

DETAILED DISCUSSION OF REGULATORY DEVELOPMENT OPTIONS FOR NRC REGULATION OF THE GLOBAL NUCLEAR ENERGY PARTNERSHIP

Option 1: Consolidated Fuel Treatment Center (CFTC):

Revise Part 70 to include spent fuel reprocessing; consider additional safety analysis requirements for a reprocessing facility and revise Part 50 as appropriate.

Advanced Burner Reactor (ABR):

Use existing Part 50, with exemptions, as necessary, or a suitably modified and adapted Part 52 process, to address sodium-cooled fast reactor (SFR) technology.

CFTC

This option for developing the regulatory infrastructure for a reprocessing facility like the CFTC involves revising Part 70 to authorize the Commission to issue one combined license to construct and operate a reprocessing facility and to possess, use and reprocess the requisite radioactive materials. Part 70 was revised, in September 2000, to add Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material." Subpart H includes requirements for an integrated safety analysis (ISA), which evaluates hazards and their interrelationships, which will be important for the types and quantities of organic reagents and materials that will likely be used in the CFTC. The ISAs allow flexibility in that complex risk significant processes require more rigorous and comprehensive safety attributes than that required for processes that are less complex and risk significant. In principle, if the facility has processes with high complexity, uncertain phenomenology, or potentially high risk, then the applicant should choose more rigorous methods of analysis than is typical for lower risk facilities, to identify accident sequences, evaluate reliability and availability of safety controls, and assess phenomena and consequences.

In this option, the staff would evaluate whether, and what types of, safety analyses for the CFTC are appropriate and necessary. Based on discussions with the U.S. Department of Energy (DOE), the staff expects that the CFTC will have significantly greater quantities of plutonium, other transuranic (TRU), and fission products present at the facility as compared to current facilities where Part 70 licensed material is processed into nuclear fuel. Considering both soluble and insoluble forms of dispersible plutonium and other materials that are highly radioactive, the magnitude of potential exposures and release from potential accident sequences could be significantly higher at the CFTC than at other facilities where Part 70 licensed materials are currently being used. Therefore, enhanced risk assessment and management may be appropriate for CFTC fuel recycle plants, through revised ISA requirements that could approach or even be equivalent to, a Probabilistic Risk Assessment (PRA). If Part 70 were modified to incorporate reprocessing (both for materials reprocessing and CFTC facility construction and operation), then Part 50¹ should be revised as appropriate to remove its applicability to reprocessing facilities.

¹ Currently, Part 50 includes Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, and Appendix F, "Policy Relating to the Siting of Fuel Reprocessing Plants and Related Waste Management Facilities."

It might be possible to place the majority of the changes to Part 70 in a separate Subpart(s). Each section of the existing Part 70 would likely fall into one of two categories. The first type would be sections which require no modifications, such as § 70.22 on general information on the contents of applications. The second type would require modification to incorporate specific features of reprocessing and irradiated material handling facilities; an example would be additions to the baseline design criteria to address shielding and other applicable requirements for reprocessing from the Part 50 appendices. The staff has already begun to perform a review of Parts 50 and 70 to determine what sections would need to be revised to take this approach.

Rulemaking with significant revisions to Part 70 would likely take two years. Consequently, technical basis development to support rulemaking on the revisions to Part 70 would need to begin in 2007. In addition, a new standard review plan (SRP) may be needed to assist the staff in applying the new portions of the revised Part 70 containing reprocessing and irradiated material handling requirements. Such an SRP could be modeled after the Mixed-Oxide SRP (NUREG-1718). Ideally, the re-issued rule would provide regulatory flexibility and could include an option for design certification modeled after some variant of Part 52.

ABR

NRC could license an ABR (most likely a sodium-cooled fast reactor) using either Part 50, with exemptions, as necessary, or a suitably modified and adapted Part 52 process. In the past, when NRC reviewed or licensed non-light water reactor (non-LWR) designs (e.g., Clinch River Breeder Reactor), it was necessary for the staff to determine the applicability of specific Part 50 requirements to these designs and the need for exemptions and/or additional requirements to address the unique aspects of these designs. These determinations were made on a case-by-case basis and were implemented by exemptions and/or license conditions, to address those areas where the current regulations did not apply. This approach would be consistent with the Next Generation Nuclear Plant (NGNP) process that is being developed currently. Efficiencies could be gained in the future from lessons learned before embarking on rulemaking. However, it would be more efficient and effective to develop additional licensing criteria for a sodium-cooled fast reactor to address the unique characteristics of the design prior to receipt of a license application. Also, if a suitable modified Part 52 process is recommended by the staff after more is known about the ABR and after a Part 50 gap analysis is completed then a rulemaking would be required if the Commission approved the modified approach to Part 52.

