**Nuclear Power Plant Regulation**

**Executive Summary: Significant Progress Toward a More Objective, Safety-Focused Process**

Sustained improvements in reliability and economic performance over the past decade demonstrate that most U.S. nuclear power plants can be competitive with other sources of electricity.

Restructuring of the electric power industry and the emergence of competition in the generation business place a premium on an efficient, disciplined regulatory system. Unnecessary Nuclear Regulatory Commission (NRC) requirements impose needless burdens on companies, which could impact the competitive position of nuclear power plants.

An inefficient, and thus costly, regulatory process could perhaps be tolerated in a cost-of-service environment—when regulatory compliance costs could be passed through to consumers. In a competitive environment, an inefficient regulatory process is unacceptable.

Industry concerns over NRC regulation go back many years. Over time, regulatory requirements became progressively more detailed and prescriptive. New requirements were often layered on top of old ones, with no consideration of safety significance or consistency. The regulatory process had no objective, measurable safety thresholds.

This situation has changed dramatically over the past two years. The NRC has taken actions,

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<tr>
<th>Nuclear Plant Assessment</th>
<th>Old Process</th>
<th>New Process</th>
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<tr>
<td>Subjective evaluation criteria</td>
<td>Objective, quantitative performance indicators</td>
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<tr>
<td>No firm, fixed safety threshold</td>
<td>Clear, quantitative safety threshold</td>
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<tr>
<td>Lagging indicators (SALP, “Watch List”)</td>
<td>Real-time trend of plant performance</td>
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<tr>
<td>Evaluation criteria, methods invisible</td>
<td>Evaluation criteria, methods transparent</td>
<td></td>
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<tr>
<td>No clear thresholds for licensee, regulatory action</td>
<td>Actionable thresholds for licensee, regulatory action</td>
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encouraged in part by sustained congressional oversight, to improve its regulatory process, including:

- developing and testing a new process to assess nuclear plant performance; replacing the Systematic Assessment of Licensee Performance (SALP) process with a more objective, focused performance appraisal; and eliminating the “Watch List.” The new plant assessment process was successfully tested at nine plants in 1999 and implemented industrywide in April 2000.

- developing a new enforcement process that emphasizes safety-significant issues and eliminates cited violations for non-safety-significant findings.

- launching a comprehensive, multi-year initiative to revise its regulations so that they are performance-based and focused on the areas of the plant that have the most impact on safe operation.
How Today’s Regulatory Process Evolved

Summary
The U.S. commercial nuclear energy industry is now more than 35 years old. In that time, it has accumulated more than 2,000 reactor-years of experience. Since the accident at Three Mile Island in 1979, the industry has recorded steady improvements in safety and performance—every year better than the one before. All the indicators of reliability and safety have improved—fewer unplanned shutdowns, fewer safety system actuations, fewer forced outages, higher capacity factors, higher reliability.

After the accident at Three Mile Island, regulatory requirements became progressively more detailed and prescriptive. New requirements were often layered on top of old ones, without weeding out duplication and inconsistency.

Opportunities to Improve
The industry has identified several broad areas for improvement in the process for regulating nuclear power plants:

* **Adopt objective standards.** Regulatory requirements and guidance should be based on objective standards of plant performance and experience, thereby eliminating subjective and inconsistent interpretations.

* **Avoid prescriptiveness.** The regulations themselves are overly prescriptive, a legacy from the 1950s and 1960s, when knowledge of nuclear safety was limited.

* **Use of risk insights.** Many aspects of the regulatory process could be made more efficient and safety-focused through the use of risk insights—identifying which systems and components are important to safety and focusing utility management and NRC resources on those systems and components.
The NRC’s New Oversight Process
For Nuclear Power Plants

As part of its broad regulatory reform process, the NRC has completely revamped its process for overseeing performance of the nation’s 103 nuclear power units—creating a new plant assessment process, and revising its enforcement policy to match the new assessment process.

In September 1998, the NRC suspended the Systematic Assessment of Licensee Performance (SALP) process, then officially discontinued it in April 2000. In April 1999, NRC eliminated the so-called “Watch List” of troubled plants, which dates back to the mid-1980s. These programs frequently resulted in inconsistent and subjective treatment of safety issues, redundancy in regulation, and inefficient allocation of resources.

