

## Background Information on the NRC's Consideration of Offsite Property Damage Within the Current Regulatory Framework

Property damage and cost-benefit determinations are conducted within regulatory analyses, backfitting, and environmental analyses and generally include property damage. In performing cost-benefit determinations, the NRC has traditionally considered two categories of property: onsite and offsite. Generally, onsite property is owned or controlled by the license or certificate holder and located within the boundaries of the licensed facility, while offsite property is located external to the site boundary and not owned or controlled by the license or certificate holder.<sup>1</sup> However, in cost benefit analysis, the distinction between offsite and onsite property is more significant than simply the location or ownership of the property. Onsite property costs include replacement power, decontamination costs, and costs associated with refurbishment or decommissioning. Offsite property costs include both the direct costs associated with property damage (e.g., property values) and indirect costs (e.g., tourism, manufacturing, and agriculture disruption). The NRC has periodically reevaluated the role of offsite property damage within its regulatory framework.<sup>2</sup>

Current staff guidelines are based in part on radiological release estimates as reported in NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," issued December 1990, and experience from the 1979 accident at Three Mile Island Unit 2. These guidelines (i.e., NUREG/BR-0184) indicate that onsite costs may be significantly greater than offsite costs and that estimated values for onsite property costs may significantly outweigh other values and impacts considered in cost benefit analysis. However, offsite property damage associated with the accident at the Fukushima Dai-ichi nuclear power plant in Japan in 2011 has initiated discussion on how the NRC considers offsite property damage following a significant release of radionuclides with subsequent contamination of the environment. In response to this discussion, the staff formed a working group with members from across the regulatory program offices and the Office of the General Counsel to review current approaches for considering offsite property damage within the regulatory framework and to identify options for modifying these approaches.<sup>3</sup> Additionally, the staff held a public meeting on May 24, 2012, to inform the public of this effort and to solicit feedback.<sup>4</sup>

This enclosure describes the development of NRC's safety goal policy statement and summarizes specific regulatory requirements addressing offsite property damage. However, it

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<sup>1</sup> As stated in NUREG/BR-0058, Revision 4, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," issued September 2004, "offsite property" refers to property that is not owned or leased by a licensee.

<sup>2</sup> See, for example, SECY-97-208, "Elevation of the Core Damage Frequency Objective to a Fundamental Commission Safety Goal," dated September 12, 1997; SECY-98-101, "Modifications to the Safety Goal Policy Statement," dated May 4, 1998; SECY-99-191, "Modifications to the Safety Goal Policy Statement," dated July 22, 1999; SECY-00-0077, "Modifications to the Reactor Safety Goal Policy Statement," dated March 30, 2000; and SECY-01-0009, "Modified Reactor Safety Goal Policy Statement," dated January 22, 2001.

<sup>3</sup> Staff from the Office of Nuclear Regulatory Research (RES), the Office of Nuclear Reactor Regulation (NRR), the Office of New Reactors (NRO), the Office of Federal and State Materials and Environmental Management Programs (FSME), the Office of Nuclear Materials Safety and Safeguards (NMSS), the Office of Nuclear Security and Incident Response (NSIR), and the Office of the General Counsel (OGC) formed the working group.

<sup>4</sup> See Agencywide Documents Access and Management System (ADAMS) Accession No. ML 121320176.

is important to note that this background information does not represent an exhaustive description of the NRC policy, precedence, and practice related to economic consequences, but rather is a collection of information, which the working group found most pertinent during the development of this paper. The NRC's legal authority concerning protection of public health and safety and offsite property damage is discussed in Enclosure 3.