Pros and Cons for Option 1

Pros -

1. Starting the rulemaking process for the CFTC now is consistent with DOE's process and plans for the CFTC. DOE is developing conceptual engineering alternative studies for fuel separations that are expected to be completed by June 2008. Staff estimates that rulemaking for revising Part 70 to include reprocessing or rulemaking for the creation of a GNEP regulation will take approximately 2 years.
2. This option is more efficient than the other options. Due to budget and commercialization uncertainties in the GNEP program, the need to aggressively

launch into a rulemaking to develop a new Part in NRC regulations for both the CFTC and the ABR may not be warranted at this time.

3. Evaluating the adequacy of the current Part 70 Integrated Safety Assessment (ISA) requirements with regard to the CFTC could lead to a greater understanding of the risk inherent in the hazards present from hazardous chemicals and highly radioactive irradiated materials potentially used in GNEP fuel separations and fuel fabrication processes.
4. This approach will avoid the need for many exemptions for CFTC licensing because it will not focus GNEP reprocessing on Part 50.
5. Although, Part 70, as it stands now, also does not address reprocessing, using Part 70 as a framework for regulating the CFTC is more compatible with material and fuel requirements and issues as opposed to Part 50 requirements.
6. For the ABR, the staff would use the work already started, as applicable, on ANPR for an alternative to Part 50, which is intended to encompass sodium-cooled fast reactors (SFRs) and High Temperature Gas-cooled Reactor (HTGR) technologies. This would promote stability and predictability in licensing SFRs.
7. With regard to the ABR, licensing a non-light-water reactor (non-LWR) using the existing regulations before developing new regulations is consistent with several industry comments provided to NRC regarding the advanced notice of proposed rulemaking (ANPR) for non-LWRs. Thus far, industry generally supports the approaches to risk-inform and performance-base requirements for nuclear power reactors, but there are concerns that they may require considerable time to resolve, especially regarding advanced reactors. The Nuclear Energy Institute (NEI) believes it is premature to write a new rule, such as a new advanced reactor regulation that is being explored through the ANPR for an alternative to Part 50, until more experience is available in the licensing of new reactors, especially new non-LWRs. It would be preferable to NEI to first gain experience with a design certification of new non-LWRs under Part 52. See comment letter from Adrian P. Heymer, NEI (Comment #4) under <http://ruleforum.llnl.gov>, Approaches to Risk Inform and Performance-Base Requirements for Nuclear Power Reactors (RIN 3150-AH81), as well as all other public comments received to date.
8. With regard to the ABR, this option is also consistent with the NGNP licensing strategy. HTGR stakeholders are advocating the use of the Part 50 licensing process with exemptions, as necessary for licensing the first HTGR.

Cons-

1. Because the CFTC and ABR are addressed separately, by different regulations and potentially different licensing organizations, this approach has the potential to create a situation that may overlook fuel and reactor technology interfaces that may affect reactor performance and operation (e.g., licensing a fuel type at the CFTC that may not be able to be used in the ABR).

2. Technology-specific reliability and availability data may not be available for the CFTC or ABR because it would be a first-of-a-kind facility and some systems may be passive. Under this scenario for the reprocessing facility, during the development of a technical basis for revising Part 70, if staff determines that a Probabilistic Risk Assessment (PRA) is appropriate for reprocessing facilities, it may be challenging to conduct a PRA with limited data or to address passive systems. Likewise, lack of specific data for the ABR could result in similar difficulties.
3. Part 50 may not address the sufficient range of hazards associated with ABR. It will be necessary for the staff to determine, on a case-by-case basis, the applicability of Part 50 to these designs and the need for exemptions and/or additional requirements to address the unique aspects of these designs and the potential interrelationships between the facilities and materials in the closed fuel cycle. Licensing such a facility under Part 50 would require numerous exemptions to address those areas where the current regulations did not apply and license conditions to ensure that safety requirements for SFRs are met. Without developing additional licensing criteria to address the unique characteristics of the design, this approach would not be efficient nor effective for a standardized design, which is currently envisioned for the GNEP program.

Option 2: CFTC: Same as Option 1.

ABR: Create a new Part 5X.

CFTC

This option is the same as Option 1 for the CFTC.

