

**Responses to Requests for Information
Representative Fred Upton, et al.,
Letter Dated September 19, 2014**

Request 1.

Please provide an estimate of the industry's costs to implement all post-Fukushima requirements/regulatory changes that the Commission has acted on.

ANSWER.

The U.S. Nuclear Regulatory Commission's (NRC) post-Fukushima regulatory requirements were generally promulgated to provide reasonable assurance of adequate protection of public health and safety, which is a statutory standard the NRC must meet under Section 182a. of the Atomic Energy Act, 42 U.S.C. § 2232(a). Actions taken to provide such assurance are not subject to a regulatory analysis and are pursued without consideration of costs. Case law has affirmed this position. The NRC, however, works with its licensees and applicants to find a cost-effective means of implementing requirements imposed for adequate protection purposes.

The NRC can also implement regulatory requirements to substantially enhance safety beyond those that are needed for reasonable assurance of adequate protection; these types of safety enhancements must be cost-justified. These types of cost-justified safety enhancements are evaluated using a thorough and systematic regulatory analysis and pursued if the proposed change results in a substantial safety enhancement and the estimated benefits are found to outweigh the projected costs. For nuclear power reactor licensees, the NRC's backfit rule (Title 10 of the *Code of Federal Regulations* (10 CFR) 50.109) governs the process of determining whether a proposed requirement results in a substantial safety enhancement and is cost-justified. Requirements imposed as a result of implementing the Section 182a. requirement for adequate protection are excluded from the backfit rule. The backfit rule also provides for the Commission to administratively exempt a given proposed requirement from the backfit rule.

The orders issued in March 2012, to establish mitigation strategies for beyond-design-basis external events and hardened containment vents for boiling water reactors with Mark I and Mark II containments are intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities. These orders were issued based on the Commission's decision that these actions were needed for reasonable assurance of adequate protection. Subsequently, in June 2013, the order requiring hardened containment vents was revised to include a requirement that the vents remain functional under severe accident conditions – this requirement was evaluated as a cost-beneficial safety enhancement. Additional orders issued in March 2012, which require all power reactor licensees to install reliable spent fuel pool instrumentation, were issued under an administrative exemption to the NRC's backfit rule. The administrative exemption, which is used only in exceptional circumstances, was utilized because the Commission determined that use of such instrumentation would increase the capability of nuclear power plants to mitigate beyond-design-basis external events and would provide a substantial increase in the protection of public health and safety.

Because these post-Fukushima orders were determined to be necessary for adequate protection or were administratively exempted from NRC's backfit rule, the NRC only has detailed cost estimates for one of these orders. The total cost to implement the revised June 2013 order requiring severe accident capable hardened vents at all U.S. boiling water reactors

Enclosure

with Mark I and Mark II containments was estimated to be between \$102 and \$197 million. However, the NRC is aware of cost estimates prepared by external sources subsequent to the issuance of these orders. For example, the NRC was recently briefed by a representative of the First Energy Nuclear Operating Company, which owns and operates four nuclear power plants in the U.S. According to First Energy, they estimate that they will spend approximately \$125 million¹ to implement the new regulatory requirements at their four nuclear power plants. Extrapolating this average cost to all U.S. nuclear power plants would result in a “rough-order-of-magnitude” total industry cost of approximately \$3 billion. Separately, Platts – McGraw Hill Financial² estimated that the total industry cost to implement the post-Fukushima regulatory requirements is approximately \$3.6 billion. These two external cost estimates do not purport to account for all Fukushima-related activities being taken by the NRC’s nuclear power plant licensees, and the actual final costs to licensees have the potential to be significantly higher. To ensure that these new regulatory requirements can be implemented without undue costs, the NRC is committed to working with the industry and other stakeholders to allow for the most cost-efficient and effective implementation of these requirements.

Request 2.

Please provide an estimate of the NRC’s resources already expended to develop all post-Fukushima requirements/regulatory changes including guidance, and review and approval of industry implementation plans

ANSWER.

The following table provides data on direct staff effort and contract support; it does not include overhead and corporate support for Fukushima-related activities.

Fiscal Year	Staff Full Time Equivalent (\$K)	Contract Support (\$K)	Total (\$K)
2011	Resources not tracked separately	Resources not tracked separately	Resources not tracked separately
2012	\$5,924	\$2,405	\$8,329
2013	\$10,553	\$8,584	\$19,137
2014	\$17,600 ³	\$9,221 ⁴	\$26,821

¹ Commission meeting slides as presented by Pete Sena (President and Chief Nuclear Officer, First Energy Nuclear Operating Company), “Industry Perspective: Mitigating Strategies (FLEX),” dated July 31, 2014.