### **Policy Statement on Safety Goals for the Operation of Nuclear Power Plants**

When the NRC considers actions beyond adequate protection, the staff determines if the incremental safety benefits of the action would substantially improve the existing level of safety. The NRC has used the Commission's Policy Statement on Safety Goals for the Operation of Nuclear Power Plants<sup>5</sup> to support decisionmaking on actions beyond adequate protection where cost may be considered.<sup>6</sup>

Discussion of offsite property damage manifested itself in the early stages of developing this policy statement. In response to the recommendations of the President's Commission on the Accident at Three Mile Island Unit 2,<sup>7</sup> the NRC undertook a large-scale effort to develop safety goals, which were intended to broadly define an acceptable level of risk to the public from nuclear power plant operation, in other words, determining how safe is safe enough. During the development and implementation of the safety goals, which spanned two decades, the Commission engaged in considerable debate regarding whether and how offsite property damage risks, as well as averted onsite costs, should be taken into account. In 1983, the Commission approved the preliminary policy statement for a two-year evaluation period. This statement expressed the Commission's views on the acceptable level of risks to public health and safety and on the safety-cost tradeoffs in regulatory decisionmaking. However, the Commission decided that the aversion of economic losses should not be considered a benefit in the implementation of the preliminary safety goal policy. Instead, the Commission's cost-benefit guidance focused on protection of the public health and safety. Therefore, in the preliminary policy statement, the Commission did not address nonhealth-related economic consequences, but did adopt for trial use of a health benefit-cost guideline of \$1,000 per person-rem averted as one consideration in decisions on safety improvements.<sup>8</sup> The NRC incorporated this cost-benefit guideline into NUREG/CR-3568, "A Handbook for Value-Impact Assessment," which

<sup>5</sup> See Volume 51, page 28044, of the *Federal Register* dated August 4, 1986, as revised, "Safety Goals for the Operation of Nuclear Power Plants, Policy Statement."

<sup>6</sup> Although reactor safety goals have been established through the August 4, 1986 policy statement, the Commission's approach for safety goals for the materials and waste regulated areas is less formal. The Commission approved in the Staff Requirements Memorandum (SRM) for SECY-04-0182, "Status of Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," dated October 7, 2004, the staff's plan to continue applying risk-informed methods on materials and waste repository issues. Furthermore, the Commission stated that the staff should consider applying the risk-informed decision-making guidance, which contained the six proposed safety goals for materials and waste activities, to planned and emergent activities. The safety goals are contained in "Risk-Informed Decision Making for Nuclear Material and Waste Applications" (ADAMS Accession No. ML080720238).

<sup>7</sup> See "Report of the President's Commission on the Accident at Three Mile Island, The Need for Change: The Legacy of TMI," dated October 30, 1979.

<sup>8</sup> See NUREG-0880, Revision 1, "Safety Goals for Nuclear Power Plant Operation," issued May 1983. The benefit-cost guideline in the policy statement states: "The benefit of an incremental reduction of societal mortality risks should be compared with the associated costs on the basis of \$1,000 per person-rem averted. During the evaluation period, the application of the benefit-cost guideline should be focused principally on situations where one of the quantified safety goals is not met. No further benefit-cost analysis should be made when it is judged that all of the design objectives have been met."

was endorsed in Revision 1 of NUREG/CR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," as an acceptable method for conducting cost-benefit analyses.

In its report<sup>9</sup> following the two-year evaluation period, the Safety Goal Evaluation Steering Group concluded that, for core-melt accidents averted, the economic costs of onsite consequences, as well as offsite costs borne by the public, should be considered as a benefit in the cost-benefit guideline. In addition, the report concluded that the \$1,000 per person-rem conversion factor adequately bounded the offsite nonhealth-related economic costs. As such, the \$1,000 per person-rem factor was determined to include both health and nonhealth-related offsite impacts. However, the Steering Group recommended that the safety goals exclude the loss of societal resources (e.g., water bodies, arable land, endangered species, burial grounds, national monuments and parks<sup>10</sup>), beyond their economic value, because of the difficulty in quantifying the loss of such resources.

In response to other recommendations identified by the Steering Group, the staff proposed an integrated safety goal matrix to be used as a template for implementing the Commission's safety goals and for cost-benefit analyses for safety improvements.<sup>11</sup> The matrix provided for a sliding scale of benefits (averted onsite and offsite costs) to weigh against costs of the plant safety improvements. However, the final policy statement did not include the proposed matrix and the original cost-benefit guideline. In the final policy statement issued in 1986, the Commission established two qualitative health safety goals which were supported by two quantitative health objectives (QHOs). The goals and QHOs are described in terms of health risks; no goal or objective was established to address potential land contamination, offsite property damage, and interdiction in a direct manner. Although the safety goal policy statement does not address economic consequences, the Commission noted that the specific guidance required to implement the safety goal policy statement would address matters such as the conduct of cost-benefit analyses.

