Cumulative Impact Case Study Analysis and Recommendations

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Background

In the NRC Staff Requirements Memorandum on SECY 12-0137, *Implementation of the Cumulative Effects of Regulation Process Changes*, dated October 5, 2012, the commission directed the NRC staff to seek volunteer facilities to perform "case studies" to enable a better understanding on implementing costs associated with implementing regulations, so that more accurate cost and schedule estimates can be developed for use in NRC's regulatory analysis. The industry and the Nuclear Energy Institute supported the NRC staff in the development of these case studies and formed a task force of nuclear power plants that were willing to participate in the analysis.

The NRC performs regulatory analyses to support numerous NRC actions that affect nuclear power reactor and non-power reactor licensees. The purpose of the analyses is to ensure that the agency makes sound decisions regarding actions needed to protect the health and safety of the public. Further, the analyses ensure that the agency bases its decisions on adequate information, and that the staff arrives at its decisions by following a systematic and disciplined process that is open and transparent. The regulatory analyses exist to validate that the benefits of a new regulation are greater than the costs of implementation.

The purpose of this case study analysis is to compare the costs of new regulations that were previously estimated in specific NRC regulatory analyses to the costs that were spent by the industry, and to provide recommendations for improvements. The topics that were studied were:

10 CFR 73, Power Reactor Security Requirements [74 FR 13926]
RIN 3150-AG63
Regulatory Analysis: ML083390372

10 CFR 50.48(c), National Fire Protection Association 805 [69 FR 33550]
RIN 3150-AG48
Regulatory Analysis: ML040540542

10 CFR 26, Subpart I, Managing Fatigue [73 FR 17176]
RIN 3150-AF12
RIN 3150-AI94
Regulatory Analysis: ML080580135

Cost Comparisons

The industry's case study task force received a number of volunteers that provided input on the costs to implement and comply with the regulations listed above. The costs were then compared to the estimates made in the regulatory analyses. In some cases, the cost comparisons were simple and straight forward; in others, the comparisons were complex. Due to these variances, not all costs and cost estimates could be

accurately compared. As such, cost comparisons were conducted where appropriate data was available and easily discernible.

10 CFR 73, Power Reactor Security Requirements

Following the terrorist attacks that occurred on September 11, 2001, the NRC conducted a thorough review of security to ensure that nuclear power plants and other licensed facilities continued to have effective security measures in place given the changing threat environment. Through a series of orders, the Commission specified a supplement to the Design Basis Threat (DBT), as well as requirements for specific training enhancements, access authorization enhancements, security officer work hours, and enhancements to defensive strategies, mitigative measures, and integrated response.

In addition to the orders, the NRC conducted rulemaking to further enhance security operations at power reactors. The rulemaking, which was completed in 2009, required licensees to make facility modifications and to revise their Physical Security Plans, Safeguards Contingency Plans, and Training and Qualification Plans, among other implementation activities. The licensees were also required to submit cyber security plans for NRC review and approval as well as conduct additional security activities beyond those currently required such as additional on-the-job training for security personnel.

The costs to comply with the 2009 security rule were estimated in the regulatory analysis. Using a 3% or 7% discount rate, the NRC found that the present value costs to the industry were estimated at $857 million or $590 million, respectively, over a 30 year period. The regulatory analysis provided cost estimates for five sections of the rule. The estimates for the five sections were further broken down into a total of 25 sub-sections.

Three companies that operate 15 reactors at 12 sites volunteered information on the costs that were spent to comply with the 2009 security rule. The 12 sites provided detailed costs associated with implementing 10 CFR 73.55, *Requirements for Physical Protection.*

The regulatory analysis estimated that the average site costs for 73.55 (Physical Protection) were $402,600 in one-time costs and would save each site $11,106 in annual operating costs. The actual site costs from the 12 sites for 73.55, however, were significantly higher: an average of $34.6 million in one-time costs. Annual operating costs from the sites could not be broken out from the total security operating costs.

In order to comply with the entire security rule, not just Part 73.55, the NRC estimated that an average site would spend $1.78 million in one-time costs and $0.59 million in annual costs. The average implementation costs at each site for just one part of the rule were not only considerably higher than the estimates for that one part but also greatly higher than the NRC's estimates for the entire rule.

10 CFR 26, Subpart I, Managing Fatigue

The NRC amended the former Fitness-for-Duty (FFD) regulations in 2008 to improve effectiveness, efficiency, and clarity. One of the nine subparts of the amended regulations is Subpart I, Managing Fatigue. While licensees already maintain a variety of work hour controls, the final rule standardized and strengthened licensee programs in this area. Subpart I required licensees to change their existing practices with respect to work hours and related controls (e.g., days off between work periods, waivers from work hour limitations, and fatigue assessments).

The majority of the costs to comply with Subpart I resulted from two requirements. One of the requirements established several mandatory days off for individual workers. The NRC expected that licensees will likely incur an impact during refueling outages and other extended outages given the common industry practice of using "super crews," which typically work six or seven 12-hour shifts per week during the outage. As implemented in the final rule, the days off in effect required licensees to bring on additional staff to provide the required time off to existing staff. This new staff likely will be temporary workers who must be hired, processed, and paid, thereby generating additional costs.

The other requirement placed restrictions on the use of waivers as a means of bypassing worker hour limits when necessary. Licensees are also estimated to incur costs related to revising and implementing their fatigue policies and procedures, developing systems to track work hours in the manner specified in the rule, paying a scheduler to plan work schedules, and training staff on the fatigue provisions.

The NRC estimated that one-time costs to implement Subpart I were $0.4 million per Fitness for Duty program. The ongoing annual costs were estimated at $1.125 million per program. For comparison, two companies that operate seven units provided information on the costs that were spent to comply with Subpart I, Managing Fatigue. The average one-time costs for two FFD programs (7 units) were $2.3M per program. The average annual costs were $2.8M per program.

