UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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December 18, 2000

EA-00-248

J. H. Swailes, Vice President of
Nuclear Energy
Nebraska Public Power District
P.O. Box 98
Brownville, Nebraska 68321

SUBJECT: COOPER NUCLEAR STATION SPECIAL INSPECTION - NRC INSPECTION REPORT NO. 50-298/00-07; PRELIMINARY YELLOW FINDING

Dear Mr. Swailes:

On December 14, 2000, the NRC completed an inspection at the Cooper Nuclear Station facility. The enclosed report documents the inspection findings that were discussed on December 14, 2000, with Mr. J. McDonald and other members of your staff.

This report discusses an issue that appears to have substantial safety significance. The issue involves programmatic environmental qualification design, implementation, and documentation deficiencies. The deficiencies resulted in misapplication of approximately 2000 environmental qualification treatments affecting 600 components important to safety. As described in Section 03 of this report, this issue was assessed using the applicable significance determination process as a potentially safety significant finding that was preliminarily determined to be Yellow, i.e., an issue with substantial importance to safety that will result in additional NRC inspection and potentially other NRC action. The issue has a substantial safety significance because it had the potential to prevent operation of accident mitigation equipment. Although many components may have been affected, the significance determination process focused on the medium break loss of coolant accident scenario and the effect of the lack of qualified environmental qualification treatments on the safety relief valve tailpipe pressure switches. For this scenario, the NRC concluded that depressurization capability would have been lost.

The environmental qualification issue also appears to involve apparent violations of NRC requirements and is being considered for escalated enforcement action in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. “The current Enforcement Policy is included on the NRC’s website at www.nrc.gov/OE.”

Before the NRC makes a final decision on this matter, we are providing you an opportunity to request a Regulatory Conference where you would be able to provide your perspectives on the significance of the finding, the bases for your position, and whether you agree with the apparent violations. If you choose to request a Regulatory Conference, we encourage you to submit your

evaluation and any differences with the NRC evaluation at least one week prior to the conference in an effort to make the conference more efficient and effective. If a conference is held, it will be open for public observation. The NRC will also issue a press release to announce the conference.

Please contact Mr. Charles Marschall at 817/860-8185 within 7 days of the date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision and you will be advised by separate correspondence of the results of our deliberations on this matter.

Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for these inspection findings at this time. In addition, please be advised that the number and characterization of apparent violations described in the enclosed inspection report may change as a result of further NRC review.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Ken E. Brockman, Director
Division of Reactor Projects

Docket No.: 50-298
License No.: DPR-46

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NRC Inspection Report No.
50-298/00-07

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ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.:	50-298
License No.:	DPR 46
Report No.:	50-298/00-07
Licensee:	Nebraska Public Power District
Facility:	Cooper Nuclear Station
Location:	P.O. Box 98 Brownville, Nebraska
Dates:	April 19 through December 14, 2000
Inspectors:	J. Clark, Senior Resident Inspector M. Hay, Resident Inspector C. Osterholtz, Resident Inspector C. Paulk, Senior Reactor Engineer
Approved By:	C. Marschall, Chief, Project Branch C Division of Reactor Projects

ATTACHMENTS:
1. Supplemental Information
2. NRC's Revised Reactor Oversight Process

SUMMARY OF FINDINGS

Cooper Nuclear Station
NRC Inspection Report 50-298/00-07

This special inspection report covered the activities associated with inspection and assessment of environmental qualification issues.

The significance of issues is indicated by their color (green, white, yellow, red) and was determined by the Significance Determination Process in Inspection Manual Chapter 0609.

Cornerstone: Mitigating Systems

- ***TBD***. The inspectors identified multiple programmatic deficiencies involving the design, implementation, and documentation of environmental qualification applications. The programmatic deficiencies resulted in the existence of approximately 200 applications affecting approximately 600 components important to safety. Although many accident mitigation scenarios may have been affected, the Significance Determination Process focused on the medium-break loss-of-coolant-accident (LOCA) scenario. The NRC concluded that the lack of proper environmental qualification treatments for the safety relief valve tailpipe pressure switches would have resulted in an inability of the valves to perform their depressurization function. The loss of the depressurization function would result in only one train retaining the capability of high pressure coolant injection. As a result, the NRC concluded that, for this scenario, the reduced capability for mitigation of a medium-break LOCA resulted in substantial safety significance (Section 03).

- ***TBD***. The failures to environmentally qualify, maintain the qualification of, and document qualifications in an auditable form, for equipment important to safety, constituted an apparent violation of 10 CFR 50.49 (Section 02.02).

- ***TBD***. Plant personnel failed to identify problems with the environmental qualifications program until they were specifically characterized by the NRC. Plant personnel also failed to identify problems with equipment that did not meet program requirements during field walkdowns. In addition, plant personnel failed to enter self-identified deficiencies, in the environmental qualifications program, into the corrective action program. These failures to properly identify problems and enter them into the corrective actions process constituted an apparent violation of 10 CFR Part 50, Appendix B, Criterion XVI (Section 02.04).

- ***TBD***. The failures to ensure that environmentally qualified components had condensate drain measures described in design drawings, to properly test the containment spray valves, and to account for the effect of nonessential 125 Vdc loads on the operability of essential equipment during design basis accidents, were an apparent violation of 10 CFR Part 50, Appendix B, Criterion III (Section 02.05).

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Report Details

SPECIAL INSPECTION ACTIVITIES

01 Inspection Scope

The NRC staff conducted this special inspection to determine the risk significance, extent of condition, and the apparent causes of environmental qualification program deficiencies identified at the Cooper Nuclear Station. Following identification of degraded splice treatments, the plant was in a forced outage from April 18 to May 26, 2000, to resolve identified problems with the environmental qualifications program. The inspectors reviewed procedures, conducted field observations, and interviewed plant personnel throughout the forced outage. The inspectors used Inspection Procedure 93812, "Special Inspection Procedure," to conduct the inspection and gather information for conducting risk significance determinations after the plant was restarted. In addition, they used Inspection Procedure 71152, "Identification and Resolution of Problems," to assess corrective actions.