During 1997–2001,<sup>12</sup> the staff considered modifying the safety goal policy to include land contamination. In SECY-97-208, "Elevation of the Core Damage Frequency Objective to a Fundamental Commission Safety Goal," dated September 12, 1997, the staff noted that no goal had been established with respect to potential land contamination and interdiction and, as evidenced by the Chernobyl accident, accidents involving core damage and containment failure could result in a societal impact. Additionally, in SECY-00-0077, "Modifications to the Reactor Safety Goal Policy Statement," dated March 30, 2000, the staff noted that development of a safety goal for land contamination and overall societal impacts would provide a clear message of the importance of considering contamination of the environment following a severe accident.

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<sup>9</sup> See memorandum to W. Dircks, Executive Director for Operations, from T. Murley, Chairman, Safety Goal Evaluation Steering Group, "Safety Goal Evaluation Report," dated April 18, 1985.

<sup>10</sup> Even today, the NRC does not have formal guidance for valuing these special categories of societal resources, including tribal lands, beyond their economic value.

<sup>11</sup> See memorandum to the Commissioners from V. Stello, Acting Executive Director for Operations, "Safety Goal Policy," dated February 14, 1986.

<sup>12</sup> See SECY-97-208; SECY-98-101, "Modifications to the Safety Goal Policy Statement," dated May 4, 1998; SECY-99-191, "Modifications to the Safety Goal Policy Statement," dated July 22, 1999; SECY-00-0077; and SECY-01-0009, "Modified Reactor Safety Goal Policy Statement," dated January 22, 2001.

However, the staff recommended that no additional safety goal be developed for land contamination because of the uncertainties in predicting severe accident consequences and weaknesses in the analytical tools for evaluating land contamination and collective dose at significant distances from the plant. Ultimately, the Commission disapproved issuance of any revised Reactor Safety Goal Policy Statement, citing the need for the staff to focus on the agency's new risk-informed regulatory initiatives.<sup>13</sup>

### **Regulatory Requirements**

Beyond the context of formal Commission policy statements, the NRC's regulatory framework addresses offsite property damage both through regulations and as a component of required analyses. Consideration of offsite property damage can arise during cost-justified substantial safety enhancements, as well as regulatory and environmental analyses. In addition, various nuclear materials requirements provide for the consideration of property damage. Specific examples include the following:

- **Materials Licensing:** For 30 years, from January 1, 1961 (25 FR 8595, September 7, 1960), through October 15, 1991(56 FR 40757, August 16, 1991), 10 CFR Part 20 included the requirement for licensees to immediately notify Federal authorities "by telephone and telegraph" of any incident involving byproduct, source, or special nuclear material which caused or threatened to cause property damage in excess of \$100,000; a 24-hour notification was required for property damage in excess of \$1,000. The NRC removed this requirement in a 1991 rulemaking because "a dollar figure for property damage, regardless of amount, is not necessarily indicative of the hazard of the public health and safety."<sup>14</sup> Despite removing this criterion, the NRC, in the same rulemaking, added new criteria for the reporting of significant events at materials licensee facilities in 10 CFR Parts 30, 40, and 70 which were related more closely to health and safety issues.

Currently, the NRC expressly requires consideration of property damage within its regulatory framework for nuclear materials licensing and certification of gaseous diffusion plants. Within 10 CFR Parts 30, 40, 70, 72, and 76, several regulations,<sup>15</sup> including general requirements for the approval of certain license applications, require that the applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property. The reactor licensing regulations in 10 CFR Part 50 and 10 CFR Part 52 do not address property in a manner similar to these materials licensing requirements.<sup>16</sup>

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<sup>13</sup> See SRM-SECY-01-0009, "Modified Reactor Safety Goal Policy Statement," dated April 16, 2001.

<sup>14</sup> See 56 FR 40757.

