due to the interdependency between these areas, schedule delays in the review of one area may impact non-affected areas.
- 6. The LTR includes information about the elimination of the Shift Technical Advisor (STA) in conjunction with an absence of degree requirements for applicants applying to become a Control Room Operator (CRO). This approach is counter to Commission policy for education and experience for operators on shift. As a result, the staff may need additional time to engage the Commission on this approach.
- 7. Some of the technical justifications intended to support future requests for exemptions described in the LTR depend on aspects of the Xe-100 design that are not yet available for review. The staff has not yet conducted a review of the Xe-100 accident analysis, risk analysis, detailed plant design, and so forth, necessary to confirm these attributes of the Xe-100 design. Therefore, the staff would likely be challenged to review future exemption requests that are based on assertions of the Xe-100 design.

### **Detailed NRC Observations**

### Specific Feedback on "Xe-100 Training Programs SAT Methodologies" Section

- Section 3.1, "Regulatory Basis and Applicability," states the following: "the intent of the Xe-100 Training Programs is to provide NRC Staff approved, vendor-supplied, plant personnel training programs that would be utilized by the responsible 'applicant' and/or 'licensee." However, there is no detail provided regarding how the X-energy intends to establish, maintain, and control plant personnel training programs that would be utilized by the applicant in such a manner as to allow the program to be NRC staff approved without further staff review.
- 2. Section 3.3.5, "Evaluation and Modification of Training," states that plant procedure series being developed address the training program, with six sub bullets providing details that the procedures will cover. However, the details regarding the Xe-100 plant procedures do not include the overall systems approach to training process, including details on program execution of the five phases of SAT. Therefore, the ability for the NRC staff to perform further review of the adequacy of the Xe-100 plant procedures is limited without further information.
- 3. Section 3.4.1, "Analysis," states that the X-energy job analysis process includes assembling a specific task list for each Xe-100 position. However, there is no additional detail regarding X-energy's definition of what a task is, including the consideration of cognitive tasks for automation actions or controls. Therefore, the ability for the NRC staff to verify adequacy of the job analysis results (the task list) is limited without further information.

- 4. Section 3.4.1 states that the task list and Difficulty, Importance, Frequency Analysis results are used to identify task conditions and standards for tasks requiring further training. However, there are no details regarding additional scopes of task analysis, including branch step/alternate path development, task elements, etc.
- 5. Section 3.4.2, "Design," includes a bullet defining methods considered for evaluating overall training mastery includes, among other things, on-the-job evaluations. This item is not defined in the submittal, nor is it clear to the NRC staff how an on-the-job evaluation is different from a job performance measure or task performance evaluation.
- 6. Section 3.4.4, "Implementation," includes a statement that X-energy will utilize a cross-trained non-licensed operator and a 'fix it now' technician, requiring cross-training in multiple disciplines. This is further detailed in Table 1, "Xe-100 Equivalent Positions," in which the Xe-100 Plant Field Technician assumes the requirements for non-licensed operator, instrument and control technician, electrical maintenance personnel, and mechanical maintenance personnel. However, there are no details regarding the training methodology for each of these cross-training positions, including the number of qualified personnel, method of qualification (task vs. role), and process for which maintenance of qualifications will be established for the shifts.
- 7. Section 11.4.5.1, "Supervisory Review for Training Effectiveness," states that observations are discussed to determine subjects that may be added or removed from the Xe-100 Training Programs. However, there are no details regarding the training process for systematic analysis of the observation to confirm whether modification of the approved training program is required.

#### Specific Feedback on "Control Room Operator Training" Section

- 8. Section 3.6, "Control Room Operator Training," includes a statement that the training program will include an initial examination program for testing a representative sample of the knowledge, skills, and abilities needed to safely perform CRO duties. However, there is no additional detail provided on the scope of the initial examination program utilized.
- 9. Section 3.6.1, "Initial Training," includes classroom (or equivalent), hands on training, and program exams. However, there is no details regarding proficiency training (time on shift under instruction watches) being included in the program requirements.
- 10. Section 3.6.2, "Requalification (Continuing) Training," includes requirements for requalification programs, including testing a sample of topics, examination methods and criteria for passing performance, periodicity for requalification examinations, and Commission representative presence during the requalification examination administration. However, there is no detail regarding the retraining schedule established based on the SAT task Difficulty, Importance, Frequency data.
- 11. Section 3.6.3, "Control Room Operator Examination and Remediation," includes a statement that "Any or all of the requirements for an examination may be waived in accordance with procedurally established criteria." However, there is no additional detail regarding what those criteria are.

12. Section 3.6.3, "Control Room Operator Examination and Remediation," includes a statement that a CRO who either demonstrates unsatisfactory performance on, or fails to complete, the requalification examination will be removed from the performance of CRO duties. However, the X-energy submittal does not provide any details regarding the consequences related to a CRO (or other trainee) who fails to attend the requalification (continuing training) program.