As part of their ongoing review, on September 27, 2000, plant engineers questioned the environmental qualification of the safety relief valve tailpiece pressure switches. The engineers noted that installed switches did not have conduit seals, as shown in the qualification report, and were susceptible to grounding under a harsh environment. The engineers observed that these switches were located in the same electrical circuit as the control power for the safety relief valves. The grounding of these switches, during a design basis loss-of-coolant accident (LOCA), could cause the loss of the safety relief valve depressurization function due to electrical supply failure. The inspectors gathered additional information about the design and installation of these components and their support systems. Plant engineers developed an operability evaluation for these switches and their effect on the safety relief valves. The inspectors reviewed this operability evaluation and conducted additional interviews with plant personnel to assess the potential risk of the unqualified tailpiece pressure switches. The NRC staff conducted additional reviews of the overall environmental qualifications issue, with the addition of the tailpiece pressure switches, to finalize the significance determination.

02 Special Inspection Areas

02.01 Overview and Sequence of Events

Engineering personnel began several design reviews in 1999, while preparing for the use of GE-14 fuel assemblies during Operating Cycle 20. The engineers reviewed the containment temperature and pressure response to design basis accidents. On February 8, 2000, they identified a potential discrepancy with the assumed peak temperature of the containment following a LOCA. General Electric assumed a value of 340°F for plants with a Mark I containment, such as Cooper. The engineers noted a value of 295°F was shown in Updated Safety Analysis Report Figure XIV-6-8 for the station environmental qualification profile of the containment. A problem identification report (PIR 4-00683) was written to enter this problem into the corrective action process. The engineers subsequently determined that a previous error was made by environmental engineers in assuming the large-break LOCA was the limiting condition,

instead of a small-break LOCA. A small-break LOCA would produce a higher accident temperature. Engineering personnel further evaluated the error in design basis for peak containment temperature, after a LOCA, through another problem identification report (PIR 4-07770).

While evaluating this error on April 10, 2000, the licensee identified several questions about the adequacy of environmental qualification of numerous installed configurations at the facility. One of the specific questions dealt with the existence of cable splices in the drywell that were insulated with Okonite® tape. The qualifications reports, in the licensee's environmental qualifications data packages, did not support the use of Okonite® tape above 314°F. The plant was in a refueling outage at this time. Engineers began working on an operability evaluation to raise the qualified temperature of Okonite® tape to 340°F, and support startup of the plant.

Between April 11 and 14, 2000, the NRC discussed with plant engineers and management the concerns with Okonite® tape use, the potential extent of condition, and the basis for operability. The inspectors were concerned that Okonite® tape was found in questionable configurations at the plant in 1990 and that two previously submitted test reports for Okonite® tape were rejected by the NRC. The inspectors noted that deficiencies in application methods of Okonite® tape could lead to splices being in configurations that were not supported by test reports. 10 CFR 50.49 requires licensees to ensure that electrical equipment important to safety will be able to meet its performance specifications under conditions existing during and following design basis accidents. Therefore, the questionable configurations are not qualified to ensure performance during a postulated accident.

The inspectors were also concerned that engineering personnel could not produce a list of potentially affected components. The engineers stated that the environmental qualification program at Cooper allowed several methods of qualification for installation of a splice. The inspectors were concerned that there was no available documentation to show as left conditions of the Okonite® tape treatments. The inspectors expressed concerns to plant management that potentially noncompliant Okonite® tape splices may be in the containment. The inspectors further expressed concerns that, without a list of affected equipment, the overall risk associated with potential failures of these splices could not be determined.

The inspectors noted several problems with the translation of design basis information into plant procedures for the maintenance of environmentally qualified components. The inspectors noted that environmental qualifications program personnel continued to rely on Okonite® tape treatments even though numerous industry problems had been identified with certain configurations of this tape. The inspectors also noted that engineers developed a number of justifications for continued operation with the use of Okonite® tape, to resolve previous NRC concerns, in 1990 and 1991.

On April 14, 2000, engineering and maintenance personnel made an entry into the containment to visually inspect three terminal boxes for Okonite® tape-insulated splices. These boxes contained wiring for temperature elements that provide Regulatory Guide 1.97 indications. An NRC inspector accompanied the team. The team found that the

boxes contained Okonite® tape-insulated splices. The team, and the inspector, also noted that the outer layer of tape was unwrapping on most of the splices. On several splices, the initial substrate layer of tape was visible. The inspectors were concerned that the outer tape was not properly protecting, and holding in place, the inner tape. The outer wrap coverage was clearly described as part of the required configuration in the environmental qualification test reports for Okonite® tape.

On April 15, 2000, inspectors discussed specific concerns with the observed Okonite® tape applications with plant management. The inspectors observed that, along with the Regulatory Guide 1.97 instrumentation, other vital equipment in the drywell might be deficient. These deficiencies could result in substantial risk. The inspectors stated that, given the potential for a substantial increase in risk, they were concerned with the startup of the facility, scheduled for the next day. Plant management requested a conference call with NRC management. On April 16, 2000, regional management and NRC technical specialists from headquarters, the regional staff, and the resident staff participated in a conference call with plant management and environmental engineering staff. The plant staff failed to understand the significance of the Okonite® tape deficiencies, specifically the purpose of the outer tape layer. After NRC personnel explained environmental qualification requirements and their significance to the licensee, the plant manager decided to place a hold on plant startup. In addition, he initiated a problem identification report and further investigation into the use of Okonite® tape applications.

Between April 16 and 19, 2000, maintenance and engineering personnel conducted further inspections of environmental qualification treatments in the drywell and the steam tunnel. NRC personnel accompanied the plant staff on some of these entries. The teams discovered additional problems with Okonite® tape-insulated splices, in various locations, including components of the high pressure coolant injection and the reactor core isolation cooling systems. Additional components of the main steam system and the residual heat removal system were also found to have splice treatments in unqualified configurations. The NRC was concerned with the potential risk significance of this issue. To determine the risk significance, extent of condition, and the apparent causes of environmental qualification program deficiencies identified at the Cooper Nuclear Station, the NRC commenced the special inspection on April 19, 2000.