In addition to nuclear operators complying with Subpart I, nuclear vendors who provide support services to the plants must also comply with Subpart I. Based on data from one vendor who supports more than 20 nuclear outages each year, the additional costs of complying with the new fatigue management requirements are $1 million - $2 million per outage, which is added to the outage invoices for the nuclear operators.

The NRC's cost estimates for Subpart I were 2 - 5 times lower than the actual costs reported by the two companies and vendor.

10 CFR 50.48(c), National Fire Protection Association 805

The NRC amended the fire protection requirements to give holders of operating licenses for light-water reactors the option to voluntarily adopt the set of fire protection requirements contained in the national consensus standard promulgated by the National Fire Protection Association (NFPA), "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition" (NFPA 805). NFPA 805 is an alternative to the existing fire protection requirements of 10 CFR 50.48(b), or existing fire protection license conditions or technical specifications.

The 50.48(b) deterministic fire protection requirements are prescriptive in nature and licensees have requested numerous exemptions to those requirements because of plant-specific circumstances. The developing and processing of these exemption requests has placed a large burden on the resources of the industry and NRC.

Instead of the requirements in Appendix R to Part 50, the final rule permits licensees to voluntarily adopt NFPA 805, which would give licensees the option to use a performance-based and risk-informed approach to manage the fire protection configurations and procedures of their plants. This alternative regulatory structure is estimated to reduce the number of future licensee exemption or deviation requests related to fire protection changes in licensed reactor facilities, and permits licensees to apply acceptable analytical methods and approaches to establish and/or change reactor plant configurations and procedures to meet the performance objectives of NFPA 805.

Each licensee choosing to implement the NFPA 805 fire protection requirements has to conduct a one-time, plant-wide analysis of its fire protection systems, fire barriers, equipment, features, and procedures to establish that they meet the adopted standard. The NRC estimated that the costs of this analysis were about $1.68M for each facility that adopts the new standard. For comparison, five units from three different nuclear companies provided costs to adopt NFPA 805. The average cost of the five units to conduct the one-time analysis was $10.5 million. The NRC's cost estimates for the analysis were about five times lower than the actual costs spent by each unit.

In addition to the costs spent for the analysis, the five nuclear units spent between $2 million and $16 million on capital, O&M, procedure changes and modifications to enhance the units to be able to adopt NFPA 805. These additional costs to upgrade each unit in order to comply with NFPA 805 were not estimated by the NRC.

Recommendations

In each of the three regulations where NRC's cost estimates were analyzed and compared to the industry's implementation costs, the costs were underestimated in the regulatory analyses, in most cases significantly. In order to improve upon the cost estimates going forward, and thus upon the cost/benefit analysis of future regulation, the industry determined a number of reasons for the significant cost variances and provided recommendations for improvements below.

The proposed recommendations are based on NRC's Principles of Good Regulation: independence, openness, efficiency, clarity and reliability.

1. Scope.

The biggest factor identified as the reason for large differences in cost estimates versus actual implementation costs is the ambiguity of the scope and implementation details for the regulation or action. Generally, the regulatory analysis, basis and implementation estimates are based on the purpose and scope of the new requirements that are often broad, devoid of specifics and open to a variety of interpretations. The NRC staff typically publishes for comment the regulatory analysis and the proposed regulation before the implementing guidance has been fully developed.

During the time between the comment period on the proposed rule, the draft regulatory analysis and publishing the final regulation, the scope of the regulation can change significantly. Often times the scope of the regulation may increase and additional requirements may be introduced without an adjustment to the regulatory analysis and cost-benefit determinations. The change in the scope increases implementation costs.

The companies and plants involved in the case studies indicated that poor problem definition and the development of detailed implementing guidance after the development of cost estimates was a likely contributor to the extreme variance between estimates and actual spend. If the scope of the requirement is not clearly defined, its implementation can be subject to misinterpretation. NRC staff may have written the regulation with a specific intention in mind, but if that intention is not clear, industry and NRC staff may misinterpret the intent of the new requirement. This misinterpretation increases the potential for differing expectations and uncertainty in implementation which leads to overspending to meet the assumed new requirements. Without a clear, firmly defined scope, estimating costs for implementing the regulation is impossible either for the NRC or the industry.

Recommendation: Clearly define the scope, closure criteria and characteristics so that realistic resources can be estimated for compliance with the new action/position.

2. Early release of regulatory analysis and detailed implementation guidance.

A regulatory analysis is conducted to determine the costs and benefits of a regulation where many assumptions and numbers are used to justify the regulation's benefits. When a new regulation is published for comment, the NRC has already completed a significant amount of research and work with little to no public input. As shown on the previous pages, the cost estimates in the regulatory analyses have been proven to be significantly underestimated.

Recommendation: Before the regulation is first published for comment, the scope, regulatory analysis and guidance of the regulation should receive early public input in order to help accurately estimate the costs and benefits of the regulation. This should be done before the public comment period for the proposed rule so the basis for the proposed rule is as accurate as possible.

3. Cost estimates in regulatory analyses.

As shown in the case studies, cost estimates in the three regulatory analyses were significantly underestimated. A more detailed comparative analysis of the differences in assumptions and costs, however, cannot be provided. This is because the cost estimates in the regulatory analyses are presented at a high level. The assumptions and sources that make up the basis of the estimates are not provided in the analyses.

Recommendation: Regulatory analyses should include information on the basic assumptions and sources that drive the high level estimates. Further, the regulatory analyses should provide a range of estimates based on various sensitivities instead of single point estimates.