



# U.S. NUCLEAR REGULATORY COMMISSION

# ENVIRONMENTAL STANDARD

# REVIEW PLAN

## 5.7.2 TRANSPORTATION OF RADIOACTIVE MATERIALS

### REVIEW RESPONSIBILITIES

Primary— Organization responsible for the review of transportation information

Secondary—None

### I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's review and analysis of the proposed means of transporting radioactive materials. The scope of the review directed by this plan will include those design and operational parameters specified in 10 CFR 51.52(a) and, if necessary, a detailed analysis of the impacts of transporting fuel and waste to and from the reactor.

#### Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 3.2. Obtain input on the reactor type and rated core thermal power, the fuel assembly description, and the average irradiation level of irradiated fuel.
- ESRP 3.5. Obtain input on the characteristics, treatment, and packaging for radioactive waste.
- ESRP 3.8. Obtain input on unirradiated and spent fuel characteristics, packaging systems, and transport modes.
- ESRP 7.4. Provide the reviewer for ESRP 7.4 with a description of postulated accidents associated with transportation of radioactive materials and an evaluation of the transport relative to the criteria associated with Table S-4 of 10 CFR 51.52(c). If an independent analysis of the

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### USNRC ENVIRONMENTAL STANDARD REVIEW PLAN

This Environmental Standard Review Plan has been prepared to establish guidance for the U.S. Nuclear Regulatory Commission staff responsible for environmental reviews for nuclear power plants. The Environmental Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required.

These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-1555 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of New Reactors, Washington, D.C. 20555-0001.

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impacts of transportation accidents is required, ensure that sufficient information to support an independent analysis of these impacts is provided.

- ESRP 5.11. Provide the reviewer of ESRP 5.11 with the estimated radiological impacts of routine (incident-free) transportation of fuel and waste to and from the reactor, including a SMALL/MODERATE/LARGE impact characterization (see the Introduction to NUREG-1555 for definitions of SMALL, MODERATE, and LARGE impacts).

### Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- reactor type and rated core thermal power (from ESRP 3.2)
- fuel assembly description (from ESRP 3.2)
- average irradiation level of irradiated fuel (from ESRP 3.2)
- the capacity of the onsite storage facilities to store irradiated fuel and the minimum fuel storage time between removal from the reactor and transportation offsite (from the environmental report [ER])
- treatment and packaging procedures for radioactive wastes other than irradiated fuel (from the ER)
- transportation packaging systems to be used for fresh fuel, spent fuel, and other radioactive wastes (from ESRP 3.8)
- estimated transportation distance from the fuel fabrication plant to the reactor and from the reactor to the facilities to which irradiated fuel and radioactive waste will most likely be sent, if applicable (from the ER)

## II. ACCEPTANCE CRITERIA

Acceptance criteria for the description of the transportation of radioactive materials are based on the relevant requirements of the following:

- 10 CFR 51.52 with respect to the design and operational parameters related to the transportation of fuel and waste to and from the reactor.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- There are no regulatory positions specific to this ESRP. Note, however, that the NRC has generically considered the environmental impacts of spent nuclear fuel with U-235 enrichment

levels up to 5% and irradiation levels up to 62,000 megawatt-days per metric ton and found that the environmental impacts of spent nuclear fuel transport are bounded by the impacts listed in Table S-4 provided that more than 5 years has elapsed between removal of the fuel from the reactor and shipment of the fuel offsite (NRC 1996; NRC 1999). However, these analyses cannot serve as the initial licensing basis for a new reactor.

### Technical Rationale

The technical rationale for evaluation of the applicant's proposed means for transporting radioactive materials is discussed in the following paragraph:

The proposed method for the transportation of fuel and radioactive wastes to and from the facility needs to be described so that impacts from transportation can be appropriately analyzed in other sections of the ESRP. The regulations in 10 CFR 51.52 give the environmental impacts that result, given a specific thermal power level in the reactor core, type of fuel, average irradiation of fuel, and specific parameters on packaging and shipping. If the description of the transportation falls within the specific parameters given in paragraph (a) of 10 CFR 51.52, then Table S-4 can be used to determine the environmental impact; otherwise, a detailed analysis of transportation impacts is required. For both analytical approaches, the NRC must review and confirm the results of the transportation impact analysis.

### III. REVIEW PROCEDURES

The reviewer's analysis of the data and information is required to support the reviewer's evaluation for conformance with 10 CFR 51.52(a) (see Evaluation Findings in this ESRP). The analysis should consist of assembling the data listed in the procedures below and verifying their accuracy. The reviewer may consult with the reviewers for ESRPs 3.2 and 3.5 to verify the data.

The reviewer should take the following steps:

(1) Compare the verified data (listed under Data and Information Needs above) with the following criteria:

- reactor type – light-water cooled (LWR)
- rated core thermal power level – 3800 MW maximum (see ESRP 3.2 for a definition of “rated.”)
- fuel assemblies – zircaloy fuel rods, sintered low enrichment uranium dioxide (maximum 4% by weight of <sup>235</sup>U) pellets (Use of 5% enriched fuel in conjunction with irradiation levels above 33,000 megawatt-days per metric ton has been considered generically for existing reactors but cannot serve as the initial licensing basis for a new reactor.)
- average irradiation level of irradiated fuel – 33,000 megawatt-days per metric ton maximum for use of Table S-4 directly. For existing reactors, irradiation between 33,000 megawatt-days per metric ton and 62,000 megawatt-days per metric ton maximum requires references to other environmental documents. These references cannot be used as the initial licensing basis for new reactors. New reactors must meet the 10 CFR 51.52(a) conditions or provide a full description and detailed analysis of the impacts of transporting fuel and waste to and from the reactor.