ABR

The second option for regulating the ABR involves developing a new regulation, a new Part 5X, specific to sodium-cooled fast reactors. This new Part 5X would employ design certification and other appropriate processes similar to those in Part 52 and would require a PRA, based on the level of risk and potential consequences associated with potential accidents at ABRs. Because NRC guidance and review procedures for PRA for reactors are mature, based on the experience with LWR PRAs, requiring PRAs for a sodium-cooled fast flux reactor would promote stability and predictability in licensing SFRs with additional development.

One possible approach to this new regulation has already been initiated by the Commission. To address non-LWR designs, the Commission had directed the staff to explore developing a risk-informed and performance-based regulatory framework for licensing advanced reactor designs (i.e., ANPR for an alternative to Part 50²). The staff has not yet determined whether a new reactor regulation will be technology-neutral or if it will include technology-specific sections

²“Approaches to Risk-Informed and Performance-Based Requirements for Nuclear Power Reactors,” 71 Fed. Reg. 26267 (May 4, 2006) (NRC is considering developing a comprehensive set of risk-informed, performance-based, and technology neutral requirements for licensing nuclear power reactors). “

(e.g., for a High Temperature Gas-cooled Reactor and a SFR). The staff published the draft framework as a Working Draft - NUREG-1860 in December 2006. A recommendation to the Commission on how to proceed with the advanced reactor initiative is planned for May 31, 2007. If Option 2 is selected, then staff would ensure that it would be consistent with the direction by the Commission on the ANPR for an alternative to Part 50.

Pros and Cons for Option 2:

Pros -

Pros 1 through 5 for Option 1 above apply to this option.

Cons -

1. Con 1 and Con 2 for Option 1 above apply to this option.
2. Pro 7 for Option 1 above applies as a Con for this option with respect to the ABR. See <http://ruleforum.llnl.gov> for all public comments received to date on, Approaches to Risk Inform and Performance-Base Requirements for Nuclear Power Reactors (RIN 3150-AH81). Specifically, under this option, creating a new Part 5X, is not consistent with NEI's comments expressing an interest in initially using Part 50, with exemptions as necessary, to license a next generation reactor. NEI's opinion indicates that rulemaking should not be pursued at this time until more information is gained through experience.
3. For a new ABR regulation, there is a possibility that increased comment and controversy on portions of the entire proposed regulation that were otherwise closed or accepted by licensees (e.g., general reporting requirements in Part 50) would occur, even though those portions may not have significantly changed. This could result because of concern about new material in Part 5X, eventually resulting in further changes in Parts 50 or 52.
4. Promulgating a new Part 5X will involve more effort than amending existing Parts. It increases the size of rulemaking and requires more effort to be expended to incorporate and respond to public comments on requirements that are being carried over from existing Parts (e.g., Parts 50, 52, and 70).
5. If Part 5X rulemaking is undertaken, then the placement of technology specific and/or generic requirements in Part 5X may require subsequent modification or clarification to be consistent with the decisions that the Commission will make on the ANPR for an alternative to Part 50.

Option 3: Develop a specific GNEP regulation applicable to both fuel reprocessing and recycle reactors (10 CFR Part XX).

A third option for regulation of GNEP facilities is to create a new Part XX to 10 CFR. This new Part XX would contain regulatory requirements for both the CFTC and the ABR, thereby providing one regulation for all facilities and associated SNM involved with GNEP, addressing

both facilities for spent fuel reprocessing and fuel fabrication, and reactor facilities for fuel “burning.” This option obviates the need to make extensive changes to existing regulations. A new Part XX would combine the applicable portions of reactor regulations from Part 50, fissile material processing regulations from Part 70, and a design certification and other appropriate processes either similar to those in Part 52 or a suitably modified. Additional licensing criteria (technical requirements) would be necessary to address the unique characteristics of the ABR design and to assess the design for enhanced safety in light of other recycling processes (fuel separation and fuel fabrication) and NRC’s policy on advanced reactors (see 51 Fed. Reg. 24643 (July 8, 1986)). Furthermore, a standardized design for an advanced recycling reactor, such as the ABR, designed to produce recycled material to be used as a product to fabricate fuel for the ABR, will involve a close interrelationship with the fuel separation and fuel fabrication designs.

The new Part XX would also give a DOE-industry partnership the option of design certification of a smaller, design-certified module [e.g., 400-800 metric tons/yr (440-880 tons)/yr] that could be duplicated to provide the desired total capacity [e.g., 2000 to 3000 metric tons (2200-3300 tons)/yr]. Specific regulatory requirements related to spent fuel reprocessing and irradiated material handling for the CFTC and ABR could be included in the new Part.