The inspectors and plant staff subsequently identified discrepancies in other types of environmental qualification treatments and components. Plant staff replaced or repaired over 2000 electrical connections or environmental qualification configurations, involving over 600 components. These included terminal boards, other taping systems, questionable application of shrink tubing, and inadequacies of equipment condensate drains. On September 27, 2000, plant staff identified that tailpiece pressure switches for the safety relief valves were not in a configuration that was supported by test reports. Additionally, nonqualified 125 Vdc loads were found in containment that could have failed during a LOCA and adversely impacted essential equipment. The tailpiece pressure switches were repaired during a forced outage on October 16, 2000.

02.02 Treatment Deficiencies and Documentation Files

Based upon industry experience, and information from NRC specialists, the NRC staff determined that splices which did not have a supporting test configuration, or were installed contrary to test report requirements, would not survive the harsh environments encountered during design basis accidents. The inspectors further determined, from environmental qualification test reports, that these failures could cause ground paths that would blow fuses, reduce required operating voltages below minimum acceptable levels, or produce other electrical problems that would render the associated piece of equipment inoperable.

The inspectors and plant staff initially focused attention on Okonite® tape treatments on electrical splices in the drywell. Numerous Okonite® tape treated splices were found to have a variety of configuration problems. On April 20, 2000, the inspectors examined approximately 40 Okonite® tape splices that were removed from the drywell. The inspectors informed engineering personnel that none of theses splices appeared to meet test report configurations. Splice deficiencies included loose or misapplied outer tape, spaces or nicks in the outer tape, insufficient tape coverage of the splice, excessive bend radius of the splice, use of the tape on unapproved wiring, and tape extending over braided jacket material (creating a wick path). The tested configurations for Okonite® tape did not display these characteristics. Plant personnel also bisected some of the Okonite® tape-insulated splices for detailed examination. They found additional problems with splice hardware protruding through the inner tape and incorrect splice hardware. Engineering personnel, and plant management, concluded that they could not have reasonable assurance that Okonite® tape could be applied, and be maintained, in test report configurations that demonstrated environmental qualification. Therefore, a comprehensive plan was developed to replace all Okonite® tape, in any environmental qualification application, with other approved methods of qualification.

Maintenance and engineering personnel began replacement activities, of the nonconforming Okonite® tape-insulated splices, with a 3-M® tape treatment. However, the inspectors were concerned that many of the deficiencies, observed with the Okonite® tape, were related to the application methods, rather than the material. The inspectors checked several of the new splices and noted similar problems to the Okonite® tape-insulated splices.

The inspectors asked engineering and maintenance personnel for a lab demonstration of application techniques. During this demonstration, plant maintenance personnel were unable to produce a splice that met their own procedures for 3-M® tape application. The inspectors noted that, besides being a very cumbersome task, the craft also did not perform some steps as they were stated in the procedure. An example of this was the application of the outer tape layer. The instructions called for the application of two half-lap layers of tape, applied from the middle of the splice to one end of the splice, back to the other end of the splice, and ending in the middle of the splice. The inspectors noted that each time the craft performed a splice, they began taping at one end of the splice, went to the other end of the splice, and ended at the original end of the splice. While this produced two half-lap layers, as called out in the procedure, the inspectors noted that the start/finish end was not doubled over. That left the end of the

splice loose and susceptible to unwrapping and to providing an ingress path for moisture. The inspectors questioned the workers, peer quality control personnel observing the task, and maintenance supervision about the observed discrepancies in the tape application. All of the personnel stated to the inspectors that they did not see a problem with what was being done.

The inspectors informed plant management of their observed problems with the use of 3-M® tape-insulated splice applications. The inspectors were also concerned that the licensee did not have an approved test configuration for the use of 3-M® tape. The inspectors reviewed documentation that plant engineers were using to develop a configuration justification. The inspectors also provided this information to NRC environmental qualification specialists at headquarters. The NRC staff noted several problems with the applicability of the documentation to the plant specific use of the treatments. The NRC staff also noted that several key elements of environmental qualification requirements, such as leakage current measurements and hi-pot testing, were not demonstrated in this documentation.

Plant engineers and management halted all splice replacement activities with 3-M® tape. They conducted a review of the 3-M® tape application methods, available test report information, and viability of using other environmental qualification treatments. Plant management decided to employ Raychem® heat shrink tubing in as many of these applications as possible. Plant management ordered the replacement of existing Okonite® and 3-M® tape-insulated splices, throughout the plant, with Raychem® treatments. This decision was made regardless of mild or harsh environment considerations for a specific application. Equipment affected by these repairs included numerous emergency core cooling system components, safety-related support equipment for the emergency core coolant system, safe shutdown equipment, and instrumentation necessary to assess plant conditions during and following an accident as discussed in Regulatory Guide 1.97.

The inspectors also discussed high energy line break analyses with plant engineers. The inspectors noted that some of the environmental qualification data packages lacked detailed high energy line break analyses for applicable areas of the plant. The inspectors were also concerned that some areas of the plant had been modified without updating the high energy line break analyses. An example of this was the removal of floor plugs, in the reactor building quads, for ventilation enhancements. The inspectors noted that, after removing the floor plugs, plant staff did not fully analyze the effect of releasing steam into previously analyzed mild environment areas of the plant. On June 21, 2000, engineers initiated a problem identification report (PIR 4-10031) addressing inconsistent application of assumptions, modeling errors, and inadequately developed human response actions for various high energy line break analyses throughout the plant. Due to the demonstrated problems with taped splices in such environments, plant management initiated a review of taped splices throughout the plant. In a licensee event report (LER-2000-008), plant management committed to performing additional high energy line break analyses by the end of this year.

