NRC'S Revised Performance Based Inspection, Assessment And Enforcement Program

Robert F. Yewdall

PSEG Nuclear LLC

The US Nuclear Regulatory Commission (NRC) has established a revised regulatory oversight process. The purpose of the new program is to establish a more objective, safety-focused process for maintaining oversight of nuclear power plants, while reducing unnecessary regulatory burden of utilities.

Background

The program was initiated in June 1999 when nine commercial nuclear power stations were selected as part of a pilot program. The pilot program ran for six months in 1999 in order to test process effectiveness and to identify possible problems. The stations selected were a cross-section of reactor types, size, vintage and regulatory region. The nine stations are listed in Figure 1.

The process was initiated and driven by the Nuclear Energy Institute (NEI). However, the program change was due to a cooperative effort by all 'stakeholders'. The revised program was developed through open discussions, numerous meetings and dissemination of information in several mediums, but very effectively by the Internet technology. Players included utility representatives, NEI, the USNRC, Institute of Nuclear Power Operations (IMPO), and the general public.

The NRC incorporated lessons learned from the pilot program, meeting with representatives of the nuclear industry and general public then began initial implementation of the revised ROP for all plants in April 2000. After a year of experience is gained in the new process, the NRC anticipates making further improvements.

Changes to the NRC's Reactor Oversight Process

The NRC recently revised its reactor oversight process (ROP) to make it more risk-informed, objective, predictable, understandable, and focused on areas of greatest safety significance. Key features of the new program are a risk-informed regulatory framework, risk-informed inspections, a significance determination process to evaluate inspection findings, performance indicators, a streamlined assessment process, and more clearly defined actions the NRC will take for plants based on their performance.

In general terms, the NRC uses inspection findings and performance indicators to assess plant performance within a regulatory framework of seven cornerstones of safety. The revised ROP recognizes that issues of very low safety significance inevitably occur, and

plants are expected to effectively address these issues. The NRC may take additional actions to ensure significant performance issues are addressed, as necessary.
The revised ROP takes into account improvements in the performance of the nuclear industry over the past twenty-five years and improved approaches of inspecting and evaluating the safety performance of NRC licensed plants. The improvements in plant performance can be attributed both to efforts within the nuclear industry and to successful regulatory oversight. The impetus behind this comprehensive change in approach came both from the NRC's own fundamental reviews of its regulatory program as part of the "reinventing government" process, and from concerns expressed by public interest groups, the nuclear industry, and Congress. The revised ROP is consistent with the NRC's objectives of maintaining safety, enhancing public confidence, improving the effectiveness and efficiency of our processes, and reducing unnecessary regulatory burden. While the oversight process is changing, the regulatory structure that provides the foundation upon which safe operation is based remains unchanged.

Impact[1]

The NRC has already made significant changes in its inspection, assessment, and enforcement processes in response to this initiative. The SALP process has been terminated. The Watch List process has been suspended. NRC has instructed its resident inspectors to focus activity on more risk-significant areas, resulting in a precipitous decline in Level IV violations. The Enforcement Policy has been revised to minimize the paperwork reporting for minor violations. The eventual impact will be a rational methodology for inspection, assessment and enforcement of NRC licensees, which will save resources, and focus NRC and licensees on risk-significant issues. Civil penalties and severity levels should be eliminated for most violations. The consensus process used in the development of this new oversight approach will also provide a success model for other consensus activities between NRC and the industry to risk-informed the regulations.

References

NEI 99-02 Regulatory Assessment Performance Indicator Guideline March 2000, Nuclear Energy Institute, 1776 I Street N.W., Suite 400 Washington, DC

SECY-99-007 Recommendations For Reactor Oversight Process, Dated Jan. 8, 1999

RIS 2000-08 NRC Regulatory Issue Summary 2000-8 Voluntary Submission of Performance Indicator Data; Dated March 29, 2000