The new regulatory oversight process was successfully tested at nine nuclear plants in 1999 and implemented industrywide in April 2000. The program is designed to make the oversight process more effective and efficient, and will help focus NRC resources on safety-significant activities. It integrates objective, quantitative performance indicators and inspection findings to produce more objective, predictable and understandable regulatory assessment and enforcement actions.

The new process monitors nuclear plant performance in three broad areas:

- reactor safety, which determines how best to avoid events and how to reduce the consequences of potential accidents;
- radiation safety for plant workers and the public; and
- protection of plants against security threats.

Within these areas, NRC has identified seven “safety cornerstones” to monitor:

- initiating events
- mitigation systems
- barrier integrity
- emergency preparedness
- public radiation safety
- occupational radiation safety
- security
The new process established 18 “performance indicators” in these seven “cornerstone” areas, and includes thresholds for plant performance to indicate the point at which the NRC would step in with increased oversight or enforcement action. Additional performance indicators are being developed.

Under the new assessment process, all plants will receive, at a minimum, a baseline inspection program that monitors plant activities as an indicator of plant performance. The NRC will not significantly reduce its oversight of plant activities, but will base its oversight on results of both inspection findings and performance indicators instead of its past practice of analyzing inspection findings alone.

Under the new assessment process, the Nuclear Regulatory Commission will monitor the seven safety “cornerstones” using 18 performance indicators. Each indicator will be recorded on a chart like the one shown above, with performance over time shown as a trend line. The agency’s regulatory response will depend on whether a plant’s performance falls within the green, white, yellow or red performance bands. The public can access performance data for each nuclear plant at:


If performance declines, inspection efforts would increase to determine the cause of the decline. The baseline program will concentrate on plant activities and systems with the greatest potential impact on protecting public
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safety. This “risk-informed” approach will be linked to NRC’s three oversight areas—inspection, assessment and enforcement.

Each quarter, NRC inspectors will review performance of nuclear power plants in each of the four regions of the country based on the performance indicators and inspection findings. More detailed plant assessments will be conducted during the final quarter of every year. These results will be contained in a final performance report to be given to NRC senior management and NRC commissioners.

<table>
<thead>
<tr>
<th>Reactor Oversight Process: Key Results</th>
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<tbody>
<tr>
<td><strong>Performance Indicators</strong></td>
</tr>
<tr>
<td>2nd Quarter 2001</td>
</tr>
<tr>
<td>93 units all “green”</td>
</tr>
<tr>
<td>10 units with one “white”</td>
</tr>
<tr>
<td>1 unit with two “whites”</td>
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<td>1 unit with three “whites”</td>
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How The NRC’s New Assessment Process Works
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<th>Plant Performance</th>
<th>Regulatory Response</th>
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<td><strong>Regional Response</strong></td>
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| All performance indicators and cornerstone inspection findings GREEN | • Routine resident inspector and staff interaction  
  • Normal baseline inspection program  
  • Annual assessment public meeting |
| No more than two WHITE inputs in different cornerstones | • Staff to hold public meeting with utility management  
  • Utility corrective action to address WHITE inputs  
  • NRC inspection follow-up on WHITE inputs and corrective action |
| One degraded cornerstone (two WHITE inputs or one YELLOW input or three WHITE inputs in any strategic area) | • Senior regional management to hold public meeting with utility management  
  • Utility to conduct self-assessment with NRC oversight  
  • Additional inspections focused on cause of degraded performance |
| **Headquarters Response** |                          |
| Repetitive degraded cornerstone, multiple degraded cornerstones, or multiple YELLOW inputs, or one RED input | • Executive Director for Operations to hold public meeting with senior utility management  
  • Utility develops performance improvement plan with NRC oversight  
  • NRC team inspection focused on cause of degraded performance  
  • “Demand for Information,” “Confirmatory Action Letter” or Order |
| Unacceptable performance—overall RED | • Plant not permitted to operate  
  • Commission meeting with senior utility management  
  • Order to modify, suspend, or revoke license |

**New Enforcement Process Reflects Safety Significance of Violations**
In March 1999, the NRC took two significant steps toward fundamentally reforming its enforcement policy: simplifying the enforcement process and sharpening the focus of enforcement to reflect the safety significance of violations.