The inspectors observed that the lack of an adequate list, or database, of treatment

types and locations initially hampered plant personnel in splice inspection activities. The inspectors noted that the requirements to maintain the environmental qualifications of components was called out in the Equipment Data File and in various environmental qualification data packages. The inspectors also observed that there were individual procedures for the application of various environmental qualification treatments, including variations for different termination or splice configurations. However, the inspectors noted that there was no requirement to maintain records regarding specific as left conditions of splices.

While the inspectors noted that environmental qualification data packages referenced acceptable methods for treatments, they did not require a specific treatment. As an example, a control cable in a motor-operated valve could be treated with Okonite®, 3-M® tape, or Raychem® heat shrink tubing. The splice could also be made with butt splices or with terminal lugs connected with nuts and bolts. The inspectors observed that, since any of these configurations were considered acceptable, planners and field personnel could specify their own preference. The inspectors noted that completed work packages may state that work was conducted in accordance with an applicable environmental qualification data package and not list the specific treatment or configuration installed in the plant. The inspectors were concerned that this could produce many different configurations in the plant. If a deficiency in a specific treatment method was identified, such as improper field application techniques or a generic material concern, there was no auditable way to identify which particular plant components utilized that treatment. Therefore, plant personnel would be unable to assess the impact of a such a deficiency. This problem was clearly observed by the inspectors as plant personnel took days to determine where Okonite® tape was used. Subsequently, weeks of visual observations were required, on all environmentally qualified splices, to verify their type and configuration.

During investigations for significant condition reports associated with the environmental qualifications issues, plant personnel also determined that other referenced information, from environmental qualification data packages, was not being incorporated in plant procedures. For example, plant personnel found discrepancies between recommended and actually scheduled maintenance in 21 of 95 preventive maintenance packages reviewed.

Section (a) of 10 CFR 50.49 states that each licensee shall establish a program for qualifying specified electric equipment. Section (a)(1) of 10 CFR 50.49 specifies the environmental qualification requirements for safety-related equipment. Additionally, Section (b)(2) of 10 CFR 50.49 specifies qualification for nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of designated safety functions. Section (f) of 10 CFR 50.49 requires each item of electric equipment important to safety to be environmentally qualified by: (1) testing of identical or similar equipment under identical or similar conditions, with a supporting analysis to show that the equipment to be qualified is acceptable; (2) experience with identical or similar equipment under similar conditions, with a supporting analysis; or (3) analysis in combination with partial type-test data that supports the analytical assumptions and conclusions.

The inspectors determined that plant personnel failed to environmentally qualify, or maintain the qualification of, equipment important to safety, as required by Section (f) of 10 CFR 50.49. Plant personnel provided the NRC staff with a specific list of electrical terminations that could not be demonstrated to be in a qualified configuration, consistent with Okonite® Report NQRN-3, Revision 4, "Nuclear Environmental Qualification Report for Okoguard Insulated Cables and T-95 & No. 35 Splicing Tapes," as discussed in the plant's environmental qualifications data packages. As stated previously, this list contained hundreds of electrical terminations, for a wide variety of components. Several examples of affected components in this list were:

- Safety relief valve tailpiece pressure switches
- Main steam isolation valves
- Reactor core isolation cooling injection and steam admission isolation valves
- High pressure coolant injection and steam supply valves
- Nonenvironmentally qualified (nonessential) components, such as door lights for the drywell personnel airlock
- Residual heat removal system Loops A and B injection valves
- Suction and discharge isolation valves for both reactor recirculation pumps

Section (j) of 10 CFR 50.49 requires that a record of the environmental qualification must be maintained in an auditable form to permit verification that each item of electric equipment important to safety is qualified for its application and meets its specified performance requirements when it is subjected to the conditions predicted to be present when it must perform its safety function.

The inspectors determined that plant personnel failed to maintain an auditable form of records for environmental treatments used in the plant. Plant personnel also found several examples where records did not reflect the as-built configuration of the plant. A specific example of this was the absence of documentation regarding conduit seals for the safety relief valve tailpiece pressure switches.

The inspectors concluded that the failures to environmentally qualify, to maintain the qualification of, and to document qualifications in an auditable form for equipment important to safety, constitutes an apparent violation of 10 CFR 50.49 requirements (AV 50-298/0007-01). The significance of this violation is addressed with the overall significance of the environmental qualification issue, as described in the significance determination section of this report (Section 03).

Engineering and maintenance personnel subsequently incorporated the information, from field observations of specific methods and materials used, into a comprehensive reference database. This information was linked to the environmental qualifications

data packages and was updated as components were worked in the field. The inspectors reviewed the list for completeness and accuracy. The inspectors did not identify any significant problems with this documentation. Therefore, the inspectors did not see a further concern with the startup or operation of the facility.

02.03 Craft Application and Training

While plant personnel and the inspectors identified numerous examples of improper splice configurations in the field, few of these could be considered to be applied in violation of station procedures. The inspectors observed that specific field splice procedures were vague and lacked sufficient information for ensuring that technicians made an environmentally qualified splice that matched test report configurations specified in the environmental qualification data packages. Specifically examples of this issue included:

- minimum bend radii for splices were not specified
- prohibitions for incompatible cable material were not specified
- visual presentation of desired splice configurations were not included
- application terms were used, but not explained in procedures
- degradation issues for existing splices were not clearly defined
- specific calculations were required for splice installation beyond skill of the craft

The inspectors conducted interviews with many maintenance and engineering personnel throughout the forced outage. Along with comments regarding the vague procedures, the inspectors received comments discounting the need for much rigor in the application of environmentally qualified treatments. Craft personnel stated to the inspectors that they had little direction or guidance from supervision and management for the environmental qualifications program. The inspectors found a low level of understanding of environmental qualification concepts by system engineers and craft personnel. As stated previously in this report, the inspectors observed the application of environmental qualification treatments in a lab setting. The inspectors noted that workers made several different types of errors in applying the material, including not properly sealing the end and applying tape in a direction opposite of that specified in the procedure. The individuals told inspectors that they did not see any significance in these errors.