² Article entitled, “Post-Fukushima modifications could cost US nuclear operators \$3.6 billion,” Nucleonics Week, Platts – McGraw Hill Financial, June 6, 2013.

³ Data through 09/09/14

⁴ Data through 09/23/14

Request 3.

With regard to Enclosure 1 in the staff's paper on qualitative factors, *List of Regulatory Actions That Rely Upon the Qualitative Consideration of Factors*:

- **Within the scope of Enclosure 1, please provide a list of Commission requirements in which quantitative requirements were unavailable and for which qualitative requirements were the sole basis used by the Commission to justify imposing the new requirement.**
- **Within the scope of Enclosure 1, please provide a list of Commission requirements for which quantitative data was the sole source used by the Commission to impose new regulation.**
- **Within the scope of Enclosure 1, please provide a list of the Commission requirements where quantitative analysis was inadequate and qualitative factors were cited by the Commission to tip the balance and justify imposing the new regulation.**

ANSWER.

In Enclosure 1 to Commission Paper SECY-14-0087, "Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses," the NRC staff identified all recent regulatory actions that included consideration of qualitative factors. For all new requirements (i.e., Rules, orders, etc.) the staff considers whether they are backfits. Within the NRC's regulatory framework, this means that it triggers the requirements contained in the NRC's self-imposed backfit provisions contained in 10 CFR 50.109, 10 CFR 72.62, or the analogous backfitting provisions in 10 CFR Part 52 for new reactors. Guidance for backfitting is contained in NUREG-1409, "Backfitting Guidelines," June 1990. In addition, for new rules, the NRC performs regulatory analyses in accordance with NUREG/BR 0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," September 2004.

Qualitative factors have been, and continue to be, considered in both backfit analyses and regulatory analyses in accordance with NUREG/BR 0058 to complement the available quantitative analyses. We note that, in accordance with the Atomic Energy Act, the Commission must impose requirements necessary to ensure adequate protection, regardless of the cost, and, in such cases, no quantitative cost-benefit analysis is performed. While quantitative and qualitative factors may be considered in the associated regulatory analysis, these requirements do not fit into any of the categories identified in Request 3. We have listed the adequate protection requirements listed in Enclosure 1 to Commission paper SECY-14-0087 below for completeness:

- Reliable Hardened Containment Vents (Order EA-12-050)
- Mitigation Strategies for Beyond-Design-Basis External Events (Order EA-12-049)
- Design Basis Threat (10 CFR 73.1)
- Safeguards Information Protection Requirements (10 CFR Part 73)

We also note that several of the regulatory actions listed in Enclosure 1 to Commission paper SECY-14-0087 provide a voluntary alternative to existing regulatory requirements or a voluntary means of complying with regulations. As such, no additional requirements were imposed in

these cases. Enclosure 1 also includes changes to the NRC's adjudicatory process, and the addition of a containment spray system, or equivalent, in the AP600 design prior to certification of the design, to achieve an appropriate balance between prevention and mitigation of severe accidents. Neither of these requirements was considered a backfit. These requirements and the voluntary alternatives discussed above do not fit into any of the categories identified in Request 3. However, we have listed these requirements below for completeness:

- Changes to the Adjudicatory Process (10 CFR Part 2)
- Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standardized Passive Reactor Design (SECY-97-044)
- Voluntary Fire Protection Requirements for Light Water Reactors; Adoption of NFPA 805 as a Risk Informed, Performance Based Alternative (10 CFR 50.48)
- Enhanced Weapons, Firearms, Background Checks, and Security Event Notifications (10 CFR Part 73 [Note: portions of the rule were voluntary, portions were mandatory per statute, and portions were deemed necessary for adequate protection.]
- Alternate Fracture Toughness Requirements for Protection against Pressurized Thermal Shock (10 CFR 50.61)
- Accept the Guidance in NEI 99-01 as an Alternative Methodology for the Development of Emergency Action Levels (Revision 4 of Regulatory Guide 1.101)
- Risk Informed Categorization and Treatment of Structure, System, and Components for Nuclear Power Plants (10 CFR 50.69)
- Guidance for the Assessment of Beyond Design Basis Aircraft Impacts (Regulatory Guide 1.217)

The first category in Request 3 was "Commission requirements in which quantitative requirements were unavailable and for which qualitative requirements were the sole basis used by the Commission to justify imposing the new requirement." One requirement, Spent Fuel Pool Instrumentation, Order EA-12-051, fell into this category. This was a rare circumstance in which the Commission imposed this requirement as a significant safety enhancement under an Administrative Exemption to the backfit provisions of 10 CFR 50.109 based on qualitative considerations drawn from lessons learned from the Fukushima-Daichi accident. Specifically, as discussed in Order EA-12-051, Fukushima responders were without reliable instrumentation to determine water level in the spent fuel pool. This caused concerns that the pool may have boiled dry and that the fuel may have been damaged, resulting in confusion and misapplication of resources. This operating experience was the basis for the Commission's decision to order reliable spent fuel pool instrumentation.