First, the NRC issued an interim enforcement policy and procedure on level IV violations—those of least safety significance. The new approach recognizes that level IV violations have little or no risk significance. The NRC’s treatment of these violations has changed so that nuclear plants no longer are required to provide the NRC with a formal response to violations of little risk significance. Nuclear plants will address these violations through their corrective action programs and determine their priority based on their relative safety significance.

Second, the NRC unveiled a proposal for more comprehensive reform of enforcement policy, which includes the interim changes to treatment of level IV violations. The proposal was designed to ensure that future enforcement actions are consistent with the proposed inspection and assessment processes. The revised enforcement process, which became effective on May 1, 2000, permits NRC staff to evaluate the significance of a violation in the same way staff evaluates the results of plant inspections and to tie enforcement action to the safety significance of the violation. When the NRC finds a violation that is considered “significant”—a level III and above—the agency will issue a Notice of Violation that requires the nuclear plant to submit a formal written response. Typically, a civil penalty will not be issued unless the violation involves willfulness, actions that may have an impact on the NRC’s ability to carry out its oversight responsibility, or actual consequences, such as an overexposure to radioactive material.

In contrast to previous practice, the significance of each violation will be determined without taking into account a nuclear plant’s historical performance. Since enforcement action will be based now on objective criteria, the results are far more likely to be consistent, predictable and understandable to nuclear plants and the public. These features should lead to increased public confidence.

Enforcement reform complements the NRC’s new nuclear plant inspection and assessment processes, both of which use risk insights to evaluate plant performance.

The industry believes that regulation must have a clear nexus to objective safety standards. The key to reform is in the efficient use of risk insights to better focus resources on safety-significant matters. The existing deterministic requirements, to which the plants were designed and licensed, served well in providing a robust design with a strong defense-in-depth. They do not work as well in pointing out where to place operational focus.

There is growing support within the industry and the NRC to move toward a risk-informed, performance-based regulatory process, made possible by the development of an analytical tool called “probabilistic safety assessment.” For risk-informed, performance-based regulation to be successful, however, it must improve regulatory efficiency. It must replace existing requirements, where appropriate, and not become an additional set of prescriptive regulatory requirements layered on top of existing inefficient and subjective practices.

In a risk-informed, performance-based approach, the NRC establishes basic requirements and sets overall performance goals. Then plant management decides how best to meet those goals. Risk-informed, performance-based regulation is more sharply focused on safety than the current approach, because resources are applied to plant systems and equipment commensurate with their importance to safety. This approach blends operating experience and engineering judgment with information on the relative safety significance of various systems and equipment.

In 1999, the Nuclear Regulatory Commission launched a two-part program to implement risk-informed improvements to its regulations. The first part—risk-informing NRC “special treatment” requirements—focuses on those regulations that impose special controls and qualification requirements on equipment and licensee activities. The second part—risk-informing NRC technical requirements—is intended to improve the regulatory design bases.

**Special Treatment Requirements**
In March 2000, the NRC issued an Advanced Notice of Proposed Rulemaking for risk-informing its special treatment requirements. As a parallel activity, the industry has funded a series of pilot projects to better assess the implementation and benefits of such a rule before the rule is finalized. The industry and the NRC are working on developing an implementation guideline that will be tested in the pilot projects. Lessons
learned from the pilot projects and stakeholder comments will be incorporated into the final rule.

**Technical Requirements**

The approach for improving the technical requirements is centered on those regulatory sections that consume resources to a degree that is inconsistent with the section’s safety significance. In January 2001, the Commission approved NRC staff recommendations to proceed with expedited rulemaking on the first risk-informed technical regulation to be assessed under the risk-informed rubric, 10 CFR 50.44, *Standards for combustible gas control systems in light-water-cooled power reactors*. In June, the NRC staff is scheduled to make recommendations on risk-informing 10 CFR 50.46, *Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors*. 