#### Specific Feedback on "Training Equivalent to Shift Technical Advisor (STA) Training" Section

- 13. Section 3.7, "Shift Technical Advisor (STA)," discusses a future exemption request from the requirements of 10 CFR 50.120(b)(2)(iii) for training and qualification of the STA category. SECY-21-0039 (ML21060A823) discusses how the NRC staff addressed a past request regarding elimination of the STA position from an operating crew complement. The staff notes that 3.7.1 discusses X-energy's perspective that the STA position is not required for Xe-100 based upon design attributes. Detailed supporting information on aspects of Xe-100 such as docketed information on accident analyses and human-system interface design, as well as reports like staffing plan validation, are not available for the staff's review. Approval of the LTR may be contingent on the staff's review of these aspects of the design or use of the LTR may be subject to specific conditions of applicability.
- 14. Concurrent with the STA elimination proposed under section 3.7, section 4.2 provides proposed eligibility requirements for licensed personnel that do not require education above the level of a high school diploma. This approach is contrary to Commission policy on Education for Senior Reactor Operators and Shift Supervisors at Nuclear Power Plants (54 FR 33639). The staff will likely need to engage the Commission on this approach which does not require anyone on shift to have a four-year degree in a technical discipline.

### Further Observations on Proposed Exemptions

- 15. The report discusses a number of proposed exemptions associated with operator licensing. While these are discussed further below, the staff notes that, in general, X-energy will need to provide, in part, justification for how each of these proposed exemptions would be consistent with the Atomic Energy Act (AEA)'s requirement for uniform licensing conditions that X-energy notes in section 5.1 of the draft LTR.
  - a. Exemptions are proposed or all medical fitness and medical examination-related requirements of (i.e., 55.21, 55.23, 55.25, 55.27, 55.31(a)(6), 55.31(c), 55.33(a)(1), 55.33(b), 55.53(i), 55.57(a)(6), and 55.57(b)(1)). The staff notes that medical qualification is a required aspect of the operator licensing process for reasons that medical fitness issues will not result in operational errors endangering public health and safety. The staff recognizes a given plant design may render the ability of an operator's action or inaction to result in significant safety implications as not credible. However, making such an assessment about the plant design and its implications for the human role in achieving safe outcomes would require the review of appropriate, docketed technical information about the plant design and its analyzed performance. At present, the draft LTR makes assertions about these performance attributes, but this supporting information is not available to substantiate these assertions.

- b. Exemption is proposed from the requirement for the applicant to apply using Form 398 (i.e., 55.31(a)(1), 55.31(a)(2), 55.31(a)(4), 55.31(d), 55.35(a), 55.35(b), 55.55(b), 55.57(a)(1), and 55.57(a)(2)). The staff notes that the intent of this request is unclear; specifically, is the intent that X-energy would propose an alternative application form to be used in lieu of NRC Form 398 or is the X-energy instead seeking to forgo any application being submitted to the NRC at all for the purpose of licensing operators. In the former case, the staff notes that X-energy should discuss the proposed alternative to be used. However, in the latter case (i.e., no application at all), the staff notes that AEA section 107 directs that the NRC must determine the qualifications for licensed operators and that such an approach may not be allowable under statute since the application is a means of determining such qualifications.
- c. Exemption is proposed from the requirement for (and in the case of 55.59(a)(2)(iii), even the ability of) the Commission to prepare and administer operator licensing tests and examinations (i.e., 55.31(a)(3), 55.33(a)(2), 55.40(a), 55.40(b)(3), 55.40(b)(4), 55.40(c), 55.45(a), 55.47(a)(1), and 55.59(a)(2)(iii)). As noted in the prior comment, AEA section 107 directs that the NRC must determine the qualifications for licensed operators and that such an approach may not be allowable under statute since the NRC administration of examinations (i.e., operating tests) is a means of determining such qualifications. With specific regard to the proposed treatment of 55.59(a)(2)(iii), it should be noted that, historically, the Commission has retained the ability to prepare and administer examinations, irrespective of whether the facility's normal practice is to prepare examinations themselves. X-energy should clarify that this was indeed the proposed treatment of 55.59(a)(2)(iii).
- 16. Section 5 discusses a proposal that Xe-100 be treated as a separate class of reactor. This section contains a list of five design attributes that are similar to those in the preliminary, proposed Part 53 rulemaking for the classification of "self-reliant-mitigation" facilities. It should be noted that the Commission has not yet decided whether to include this provision within the proposed rule when it is published. Additionally, the staff has not yet conducted a review of the Xe-100 design; the staff have not reviewed the accident analysis, risk analysis, detailed plant design, and so forth necessary to confirm these attributes of the Xe-100 design.
- 17. For an example of how the staff has previously considered operator licensing-related issues associated with a Part 50 applicant that had novel technological considerations, the staff recommends referring to the safety evaluation for the SHINE Medical Technologies, LLC operating license application, which is available at ML23047A025. In particular, the information of Section 12.4.10 may be relevant.

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