The second category in Request 3 was "Commission requirements for which quantitative data was the sole source used by the Commission to impose new regulation." This category includes regulatory requirements in which some benefits were quantified, costs were quantified, and the net benefit of the quantitative analysis is positive. Although the analysis identified other benefits that were not quantified, they were qualitatively considered. These qualitatively considered benefits, combined with the positive net benefit result of the quantified attributes, further strengthen the cost-benefit justifications. The following regulatory actions fell into this category:

- Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (10 CFR Part 51) (proposed rule)
- Financial Information Requirements for Applications To Renew or Extend the Term of an Operating License for a Power Reactor (10 CFR 50.76)

The third category in Request 3 was “Commission requirements where quantitative analysis was inadequate and qualitative factors were cited by the Commission to tip the balance and justify imposing the new regulation.” Enclosure 1 to Commission paper SECY-14-0087 does not list any requirements where the quantitative analysis was “inadequate.” However, it includes regulatory requirements in which quantification of all benefits or impacts was not feasible. When the NRC does not quantify benefits or impacts of regulations, it is generally because of conceptual and empirical challenges, including an absence of relevant information. Many of the rules listed have benefits that cannot be quantified with existing information. For example, the quantification of particular benefits (such as security) can present significant challenges. For other regulations, some benefits (but not all) can be quantified. In these circumstances, the regulatory analysis identifies the important non-quantified values at stake so that they can be compared with the quantified benefits and costs. The regulatory actions that fell into this category are listed below. Many of these requirements were not considered backfits under 10 CFR 50.109, 10 CFR 72.62, or the analogous backfitting provisions in 10 CFR Part 52.

- Reliable Hardened Severe Accident Capable Vents (Order EA-13-109)
- Distribution of Source Material to Exempt Persons and to General Licensees and Revision of General License and Exemptions (Title 10 of the Code of Federal Regulations (10 CFR) Parts 30, 40, 70, 170, and 171)
- Physical Protection of Irradiated Reactor Fuel in Transit (10 CFR 73.37)
- Physical Protection of Byproduct Material (10 CFR Parts 20, 30, 32, 33, 34, 35, 36, 37, 39, 51, 71, and 73)
- Requirements for Maintenance of Inspections, Tests, Analyses, and Acceptance Criteria (10 CFR 52.99)
- Requirements for Distribution of Byproduct Material (10 CFR Parts 30, 31, 32, 40, and 70)
- Advance Notification to Native American Tribes of the Transportation of Certain Types of Nuclear Waste (10 CFR Parts 71 and 73)
- Enhancements to Emergency Preparedness (10 CFR 50.47)
- Aircraft Impact Assessment Rule (10 CFR 50.150) [Note: this requirement was imposed only on future license applicants for combined licenses or construction permits and the Commission administratively exempted the aircraft impact rule from the finality and issue resolution provisions in 10 CFR Part 52 with regard to previously certified designs.]
- Power Reactor Security Requirements (10 CFR Part 73 and 10 CFR 50.54)
- Fitness for Duty Programs (10 CFR Part 26)
- Exemptions from Licensing, General Licenses, and Distribution of Byproduct Material: Licensing and Reporting Requirements (10 CFR Parts 30, 31, 32, and 150)
- Limited Work Authorizations for Nuclear Power Plants (10 CFR 50.10)
- Requirements for Expanded Definition of Byproduct Material (10 CFR Parts 20, 30, 31, 32, 33, 35, 50, 61, 62, 72, 110, 150, 170, and 171)
- Licenses, Certifications, and Approvals for Nuclear Power Plants (10 CFR Part 52)
- Emergency Planning and Preparedness for Production and Utilization Facilities (10 CFR Part 50, Appendix E)
- Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized Water Reactors (Generic Letter 2004-02)
- Emergency Response Planning and Preparedness for Nuclear Power Reactors (Revision 5 of Regulatory Guide 1.101)
- Training and Qualification of Security Personnel at Nuclear Power Reactor Facilities (Regulatory Guide 5.75)

Lastly, the following actions from Enclosure 1 to Commission paper SECY-14-0087 were not approved by the Commission and therefore have not been categorized:

- Post-Fire Manual Actions, (10 CFR 50.48)
- Post-Fire Safe Shutdown Circuit Analysis Spurious Actuations, Generic Letter 2006 XX.