The inspectors conducted further interviews with engineering personnel and with the team that reviewed the problems and recommended corrective actions in significant condition report (SCR) 2000-0386. The inspectors noted that, until the forced outage, environmental qualifications personnel did not review field procedures for environmental qualifications, nor did they receive any feedback on field procedure changes. The inspectors also noted that there was little discussion between engineering and maintenance personnel in regard to training or procedure adequacy. The inspectors were concerned that the lack of feedback reduced the ability of field personnel to maintain environmentally qualified equipment in configurations that matched the test reports.

The licensee's methods for ensuring qualification of electrical equipment rely on the equipment being configured as specified in individual qualification test reports. The inspectors concluded that maintenance procedures and craft training did not convey important requirements of the specified test reports. Therefore, required conditions of the test reports and environmental qualification data packages were not translated into field applications. The inspectors consider the breakdown of communications for translating design requirements to field personnel and the lack of supervisory oversight as underlying causes for the failure to meet the requirements of 10 CFR 50.49, as stated in the previous section.

02.04 Design Control

Engineering personnel discovered that Buchanan 0241 terminal blocks were used, per Environmental Qualifications Data Package 211, in various containment applications. However, Buchanan 0241 terminal blocks were only certified to 311°F. The new consideration of 340°F peak containment temperature necessitated the replacement of terminal blocks used in the following:

- RR-MOV-MO53A/B [Reactor Recirculation Pump Discharge Valves]
- MS-AOV-AO80A/B/C/D [Main Steam Isolation Valves - Inboard]
- MS-AOV-AO80A/B/C/D Limit Switches
- MS-AOV-AO86A/B/C/D Limit Switches [Outboard]
- RCIC-MOV-MO15 [Steam Supply Valve - Inboard]

The licensee conducted a root cause determination of the environmentally qualified electrical splice issue under SCR 2000-0386. Plant personnel stated, in this report, that "[t]he root cause of the problem was that translating and transmitting environmental qualification information from fundamental EQDP test configuration documents into the field was less than adequate." The Corrective Action Review Board accepted this report and the proposed corrective actions contained in it. The inspectors reviewed this report and did not identify any significant concerns. The licensee also adopted SCR 2000-0330, addressing design basis information, and SCR 2000-0423, addressing engineering programs. The inspectors reviewed these reports and did not identify any significant concerns.

On April 20, 2000, inspectors expressed concerns, to environmental qualifications program personnel, that various electrical boxes and motor-operated valve enclosures did not have condensate drain paths as described in design documentation. On April 27, 2000, the inspectors raised a specific concern with condensate drain paths on environmentally qualified components in the drywell. The inspectors stated that they were concerned that terminal boards in these applications were not submersion tested and therefore could not be considered qualified if condensation were to collect in electrical boxes or valve compartments. Plant personnel did not conduct an inspection of motor-operated valves in containment until May 10, 2000. Engineering and maintenance personnel subsequently developed several work orders to install T-drains, drill drain holes, or modify conduit runs on various components in the drywell, steam tunnel, and high energy line break areas of the reactor building.

To address the concern about condensate drain paths, engineering and licensing personnel developed a justification for continued operation of the drywell structure. As part of the justification, drywell spray valves were required to operate to minimize the temperature effects to the containment structure. The inspectors noted that the drywell spray valves were already considered in containment analyses and were operated under certain scenarios of the emergency operating procedures. However, plant engineers informed the inspectors that the drywell spray valves were not included in the facility's motor-operated valve testing program. The inspectors also verified that these motor-operated valves, RHR-MOV-26A/B and RHR-MOV-31A/B, were designated as environmentally qualified, but did not have some necessary support equipment environmentally qualified. Subsequent testing of these valves determined that the operation of RHR-MOV-31A was questionable. Engineers determined that the motor for RHR-MOV-31A was undersized by 7 percent. The licensee could not ensure that the valves would close under full flow conditions. Since accident conditions would have required successive starts and stops of containment spray flow by opening and closing RHR-MOV-31A and -B, they concluded that the valves did not meet design basis requirements for accident conditions.

Both RHR-MOV-31A and -B were modified, under Change in Engineering Design 2000-0103. The valves were given higher gear ratio sets, and thrust collars were added. Additionally, Pressure Switches PC-PS-119A, -B, -C, and -D, control cables to the switches, and terminal blocks for the pressure switch wiring were modified to meet environmental qualification requirements. These modifications were required to provide reasonable assurance of operation of the drywell spray valves under accident conditions and to ensure drywell temperature limits were not exceeded.

On September 27, 2000, the licensee determined that the environmental qualification treatments for the safety relief valve (SRV) tailpiece pressure switches were in a configuration that was not supported by a tested configuration. These switches, as well as indication and controls for the SRV's, are in 10 amp-fused circuits powered from the 125 Vdc, Division 1 bus. The NRC has assumed that the nonconforming environmental qualification treatments would result in a ground flow path in the dc circuit when exposed to a harsh environment.

On September 29, 2000, engineers informed the inspectors about this concern. Operations and engineering personnel developed an operability determination and an operability evaluation for the SRVs. The engineers stated that the grounding of the pressure switches affected only the indication of the SRVs and would not hamper their operation. However, the inspectors noted that this analysis was based upon a single fault ground protection design of the 125 Vdc system. The engineers had considered that there were no other potential grounds on the system. The inspectors specifically asked the engineers if there were any nonqualified or nonessential 125 Vdc loads in the drywell that would affect this analysis.

The licensee performed a circuit analysis of the 125 Vdc bus and determined that the failure of the pressure switches would produce a ground on the positive leg of the bus. The pressure switches for all eight SRVs are in the same circuit. Therefore, multiple

tailpiece pressure switch grounds would appear as one ground on the overall bus or system. Through a series/parallel combination of equalizing resistors in the 125 Vdc ground detection system, licensee engineers determined that a single ground would produce a maximum fault current of about 1.13 amps. It was postulated by licensee engineers that, during a loss-of-coolant accident (LOCA), when combined with the expected loop currents of approximately 8 amps, the total ground currents resulting from the nonconforming SRV pressure switches could produce an overall 9.3 amps in the 10 amp circuit.