<sup>15</sup> For example, 10 CFR 30.11, "Specific Exemptions," 10 CFR 30.32, "Application for Specific Licenses," and 10 CFR 30.34, "Terms and Conditions of Licenses," include requirements to minimize danger to life or property. 10 CFR 40.32, "General requirements for issuance of specific licenses," 10 CFR 70.23, "Requirements for the approval of applications," 10 CFR 72.40, "Issuance of license," and 10 CFR 76.35, "Contents of application," include similar provisions.

<sup>16</sup> Such verbiage is absent from 10 CFR Part 52 and from the general criteria in 10 CFR Part 50 except in reference to granting relief or imposing alternate requirements for inservice inspection and inservice testing under 10 CFR 50.55a(f) and 10 CFR 50.55a(g).

- **Backfitting:** A backfit analysis is an analytical tool used by the NRC to assist in determining whether a proposed regulatory action applicable to nuclear facilities, already licensed when the new requirement is being considered, should be adopted. The requirements set forth in 10 CFR 50.109, “Backfitting,” govern backfitting for nuclear power reactors. In addition, 10 CFR Part 70, 10 CFR Part 72, and 10 CFR Part 76 include backfit regulatory provisions for other facilities.<sup>17</sup> A backfit analysis may be performed for a single facility (termed a facility-specific backfit) or for multiple facilities (termed a generic backfit).

In general, the backfitting requirements for reactor and materials facilities consider the following three main steps (see Enclosure 5 for a more detailed discussion of backfitting):

- (1) Evaluate whether a backfit analysis exemption for adequate protection or compliance applies.
- (2) Determine whether a substantial increase in the overall protection of the public health and safety or common defense and security would be achieved by the proposed change.
- (3) Complete a cost-benefit evaluation.

When evaluating whether a substantial increase in the overall protection of the public health and safety results from a proposed backfit, the NRC considers health effects related to the release of radiological contamination to the environment but does not consider the socioeconomic impact associated with property damage. The cost-benefit determination of these backfitting provisions requires the NRC to consider both the direct and indirect costs of implementing the proposed changes. Although the backfitting provisions do not directly address offsite property damage, staff guidance<sup>18</sup> for implementing these requirements includes consideration of offsite property damage and the associated economic impacts. Current staff practice is to assess potential offsite economic impacts using site-specific values for facility-specific backfits and generic values that are representative of the affected class of facilities for generic backfits.

- **Regulatory Analysis:** A regulatory analysis is an analytical tool agencies use to anticipate and evaluate the likely consequences of rules.<sup>19</sup> The NRC’s decisionmakers use regulatory analyses to assist in determining whether a proposed regulatory action is cost beneficial, and offsite property damage is an express consideration in such

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<sup>17</sup> Analogous backfitting provisions applicable to early site permits and standard design certifications, differing in some regards from those in 10 CFR 50.109, are set forth in 10 CFR Part 52. Specifically, 10 CFR 52.39 and 10 CFR 52.63 address changes in requirements under finality provisions, and 10 CFR 52.59 address standard design certification requirement changes during license renewal. The backfit requirements for materials facilities are similar to the reactor backfit requirements, though there are some differences. The backfit provisions in 10 CFR Part 70 have limited applicability (i.e., backfit provisions apply only to Subpart H, “Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material”) and have not yet been applied. Further, to date, no backfit analyses have been required for rules amending 10 CFR Parts 72, and 76.

<sup>18</sup> See NUREG/BR-0058, Revision 4 and NUREG-1409.

<sup>19</sup> See OMB Circular A-4, issued September 2003.

determinations.<sup>20</sup> No legislation or regulation requires a regulatory analysis for NRC-initiated actions. However, multiple Executive Orders have been issued on this topic over the past several years,<sup>21</sup> and the NRC has been voluntarily performing such analyses since 1976 and voluntarily complying with OMB Circular A-4, “Regulatory Analysis,” since 1981.<sup>22</sup> Nonetheless, the regulatory analysis process may be modified or eliminated at the discretion of an NRC office director or higher authority. Although regulatory analyses and backfit analyses are distinct types of evaluations, a regulatory analysis may be sufficient to satisfy the cost-evaluation requirements for a backfit analysis. Enclosure 5 also includes more discussion on regulatory analysis.