NRC's Internet Public WEB Site

NEI – Internet WEB Site

NUREG 1649 New NRC Reactor Inspection and Oversight Program

1. Excerpt from NEI's WEB Page Revised ROP Summary

Figure 1

Pilot Program Stations

	Station	Reactor Type	Size (MW_e/MW_t)	Company	NRC Region
1	Copper	BWR	764/2281	Nebraska Public Power District	IV
2	FitzPatrick	BWR	762/2536	New York Power Authority	I
3	Ft. Calhoun	PWR	478/1500	Omaha Public Power District	IV
4a	Hope Creek	BWR	1031/3293	Public Service E&G Co.	I
4b	Salem 1 & 2	PWR	1106/3411	Public Service E&G Co.	I
5	Prairie Island 1 & 2	PWR	512/1650	Northern States Power Co.	III
6	Quad Cities 1 & 2	BWR	769/2511	Commonwealth Edison Co.	III
7	Sequoyah 1 & 2	PWR	1117/3411	Tennessee Valley Authority	II
8	Shearon Harris	PWR	860/2775	Carolina Power & Light Co.	II

BWR – Boiling Water Reactor
PWR – Pressurized Water Reactor

Region I – Northeast
Region II – Southeast
Region III – Central
Region IV – West and Southwest

Figure 2

The performance assessment process previously involved three processes:

- **Plant Performance Review** - Conducted every six months to assess events, inspection findings, and other data. This review was done to plan future inspections and to identify those plants with declining performance that required further NRC action.

- **Senior management meetings** - Twice a year, NRC senior managers reviewed information assessing plant performance to discuss what regulatory action was needed at plants with declining performance. The managers designated those plants warranting heightened NRC monitoring as being on a "watch list." These "watch list" plants were then discussed at a public meeting with the Commission.

- **Systematic Assessment of Licensee Performance** (SALP) - Every 12 to 24 months, the NRC staff performed a separate review of the performance of each plant, preparing a Systematic Assessment of Licensee Performance report. This report included a numerical rating of the plant in four categories -- plant operations, maintenance, engineering, and plant support -- as well as a narrative discussion of performance in each area.

Figure 3

How This New Oversight Process Differs from the Previous Approach

The previous oversight process evolved over a period of time when the nuclear power industry was less mature and there was much less operational experience on which to base rules and regulations. Very conservative judgments governed the rules and regulations. Significant plant operating events occurred with some frequency, therefore the oversight process tended to be reactive and prescriptive, closely observing plant performance for adherence to the regulations and responding to operational problems as they occurred.

Now there is the benefit of four decades of operational experience and, generally speaking, steadily improving plant performance, particularly over the last decade or so. The new program focuses more of the NRC's resources on the relatively small number of plants which evidence performance problems. The baseline inspection program is considered the minimum inspection effort needed to assure that plants meet the "safety cornerstone" objectives. The baseline inspection program is performed at all reactor sites by NRC resident inspectors and inspectors from the regional offices.

Plants which do not meet the "safety cornerstone" objectives, measured by performance indicators and inspection findings, will receive increased inspection, focusing on areas of declining performance. There will also be inspections beyond the baseline program, even at plants performing well, if there are operational problems or events the NRC believes require greater scrutiny. Generic problems, affecting some or all plants, may also require additional inspections.

The previous oversight program relied more heavily on fines when violations occurred, while the new program will make broader use of other enforcement tools such as orders and other formal regulatory actions. When fines were imposed previously, they were often issued long after the violations occurred and their impact was substantially less than the cost of repairs or the costs associated with a shutdown to correct the violations. The new process is intended to be more effective in correcting performance or equipment problems because the agency's response will be both more timely and more predictable.

The new assessment program is substantially different from the previous process. It makes greater use of objective performance indicators. Together, the indicators and inspection findings provide the information needed to support reviews of plant performance, to be conducted on a quarterly basis, with the results posted on the NRC's Internet site.

The new assessment process also features expanded reviews on a semi-annual basis to include inspection planning and a performance report, all of which will also be posted on the NRC's web site.

Figure 4

Communications/Making Information Available to the Public

The revised oversight process will provide more information on plant performance than in the past, and the information will be available on a more frequent basis. This information will be placed on the NRC's Internet web site as well as in its Public Document Room at NRC headquarters.

A utility will submit to the NRC the quarterly performance indicator data for each nuclear power plant it operates. The NRC staff will review the data for completeness and accuracy. The staff will also evaluate inspection findings for that quarter to determine their safety significance. This review uses the agency's "Significance Determination Process," which is keyed to how plant safety systems and procedures contribute to the risk of a potential accident.