The inspectors determined that licensee engineers had not applied uncertainties (tolerance) for the resistive values used in their current analysis. The inspectors applied appropriate uncertainties to the licensee's calculations. Based on this, the NRC concluded that a harsh environment, created by a medium break LOCA in conjunction with the nonconforming environmental qualification treatments, would likely cause the 10 amp fuse to open. This would result in the loss of SRV capability.

The inspectors also determined that licensee engineers did not fully consider the effects of the multiple additional ground fault current flow paths that other nonconforming environmental qualification treatments might impose on the 125 Vdc system. Engineering personnel searched system records for sources of possible grounds in the 125 Vdc system. They determined that two nonessential loads existed in the drywell that were powered from the essential 125 Vdc system. These loads were the control and indication power for the reactor recirculation system isolation valves and the indicating lights for the inboard drywell personnel airlock door. The inspectors noted that neither of these loads was considered in the original operability evaluation.

Plant engineers concluded that the control power for the reactor recirculation system valves would be isolated from the drywell very shortly after a LOCA isolation signal. However the power for the indicating lights on the inboard drywell personnel airlock door were not isolated by any signal. The engineers informed the inspectors that this load did not show up in their load database or environmental qualification data packages.

Plant engineers assumed that the SRV circuits could automatically transfer to the alternate division of power, if a negative leg fault resulting from additional environmental qualification nonconformances was only present in Division 1. The licensee also assumed that no other negative leg ground existed, or would be created, on Division 2. The inspectors identified, however, that the faults caused by the SRV pressure switches would also cause current in excess of the 9.3 amps on Division 2. The NRC concluded, therefore, that the ground fault current could exceed the rating of the 10 amp fuses.

Based upon the NRC review and the licensee's evaluation, NRC staff concluded that the incorrectly applied environmental qualification treatments for the SRV pressure switches, coincident with a medium-break LOCA, would cause the circuit fuses to open. The result would be a loss of the SRV opening function. Without the SRVs, there is neither an automatic nor manual capability of initiating an emergency depressurization.

Requirements in 10 CFR Part 50, Appendix B, Criterion III, state that design control measures shall provide for verifying or checking the adequacy of design. The criterion also states that design changes, including field changes, shall be subject to design control measures commensurate with those applied to the original design.

The inspectors concluded that the failure to ensure that environmentally qualified components had condensate drain measures described in design drawings, the failure to properly test the containment spray valves, and the failure to account for the effect of nonessential 125 Vdc loads on operability of essential equipment during design basis accidents were examples of an apparent violation of 10 CFR Part 50, Appendix B, Criterion III (AV 50-298/0007-02). The significance of this violation is addressed with the overall significance of the environmental qualification issue, as described in the significance determination section of this report (Section 03).

Maintenance and engineering personnel made several changes to environmental qualification procedures. The inspectors observed that specific acceptance criteria, including examples, were added to the procedures. The inspectors also noted that training was given to all maintenance and engineering personnel involved in conducting environmentally qualified splice activities. Quality assurance personnel also audited the training and qualification of personnel to the new procedure revisions. The inspectors noted that all quality assurance comments were incorporated into further changes or training, prior to plant management accepting the procedures for field use. The inspectors also noted that the extent of condition problems were captured in the corrective action program. The inspectors concluded that the licensee had incorporated all the major design basis issues with environmental qualifications into the corrective action program. The inspectors also concluded that sufficient guidance and training was being provided on environmental qualification field procedures. Therefore, the inspectors determined that they had no further concerns in this area.

02.05 Identification and Resolution of Problems

The inspectors were concerned with an initial lack of questioning attitudes by the plant staff in regard to numerous aspects of the resolution to environmental qualifications issues. The inspectors were also concerned that plant personnel missed several opportunities to identify and correct some of these issues in the past 2 years. Specific examples of this included:

- On the initial containment entry, plant personnel asked the inspector what to do after identifying the loose tape on the environmentally qualified splices. The craft personnel stated that this was not abnormal and did not see a concern. Based upon these discussions, the inspector concluded that plant personnel did not understand the significance of the observations. Only after further discussion with the inspector did they identify the need for a problem identification report.

- The NRC staff determined it was evident during the conference call on April 16, 2000, that plant staff relied solely on their on-site expert and were not considering arguments to the contrary about the Okonite® tape problems. For

example, the NRC staff had to inform plant management that the outer wrap was required to ensure the function of the inner wrap, contrary to their expert's understanding.

- After rejecting the use of Okonite® tape, engineering and plant management initiated the process to replace all Okonite® tape with 3-M® environmental qualification tape. Again, the NRC had to inform plant staff, including conference calls with plant management, to specify that the splice treatments had to be installed in a configuration documented in a qualification test report.

- The plant staff could not produce a list of affected components in over a month of the forced outage. In the absence of such list, plant personnel searched for all environmental qualification treatments by area location in the plant.

- The inspectors accompanied maintenance and engineering personnel on field walkdowns of environmentally qualified components. On numerous occasions, the inspectors brought up discrepancies with the equipment, or configurations, that were not identified by the plant staff. Examples of these issues included:

  - On May 3, 2000, the inspectors observed the use of Raychem® shim material as an outer jacket on splices.

  - On May 3, 2000, craft personnel performed inspections on splices in wires they could not identify, due to a lack of cable markings. The inspectors were concerned that the correct splices and cables were being inspected.

  - Between May 1 and 4, 2000, the inspectors questioned several plant staff as to why they were not checking for splices in condulets. The inspectors were informed that splicing in condulets was not permitted at Cooper. Maintenance personnel subsequently identified splices in condulets in the standby gas treatment system and initiated a problem identification report.