- **Environmental Reviews:** There are two principal actions for which the environmental impacts from nuclear power plant accidents are evaluated—license renewal for operational reactors and new reactor applications (e.g., design certifications, combined licenses, or early site permits under 10 CFR Part 52 or construction permits and operating licenses under 10 CFR Part 50). For license renewal, the provisions of 10 CFR 51.53(c)(3)(ii)(L) require that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated severe accident mitigation alternatives (SAMAs) or severe accident mitigation design alternatives (SAMDA)<sup>23</sup> for the applicant’s plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment.<sup>24</sup> The staff addresses offsite property damage within cost-benefit determinations related to SAMAs and SAMDAs. Enclosure 6 includes a more detailed discussion of environmental analyses and SAMAs and SAMDAs.
- **Siting:** An October 17, 1994, proposed rule and proposed denial of petition for 10 CFR Parts 50, 52, and 100, “Reactor Site Criteria Including Seismic and Earthquake Engineering Criteria for Nuclear Power Plants and Proposed Denial of Petition from Free Environment, Inc. et al.,” (59 FR 52255) addressed the Commission’s explicit consideration of societal risk and land contamination as it pertains to requirements for a low population zone outside the exclusion area. The Commission noted that, “Whereas the exclusion area size is based upon limitation of individual risk, population density requirements serve to set societal risk limitations and reflect consideration of accidents

<sup>20</sup> See NUREG/BR-0058, Revision 4, Section 4.3.3.

<sup>21</sup> For example, see Executive Order 12291 (1981) and Executive Order 12866 (1993).

<sup>22</sup> OMB Circular A-4 provides guidance to Federal agencies on the development of regulatory analysis as required under Section 6(a)(3)(c) of Executive Order 12866, “Regulatory Planning and Review,” (referred to as the Regulatory Right-to-Know Act), and a variety of related authorities. OMB Circular A-4 provides high level guidance for the conduct of regulatory analysis and does not specifically address property damage due to radiological contamination. However, OMB Circular A-4 notes the importance of accounting for land use changes when accounting for costs. The circular further notes that when demonstrating the need for regulatory action, significant market failures caused when one party’s actions impose uncompensated benefits or costs on another party can be considered.

<sup>23</sup> The purpose of a SAMA/SAMDA is to ensure that plant design changes with the potential for improving severe accident performance (i.e., reducing the risk or probability-weighted consequences) are identified and evaluated. SAMAs include SAMDAs, which are particularly important for design certifications, but SAMAs also include changes in operating procedures and training.

<sup>24</sup> Section 5.4 of NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants,” provides background information on the genesis of the SAMA regulatory requirement. The severe accident analysis for license renewal is prepared as a site-specific environmental impact statement supplement to NUREG-1437.

beyond the design basis, or severe accidents” (59 FR 52259). The Commission also described the specific benefits of limiting population density:

Limitation of population density beyond the exclusion area has the following benefits:

- (a) It facilitates emergency preparedness and planning.
- (b) It reduces potential doses to large numbers of people and *reduces property damage* in the event of severe accidents” (59 FR 52259).

The Commission also stated that:

In addition to the risks of latent cancer fatalities, the Commission has also investigated the likelihood and extent of land contamination arising from the release of long lived radioactive species, such as cesium-137, in the event of a severe reactor accident...From analysis done in support of this proposed change in regulation, the likelihood of permanent relocation of people located more than about 20 miles (50 km) from the reactor as a result of land contamination from a severe accident is very low.

Therefore, the Commission concludes that the current NRC staff guidance in Regulatory Guide 4.7 provide a means of locating reactors away from population centers, including “major” population centers, depending on their size, that would limit societal consequences significantly, in the event of a severe accident...

The Commission also notes that future population growth around a nuclear power plant site, as in other areas of the region, is expected but cannot be predicted with great accuracy, particularly in the long-term. Since higher population density sites are not unacceptable, per se, the Commission does not intend to consider license conditions or restrictions upon an operating reactor solely upon the basis that the population density around it may reach or exceed levels that were not expected at the time of site approval. Finally, the Commission wishes to emphasize that population considerations as well as other siting requirements apply only for the initial siting for new plants and will not be used in evaluating applications for the renewal of existing nuclear power plants.