The performance indicators and the assessment of inspection findings will be placed on the NRC web site using the color notation of their significance -- green, white, yellow, or red. The statistics and inspection findings which underlie the color notation will also be posted on the web site.

The revised oversight program is intended to fulfill the following four goals established by the Commission:

1. To maintain safety by establishing a regulatory oversight framework that provides assurance that plants continue to be operated safely by plant operators. Maintaining safety is the NRC's overarching mission.

2. To enhance public confidence in the NRC's regulatory program by increasing the predictability, consistency, objectivity and transparency of the oversight process so that all parties will be well served by the changes taking place.

3. To improve the effectiveness, efficiency, and realism of the oversight process by focusing both agency resources and utility resources on those issues with the most safety-significance.

4. To reduce unnecessary regulatory burden as the process becomes more efficient and effective.

Figure 5

Violations of NRC Requirements

Each violation of NRC requirements found during NRC inspections will be evaluated to determine its effect on plant safety and risk. If the violation is of very low safety significance, it will be discussed in the inspection report with no formal enforcement action. The utility is expected to deal with the violation through its corrective action program, correcting the violation and taking steps to prevent a recurrence. The issue may also be reviewed during future NRC inspections.

If the NRC risk evaluation finds that the violation has higher safety significance, a Notice of Violation will be issued. A Notice of Violation may also be issued if the utility fails to correct a violation of low safety significance in a reasonable period of time or if a violation is found to be willful.

The Notice of Violation requires the utility to respond formally to the NRC with its actions to correct the violation and what steps it will take to prevent the violation from occurring again. The agency will then review the utility's actions in a later inspection.

Normally, these violations will not be the subject of a fine. However, there may be violations that warrant a fine because of their unusual significance. These violations are likely to be uncommon. Possible examples include exceeding a safety limit specified in a reactor license or the inadvertent startup of a reactor.

In addition, some violations will call for the traditional enforcement approach, including the possible issuance of fines. Examples include:

- Discrimination against workers for raising safety issues or other willful violations.

- Actions that may adversely affect the NRC's ability to monitor utility activities, including failure to report required information, failure to obtain NRC approval for plant changes, failure to maintain accurate records, or failure to provide the NRC with complete and accurate information.

- Incidents with actual safety consequences, including radiation exposures above NRC limits, releases of radioactive material above NRC limits, or failure to notify government agencies when emergency response is required.

Figure 6

NRC Response to Plant Performance

The quarterly reviews of plant performance, using both the performance indicators and inspection findings, will determine what additional action, if any, the NRC will take if there are signs of declining performance. This approach to enforcement is intended to be more predictable than previous practices by linking regulatory actions to performance criteria. The new process utilizes four levels of regulatory response with NRC regulatory review increasing as plant performance declines. The first two levels of heightened regulatory review are managed by the appropriate regional office. The next two levels call for an agency response, involving senior management attention from both headquarters and regional offices.

The oversight program retains the same tools used in the past for dealing with declining plant performance and violations. These tools, however, are used in a more predictable manner that is commensurate with the decreased safety performance. In the past, the NRC tended to use fines as a prime indicator of agency concern and as a motivator to affect licensee corrective actions. Under the new approach, there is a system of specified agency actions if performance declines. Fines will generally be reserved for such things as discriminating against workers raising safety concerns, or willful misreporting of required information.

The NRC's actions for performance below the "green" level may include meetings with the utility, additional inspections, and required reviews and response by the utility. Further declines in performance would warrant stronger action by the NRC, including a civil order or even the suspension of the utility's operating license.

Figure 7

Assessing Plant Performance

The inspection staff has developed a procedure, called the "Significance Determination Process," to help inspectors determine the safety significance of inspection findings. This process will be used for an initial screening review to identify those inspection findings that would not result in a significant increase in risk and thus need not be analyzed further (a "green" finding) . Remaining inspection findings -- which may have an effect on plant risk -- will then be subject to a more thorough risk assessment, using the next phase of the Significance Determination Process. This more detailed assessment may involve NRC risk experts from the appropriate regional office and further review by the utility's plant staff. The final outcome of the review -- evaluating whether the finding is green, white, yellow, or red -- will be used to determine what further NRC action may be called for.