  - On May 8, 2000, the inspectors noted that craft personnel observed characteristics of splices on their inspection checklist, but did not look at other splices or components in the immediate location. The inspectors pointed out several nearby discrepancies to the craft personnel.

  - Engineering and quality assurance personnel performed several self-assessments in the environmental qualifications area over the past 2 years. These assessments failed to identify many of the problems identified throughout the forced outage. Also, as stated in a problem identification report (PIR 4-09419) dated May 18, 2000, “An assessment of the environmental qualification program at CNS was conducted from 11/15 to 11/18/99 and a final report was issued November 22, 1999. This report contained 5 findings (identified as strongly recommended for

action) and 15 recommendations (identified as recommended for action). There is no evidence that any of these findings or recommendations were entered into the CAP database."

- Throughout the environmental qualifications forced outage, the inspectors repeatedly asked about the environmental qualification status of the safety relief valves and their support equipment. The inspectors clearly described the risk importance of the safety relief valves, considering the effect of all of the other nonconformances that had been identified. Consistently, plant staff told the inspectors that there were no problems with the safety relief valves or equipment and that methodical reviews had been conducted to ensure this. Four months later, engineers discovered the nonconformance of the safety relief valve tailpiece pressure switches, through a paperwork review.

The inspectors noted that the above problems caused the licensee to perform multiple walkdowns of the same equipment over a period of about a month. The inspectors observed that seven revisions of the walkdown procedure, "Engineering Data Package (EDP-35) EQ Splice Walkdowns," were required to finalize acceptance criteria for the environmental qualification treatments.

The requirements of 10 CFR Part 50, Appendix B, Criterion XVI, state that measures will be established to assure that conditions adverse to quality are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

The inspectors determined that plant personnel failed to identify problems with the environmental qualifications program until they were specifically characterized by the NRC. During field walkdowns, plant personnel also failed to identify problems with equipment that did not meet program requirements. Plant personnel also failed to enter self-identified environmental qualification program deficiencies into the corrective action program. These failures to properly identify problems and enter them into the corrective actions process constituted an apparent violation of 10 CFR Part 50, Appendix B, Criterion XVI (AV 50-298/0007-03). The significance of this violation is addressed with the overall significance of the environmental qualification issue, as described in the significance determination section of this report (Section 03).

The inspectors noted that, after identification by the inspectors, all the above items were subsequently captured in the corrective action program.

03 Significance Determination Process

03.01 Entry Conditions

As described in Section 02.01 of this inspection report, the inspectors and plant staff collectively identified hundreds of plant components that were not properly qualified for

the environmental conditions expected during postulated design basis accidents. These degraded components primarily affected the reliability of accident mitigation systems. Additionally, some components associated with system isolation valves and instrumentation were degraded, affecting the containment barrier. Sections 02.02 through 02.05 describe licensee performance issues that resulted in both the adverse conditions identified and the failure of licensee personnel to identify these conditions prior to the identification of the degraded conditions on April 14, 2000. Finally, these conditions existed for a period ranging from 18 months to approximately 15 years and, as such, were degraded during extended power operations. Therefore, many of the improperly applied and unqualified splice treatments and related environmental qualification deficiencies met the entry conditions for NRC Inspection Manual Chapter 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations."

03.02 Phase 1 Screening

The inspectors performed a Phase 1 screening of the performance issues related to the degraded environmental qualification treatments. Based on the broad scope of this condition and the components affected, the inspectors determined that multiple safety functions in both the mitigation systems and barrier cornerstones were affected. Therefore, a Phase 2 initial risk significance approximation and basis was conducted.

03.03 Phase 2 Approximation

The Phase 2 approximation was conducted in accordance with Manual Chapter 0609, Appendix A. The following steps and the associated findings are listed below:

- Select or Define the Applicable Initiating Event Scenarios:

  The inspectors determined that the primary concern with the degraded splice treatments was the potential current leakage, resulting in shorts, and/or grounds caused by a steam environment. Therefore, the applicable initiating event scenarios were limited to high energy line breaks. These included LOCAs and main steam or feedwater system line breaks in the drywell, reactor building, or steam tunnel.

- Estimate the likelihood of scenario initiating events and conditions:

  The inspectors assumed that the likelihood of an initiating event was not increased by the degraded conditions identified. Therefore, the inspectors used SDP Table 1 from Manual Chapter 0609, Appendix A. Based on the extended time that the degraded conditions had existed, all scenarios were evaluated using an exposure time of >30 days. Based on data gathered by evaluating multiple scenarios, the inspectors developed the assumption that the worst case event was the medium-break LOCA. SDP Table 1 provides the estimated likelihood of this event as 1 in every 1000 to 10,000 years. Therefore, the estimated likelihood rating was "D."

- Estimate the remaining mitigation capability:

  The inspectors estimated the remaining mitigation capability in accordance with Step 2.3 of Manual Chapter 0609, Appendix A. In evaluating the medium-break LOCA, the inspectors assessed the equipment available to mitigate the event assuming that the 125 Vdc power to the SRVs had failed as described in Section 02.04 of this inspection report. The following assumptions were used:

  1. All SRVs fail to operate in relief mode based on the failure of their 125 Vdc power supply

  2. The SRVs are not recovered by operators

  3. High pressure coolant injection operates for 5 minutes despite degraded splice treatments for system components

  Based on these assumptions, the inspectors evaluated the scenario using the "Medium LOCA" Phase 2 risk estimation worksheet provided in Risk Informed Inspection Notebook for Cooper Nuclear Station , Revision 0, September 20, 1999. The total remaining mitigation capability rating for Sequence 4 was determined to be 1 for one train of high pressure coolant injection.

- Estimate the risk significance of the inspection findings:

  The inspectors estimated the risk significance of the inoperable SRVs using Table 2, "Risk Significance Estimation Matrix," of Manual Chapter 0609, Appendix A. According to the table, a likelihood rating of "D" and a remaining capability rating of 1 constitutes a YELLOW finding.