Under a new Part XX, GNEP facilities and associated SNM would be addressed comprehensively in one regulation. Fuel and material issues affecting reactor performance and operations are expected to be at the forefront of GNEP considerations, thereby, supporting development of one integrated regulation. This integrated, stand-alone regulation would also provide regulatory flexibility for NRC to accommodate changes in DOE’s design, while minimizing impacts to existing regulations and licensees. Furthermore, an integrated regulation would likely avoid a regulatory framework that may overlook fuel and reactor technology interfaces. In addition, creating a regulation specific to GNEP facilities would likely be easier for an applicant to navigate. Regardless of whether the GNEP facilities are co-located, as envisioned by DOE, such an approach would lend itself to facilitate integration of requirements for reprocessing, fuel fabrication, reactor operations, and waste management. Based upon staff analysis, this new GNEP regulation might also specifically require an integrated risk assessment for co-located facilities, thereby allowing for a more efficient and effective safety review for such facilities.

One possible way to organize the new regulation is to address programmatic requirements for the CFTC, the ABR, and associated interrelationships between the CFTC and the ABR in separate sections. Technical requirements could be located in a Subpart or Appendix to Part XX. The actual organization of the new Part XX with respect to the (1) ABR, (2) the CFTC, (3) associated SNM, (4) associated facilities [such as temporary storage for spent fuel and waste, waste vitrification, etc.], and (5) potential programmatic or technical criteria related to the unique interrelationship between the GNEP facilities and/or materials.

Pros and Cons for Option 3

Pros-

1. Whether co-located or not, GNEP facilities and associated SNM regulations would be addressed as a comprehensive unit that would probably be easier for an applicant to navigate. Such an approach could facilitate integration of licensing requirements for reprocessing, fuel fabrication, reactor plant facilities,

and optimization of waste management. This is consistent with the DOE strategy to consider giving preference to Funding Opportunity Announcement applicants if the proposed site has the potential for supporting both the CFTC and the ABR.

2. This integrated approach would likely avoid creating a situation that may overlook fuel and reactor technology interfaces.
3. Development and implementation of a new Part XX for GNEP facilities and associated SNM would not impede NRC's implementation of Parts 50 and 52, in reviewing new reactor applications.
4. A separate regulation, including requirements for additional safety analysis for the CFTC, may be desirable to avoid concerns from existing 10 CFR Part 70 facilities about changes to Part 70 impacting their facilities.
5. Development of a new regulation minimizes impacts on existing Part 70 and Part 50 licensees and licensing actions.
6. The new regulation will be a stand-alone regulation. This approach requires the least number of conforming changes to existing regulations. This approach will also provide the most flexibility for NRC to accommodate changes in the regulations with respect whether a DOE-industry partnership for only the CFTC versus the ABR will be pursued in the near term.

Cons-

1. Con 2 of Option 1 applies to this option.
2. A new Standard Review Plan will be needed for a new Part XX, including guidance for reviewing a more quantitative ISA, in certain technical areas, for the CFTC, and the PRA for the ABR.
3. Establishing a combined regulation that integrates requirements for reprocessing, fuel fabrication, and reactor plant facilities could involve greater effort than developing separate requirements for the different facilities, if the added complexity of the combined regulation offsets the efficiencies of scale associated by doing the combined rulemaking.
4. For a new regulation, there is a possibility that increased comment and controversy on portions of the entire proposed regulation that were otherwise closed or accepted by licensees (e.g., general reporting requirements in Part 50 or Part 70) would occur, even though those portions may not have significantly changed. This could be because of concern about new material in Part XX, eventually resulting in further changes in Parts 70, 50 or 52.
5. Promulgating a new Part will involve more effort than amending existing Parts. It increases the size of rulemaking and may require more effort to be expended to incorporate and respond to public comments.

Option 4: CFTC/ABR: (1) In fiscal year (FY) 2007, the Commission issues a Federal Register Notice (FRN) soliciting public and stakeholder input on desirable attributes of the regulatory framework for GNEP, as well as comments on whether there are any major substantive technical issues relating to an accelerated schedule that may affect development of GNEP regulations and/or how such facilities should be regulated; (2) After consideration of public and stakeholder comments, the Commission decides on either issuing an Order or directing a rulemaking to establish specific requirements; (3) Concurrently, the staff develops a licensing-basis document for fuel separations/fuel fabrication/advanced recycling reactor facilities to be used by the Commission in developing an Order or as the technical basis for the rulemaking process, as appropriate.