Each calendar quarter, the resident inspectors and the inspection staff in the regional office will review the performance of all nuclear power plants in that region, as measured by the performance indicators and by inspection findings. Every six months, this review will be expanded to include planning of inspections for the following 12-month period.

Each year, the final quarterly review will involve a more detailed assessment of plant performance over the previous 12 months and preparation of a performance report, as well as the inspection plan for the following year. This review will include NRC headquarters staff members, the regional staff, and the resident inspectors.

These annual performance reports will be available to the public on the agency's web site, and the NRC staff will hold public meetings with utilities to discuss the previous year's performance at each plant.

In addition, NRC senior management will review the adequacy of agency actions for plants with significant performance problems. The managers will also take a wider view both of the overall industry performance and of the performance of the agency's regulatory programs. The performance of plants requiring heightened agency scrutiny will then be discussed during a public meeting with the NRC Commissioners at the agency's Rockville, Maryland, headquarters.

Figure 8

Inspection Programs

The revised oversight program continues to utilize a variety of NRC inspectors who monitor plant activities. The program includes baseline inspections common to all nuclear plants. The baseline inspection program, based on the "cornerstone" areas, focuses on activities and systems that are "risk significant," that is, those activities and systems that have a potential to trigger an accident, can mitigate the effects of an accident, or increase the consequences of a possible accident. The inspection program will also review the "cross-cutting issues" of human performance, the "safety-conscious work environment," and how the utilities find and fix problems. Inspections beyond the baseline will be performed at plants with performance below established thresholds, as assessed through information gained from performance indicators and NRC inspections. Additional inspections may also be performed in response to a specific event or problem which may arise at a plant.

The inspections will be performed by NRC resident inspectors stationed at each nuclear power plant and by inspectors based in one of the four NRC regional offices or in NRC headquarters in Rockville, Maryland. The regional offices are in King of Prussia, Pennsylvania; Atlanta, Georgia; Lisle, Illinois; and Arlington, Texas.

The new inspection program uses a "risk-informed" approach to select areas to inspect within each cornerstone. The inspection areas were chosen because of their importance from the point of view of potential risk, past operational experience, and regulatory requirements.

The baseline inspection program has three parts -- inspection of areas not covered by performance indicators or where a performance indicator does not fully cover the inspection area; inspections to verify the accuracy of a licensee's reports on performance indicators; and a thorough review of the utility's effectiveness in finding and resolving problems on its own.

Inspection reports will be issued for all inspections just as under the previous inspection program

Figure 9

To measure plant performance, the oversight program focuses seven on specific "cornerstones" which support the safety of plant operations in the three broad strategic areas.

Initiating Events - This cornerstone focuses on operations and events at a nuclear plant that could lead to a possible accident, if plant safety systems did not intervene. These events could include equipment failures leading to a plant shutdown, shutdowns with unexpected complications, or large changes in the plant's power output.

Mitigating Systems - This cornerstone measures the function of safety systems designed to prevent an accident or reduce the consequences of a possible accident. The equipment is checked by periodic testing and through actual performance.

Barrier Integrity - There are three important barriers between the highly radioactive materials in fuel within the reactor and the public and the environment outside the plant. These barriers are the sealed rods containing the fuel pellets, the heavy steel reactor vessel and associated piping, and the reinforced concrete containment building surrounding the reactor. The integrity of the fuel rods, the vessel, and the piping is continuously checked for leakage, while the ability of the containment to prevent leakage is measured on a regular basis.

Emergency Preparedness - Each nuclear plant is required to have comprehensive emergency plans to respond to a possible accident. This cornerstone measures the effectiveness of the plant staff in carrying out its emergency plans. Such emergency plans are tested every two years during emergency exercises involving the plant staff and local, state, and, in some cases, federal agencies.

Occupational Radiation Safety - NRC regulations set a limit on radiation doses received by plant workers, and this cornerstone monitors the effectiveness of the plant's program to control and minimize those doses.

Public Radiation Safety - This cornerstone measures the procedures and systems designed to minimize radioactive releases from a nuclear plant during normal operations and to keep those releases within federal limits.

Physical Protection- Nuclear plants are required to have well-trained security personnel and a variety of protective systems to guard vital plant equipment, as well as programs to assure that employees are constantly fit for duty through drug and alcohol testing. This cornerstone measures the effectiveness of the security and fitness-for-duty programs.