- onsite storage of irradiated fuel – minimum of 90 days between removal from the reactor and shipment offsite (5 years, if the irradiation exceeds 33,000 megawatt-days per metric ton for existing reactors). (The reviewer should consider the proposed capacity of the facility to store irradiated fuel in evaluating this criterion.)
  - radioactive wastes other than fuel – packaged as solid waste prior to offsite shipment. (The reviewer should consider the proposed solid waste treatment and packaging procedures in evaluating this criterion.)
  - new fuel shipment to the plant – by truck
  - irradiated fuel shipments offsite – by truck, rail, or barge
  - other radioactive-waste shipments offsite – by truck or rail.
- (2) When the above criteria are met, conclude that the routine (incident-free) environmental impacts of transportation of fuel and radioactive wastes during reactor operations are represented by the values given in 10 CFR 51.52(c), Table S-4, and instruct the reviewers for ESRP 7.4 to adopt this table as representing the environmental impacts of radioactive materials transportation accidents.
- (3) For existing reactors, when the fuel is enriched greater than 4 percent by weight of <sup>235</sup>U (as given in 10 CFR 51.52(a)(2) to a maximum of 5 percent, and when the fuel irradiation is greater than 33,000 megawatt-days per metric ton (as given in 10 CFR 51.52(a)(3) to a maximum of 60,000 megawatt-days per metric ton, it has been shown that the environmental cost contributions are either unchanged or may in fact be reduced from those summarized in Table S-4 (Baker et al. 1988; 53 FR 30355 ; NRC 1996). The impacts of transportation of fuel irradiated to 62,000 megawatt-days per metric ton have also been considered and found to be bounded by those summarized in Table S-4 ( NRC 1999, 64 FR 48496) The reviewer should instruct the reviewers for ESRP 7.4 to adopt this table as representing the environmental impacts of radioactive materials transportation accidents.
- (4) When any of the above criteria are not met, expand the analysis of the required data to the level necessary to provide sufficient data to support a subsequent impact analysis that would supplement the impact data of Table S-4. The reviewer should notify the reviewers for ESRP 7.4 that Table S-4 cannot be used and that a supplemental impact assessment will be required.
- (5) When required, a full description and detailed analysis of the impacts of transporting fuel and waste to and from the reactor should include the following:
- Description of the method(s) used to estimate routine (incident-free) radiological impacts, including impacts to populations and maximally-exposed individuals. Ensure the methods used are defensible (e.g., use the latest version of RADTRAN (SNL 2007)).
  - Specification of input parameters and sources used in the impact assessment. Review the parameters and source documents to ensure they are defensible. Where assumptions are used to fill in missing or highly uncertain data, ensure the assumptions are bounding and reasonable; i.e., the assumptions tend to overstate transportation impacts yet are not so conservative that they could mask the true environmental impacts of the reactor and lead to invalid conclusions.

- Presentation of results, including population doses, maximally-exposed individual doses, and health effects for transportation crews and the general public.

(6) Perform a confirmatory analysis of the supplemental transportation impact assessment. The confirmatory analysis is intended to assess and confirm the basis and conclusions of the applicant's supplemental transportation impact assessment. Document the confirmatory analysis in the EIS.

#### IV. EVALUATION FINDINGS

When the reviewer determines that the environmental impacts of transportation can be met by use of Table S-4, a brief input to the environmental impact statement (EIS) should be prepared summarizing the data of Section III, Item (1) of this ESRP. The input should note that these data are within the scope of 10 CFR 51.52(a), and that this ESRP and ESRP7.4 will address the impacts of radioactive-material transportation by reference to Table S-4 of 10 CFR 51.52(c). When Table S-4 cannot be used, the reviewer should provide, as input to the EIS, a description of those proposed designs or procedures that do not meet the criteria of Section III, Item (1) of this ESRP and a detailed description and analysis of the environmental impacts of transporting fuel and waste to and from the reactor (i.e., describe the confirmatory analysis of Section III, Item (6) of this ESRP). This material should be provided in sufficient detail to support a subsequent impact assessment by the reviewers for ESRP 7.4. Characterize the routine (incident-free) transportation impacts during normal reactor operations as SMALL, MODERATE, or LARGE as defined in the ESRP Introduction.

#### V. IMPLEMENTATION

The method described in this ESRP should be used by the staff in evaluating conformance with the Commission's requirements, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the requirements.

#### VI. REFERENCES

10 CFR 51.52, "Environmental effects of transportation of fuel and waste."

10 CFR 51.52, Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor."

53 FR 30355. August 11, 1988. "Carolina Power & Light Co., et al., Shearon Harris Nuclear Power Plant, Unit 1; Environmental Assessment and Finding of No Significant Impact." *Federal Register*.

64 FR 48496. September 3, 1999. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*.

Baker, D. A., W. J. Bailey, and C. E. Beyer. 1988. *Assessment of the Use of Extended Burnup Fuel in Lightwater Power Reactors*. NUREG/CR-5009, Pacific Northwest Laboratory, Richland, Washington.

Sandia National Laboratory (SNL). 2007. RADTRAN, Transportation Risk Assessment Computer Code. Albuquerque, New Mexico.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3—Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants*. NUREG-1437 Vol. 1, Addendum 1, Washington, D.C.

Wiener, R.F., D.M. Osborn, G.S. Mills, D. Hinojosa, T.L. Heames, and D.J. Orcutt. 2006. *RadCat 2.3 User Guide*. SAND2006-6315. Sandia National Laboratories, Albuquerque, New Mexico.

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#### **PAPERWORK REDUCTION ACT STATEMENT**

The information collections contained in the Environmental Standard Review Plan are covered by the requirements of 10 CFR Part 51, and were approved by the Office of Management and Budget, approval number 3150-0021.

#### **PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

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