Before making a decision on whether to issue an Order or rulemaking for spent fuel reprocessing/fabrication/advanced recycling reactor facilities, the Commission could issue a FRN in FY 2007 that formally solicits public and stakeholder input on how to proceed with developing a regulatory framework for GNEP. The FRN could also solicit comment on whether there are any major substantive technical issues relating to an accelerated schedule that may affect development of the regulations and/or regulating such facilities.

Generally, the Commission does not provide the public an opportunity to comment on the possible issuance of an Order establishing licensing requirements. However, given DOE's and possibly industry's accelerated schedule, it may be too late to solicit stakeholder input and complete a rulemaking before industry submits the first application(s).

DOE is engaging industry on these topics. DOE and industry discussions about the viability of commercialization and the potential issues associated with potentially by passing engineering scale demonstration for specific new GNEP technologies are not publically available. DOE and industry have entered into confidentiality agreements associated with certain details of the responses to DOE's EOI Requests. Therefore, industry may be reluctant to provide comments to staff on the regulatory and technical framework for GNEP at this point in time. Nevertheless, there is benefit to the conceptual regulatory development process to solicit comments on any issues that may potentially impact how commercial GNEP fuel separations/fuel fabrications facilities are regulated.

With this option, the staff, concurrent with solicitation of public and stakeholder comments, would draft a licensing basis document for the CFTC/ABR. Public comments would be considered, as appropriate, in the draft licensing-basis document. The draft licensing basis document would be developed by the staff based on the "best understanding" of the technology and could be used as the basis for an Order, if the Commission decides not to proceed with rulemaking after evaluating public and stakeholder comments. Conversely, if the Commission decides to proceed with rulemaking after evaluating public and stakeholder comments, the draft licensing-basis document would be used as the technical basis in the rulemaking process.

This option recognizes the pace of DOE's selection of technology and design process. This option also allows greater flexibility to accommodate prompt and significant shifts by DOE in GNEP strategy.

Pros and Cons for Option 4:

Pros-

1. Significant time savings could be realized if the Commission decided that an Order is appropriate. Under such a situation, this option could require the least amount of time, with the bulk of the time spent on performing the review of regulations, to develop a licensing-basis document – and obtaining internal staff, committee, and Licensing Board review. For example, in a recent case, involving an enrichment facility, existing regulations provided the basis for staff's technical review of the applicant's submittals, thereby accelerating the issuance of the Notice and Commission Order.
2. By soliciting public and stakeholder comment early, may result in staff obtaining a better understanding of the potential for the commercialization of new technologies and potential health and safety and safeguards issues that may result due to an accelerated industry-focused approach.

Cons-

1. Con 2 of Option 1 applies to this option.
2. If an Order were issued, the need may arise for future Orders for amendments because conditions were not envisioned at the time of the initial Order.
3. If an Order were issued, public confidence may be undermined because of the perception that NRC is deliberately skirting the development of applicable regulations through the notice and comment rulemaking process.
4. Industry may be reluctant to provide comments to staff on GNEP at this point in time. DOE and industry discussions about the viability of commercialization and the potential issues associated with potentially by passing engineering scale demonstration for specific new GNEP technologies are not publically available. DOE and industry have entered into confidentiality agreements associated with certain details of the responses to DOE's EOI Requests.

For Options that involve rulemaking (Options 1, 2, and 3):

If the Commission decides rulemaking should be pursued for GNEP facilities and if DOE continues with its current GNEP commercial operational schedule, then the rulemaking process and the development of SRPs and regulatory guides would need to begin now (in order to process an application received in FY 2010). In general, rulemaking takes about 2 years to complete but occasionally takes longer for more complex and controversial rules. Optimally, a proposed rule would be issued at least one year before issuance of the final rule and the final rule at least six months before subsequent receipt of any license applications. The one year period between issuance of the proposed rule and the issuance of the final rule would provide industry with the opportunity to begin its design work based upon the technical requirements described in the proposed rule. Under this scenario, in order to receive quality application(s) for

the CFTC and/or the ABR, the staff estimates that it would need to begin developing a technical basis document to support any rulemaking no later than June 2007.

In addition to implementing the Commission's selected option, the staff will evaluate other regulations with respect to GNEP facilities and associated SNM, such as those that involve waste management (Part 60, 61, and 63), transportation (Part 71), material control and accounting (Part 74), facility physical protection and transportation security (Part 73), environmental protection (Part 51), and fees (Part 170 and 171) to complete the conceptual regulatory framework for GNEP by the end of September 2007, as directed by the Commission through SRM-SECY-06-0066.