Figure 10

Performance Indicators by Cornerstone

Performance indicators are reported quarterly by operators of nuclear plants, reviewed by the NRC staff, and posted on the NRC's web site.	
Safety Cornerstone	**Performance Indicator**
Initiating events	Unplanned reactor shutdowns (automatic and manual)
	Loss of normal reactor cooling system following unplanned shutdown
	Unplanned events that result in significant changes in reactor power
Mitigating Systems	Safety System not available • Specific Emergency Core Cooling Systems • Emergency Electric Power Systems
	Safety System Failures
Integrity of barriers to release of radioactivity	Fuel Cladding (measured by radioactivity in reactor cooling system)
	Reactor cooling system leak rate
Emergency Preparedness	Emergency response organization drill performance
	Readiness of emergency response organization
	Availability of notification system for area residents
Occupational Radiation Safety	Compliance with regulations for controlling access to radiation areas in plant
	Uncontrolled radiation exposures to workers greater than 10 percent of regulatory limit
Public Radiation Safety	Effluent releases requiring reporting under NRC regulations and license conditions
Physical Protection	Security system equipment availability
	Personnel screening program performance
	Employee fitness-for-duty program effectiveness

Figure 11

Evaluation of Performance Indicator Data

The performance indicator data will be evaluated and integrated with findings of the NRC inspection program. Each of the performance indicators has criteria for measuring acceptable performance. (As in all industrial activities, nuclear power plants are not error-free or risk-free. Equipment problems and human errors will occur. Each performance indicator is designed to determine acceptable levels of operation within substantial safety margins.) These objective criteria are designed to reflect risk according to established safety margins, as indicated by a color coding system.

Green coding indicates performance within an expected performance level in which the related cornerstone objectives are met

White coding indicates performance outside an expected range of nominal utility performance but related cornerstone objectives are still being met.

Yellow coding indicates related cornerstone objectives are being met, but with a minimal reduction in safety margin;

Red coding indicates a significant reduction in safety margin in the area measured by that performance indicator.

The performance indicators will be reported to the NRC on a quarterly basis by each utility. Following compilation and review by the NRC staff, the performance indicators will be posted on the NRC's web site

Page 12
Glossary

Baseline Inspection Program - The normal inspection program performed at all nuclear power plants. The program will focus on plant activities that are not adequately measured by performance indicators, on the corrective action program, and on verifying the accuracy of the performance indicators.

Corrective Action Program - The system by which a utility finds and fixes problems at the nuclear plant. It includes a process for evaluating the safety significance of the problems, setting priorities in correcting the problems, and tracking them until they have been corrected.

Cross-cutting Area - Nuclear plant activity that affects most or all safety cornerstones. These include the plant's corrective action program, human performance, and "safety-conscious work environment."

Inspection Reports - Reports are issued periodically to document inspection findings. These may cover a specific time period for the baseline inspection or a particular event or problem examined in a reactive inspection. All inspection reports are public documents and, when issued, are posted to the NRC's Internet web site.

Performance Indicator - Objective data which records performance in a specific cornerstone of safety at a nuclear power plant.

Reactive Inspection - An inspection to examine the circumstances surrounding an operational problem or event occurring at a nuclear plant.

Regulatory Conference - A meeting between the NRC staff and a utility to discuss potential safety issues or to discuss a change in performance as indicated by a declining performance indicator or inspection finding. These meetings are open to public observation unless they cover security issues, NRC investigation findings, or similar sensitive topics.

Resident Inspector - An NRC inspector assigned to a nuclear plant on a full-time basis. Each site has at least two resident inspectors.

Risk-informed - Incorporating an assessment of safety significance or relative risk in NRC regulatory actions

Cornerstone of Safety - Nuclear plant activities that are essential for the safe operation of the facility. These cornerstones are grouped under the categories of reactor safety, radiation safety, and safeguards.

Safety Conscious Work Environment - A working environment in which employees are encouraged to report safety concerns without fear of criticism or retaliation from their supervisors because they raised the issue.

Significance Determination Process - The process used by the NRC staff to evaluate inspection findings to determine their safety significance. This involves assessing how the inspection findings affect the risk of a nuclear plant accident, either as a cause of the accident or the ability of plant safety systems or personnel to respond to the accident.