- Phase 2 Conclusions:

  The inspectors identified multiple programmatic deficiencies involving the design, implementation, and documentation of environmental qualifications. The programmatic deficiencies resulted in the existence of approximately 2000 applications affecting approximately 600 components that are important to safety. The NRC evaluated these performance issues using a Phase 2 approximation of risk. One of the scenarios, a medium-break LOCA, was determined to constitute a YELLOW finding. However, given that the problems affected multiple components and all high-energy line break initiating events, additional scenarios indicating significant risk may be identified through further review. Therefore, the NRC determined that the performance issues that led to programmatic failures in Cooper's environmental qualifications program constituted a finding that was at least YELLOW. This finding was determined to have substantial safety significance because of the reduced capability for mitigation of a medium-break LOCA, as well as other reductions in safety margins caused by degraded components in the multiple safety systems affected.

03.04 Plant Management's Initial Risk Assessment

The environmental qualification problems at Cooper affected approximately 600 components and involved about 2000 electrical terminations in several system functions important to reactor safety. Licensee engineers reviewed this very complex issue using the available probabilistic risk assessment tools and determined that the issue was of very low risk significance (Green). The NRC staff and risk analysts do not concur with many of the assumptions in the licensee's evaluation. The licensee is provided the opportunity to request a regulatory conference to provide their perspectives on the significance of the finding and the bases for their position. The differences between the assumptions in the NRC's evaluation as presented in this inspection report and the licensee's evaluation would be a primary subject of such a conference.

OTHER ACTIVITIES

4OA1 Meetings

.1 Exit Meeting Summary

On December 14, 2000, the inspectors conducted a meeting with Mr. J. McDonald, Plant Manager, and other members of plant management and presented the inspection results of the special inspection. The plant management acknowledged the findings presented. Plant management also informed the inspectors that no proprietary material was examined during the inspection.

4OA2 Problem Identification and Resolution

.1 10 CFR 50.49 Issues Identification

The inspectors noted, in previous sections of this report, that plant personnel failed to have a questioning attitude regarding problems noted with environmental qualification requirements and installed configurations in the plant. The inspectors, and the plant staff, noted that there were several underlying causes to these failures. The inspectors concluded that there was a significant cross-cutting issue related to this issue. These aspects, of the cross-cutting nature of the problems, were addressed in the licensee's corrective action program. The NRC will evaluate the effectiveness of the licensee's actions to address the cross-cutting nature of this issue in future inspection activities.

4OA4 Cross-cutting Issues

.1 Aspects of Human Performance

The inspectors, and plant staff, identified numerous human performance issues during this inspection. The inspectors identified that there was a significant cross-cutting issue of human performance in many of these issues. These aspects, of the cross-cutting

nature of the problems, were addressed in the licensee's corrective action program. Additional training and program changes are planned by the licensee to address this issue. The NRC will evaluate the effectiveness of the licensee's actions to address the cross-cutting nature of this issue in future inspection activities.

ATTACHMENT 1

PARTIAL LIST OF PERSONS CONTACTED

Licensee

C. Blair, Licensing Engineer, Licensing
M. Boyce, Risk and Regulatory Affairs Manager
D. Buman, Assistant Plant Engineering Manager
P. Caudill, Senior Manager of Technical Services
C. Fidler, Assistant Maintenance Manager
R. Gibson, Nuclear Projects Manager
M. Gillan, Outage Manager
B. Houston, Quality Assurance Operations Manager
M. Kaul, Operations Support Specialist
J. Lechner, Engineering Programs Supervisor
W. Macecevic, Operations Manager
S. Mahler, Assistant Licensing Manager
M. Manning, Engineering Supervisor
C. Markert, Engineering Support Manager
E. McCutchen, Senior Licensing Engineer
J. McDonald, Plant Manager
O. Olson, Engineering Supervisor
B. Rash, Senior Manager of Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened During this Inspection

50-298/0007-01	AV	Failure to Maintain Environmental Qualifications of Safety-Related Equipment
50-298/0007-02	AV	Failure to Implement Design Requirements
50-298/0007-03	AV	Inadequate Problem Identification for Environmental Qualification Deficiencies

PARTIAL LIST OF DOCUMENTS REVIEWED

Engineering Data Package (EDP-35) EQ Splice Walkdowns Rev 0 (4/25/00) through Rev 7 (5/10/00)

Nuclear Logistics, Inc. (NLI) Qualification Plan (QP-061-004-1, Rev. 3) Qualification Plan for Electrical Splicing Tapes 3M 130C & 70 12/11/97

RayChem Engineering Data Report (EDR-5037) 8kv In-line Motor Splice Kits 1/14/82

Administrative Procedures; “7" series for Maintenance, All EQ procedures and revisions for EQ splices, kits, terminal blocks, and specialty kits; 4/1/00 through 5/30/00 (@ 60)

OE PIR 4-07770/4-08928/4-08967 Evaluation of Temperature Qualification for Electrical Equipment in Drywell 5/16/00

Change in Engineering Design (CED) Packages
CED 2000-0113 Evaluate Electrical Connections within Motor Operated Valves 5/10/00
CED 2000-0114 PC-PS-119A,B,C,D Upgrade to EQ 5/15/00

Problem Identification Reports (PIR)
All PIR’s involving EQ issues dated 4/1/00 to 5/30/00 (@ 240)
PIR 4-11673
PIR 4-11821

Resolved Condition Reports (RCR)
RCR 2000-0319 to 2000-0546

Significant Condition Reports (SCR)
SCR 2000-0386
SCR 2000-0423

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
LOCA	loss of coolant accident
MLOCA	medium loss of coolant accident
MOV	motor-operated valve
RHR	residual heat removal
SCR	significant condition report
SRV	safety relief valve

ATTACHMENT 2

NRC's REVISED REACTOR OVERSIGHT PROCESS

The federal Nuclear Regulatory Commission (NRC) recently revamped its inspection, assessment, and enforcement programs for commercial nuclear power plants. The new process takes into account improvements in the performance of the nuclear industry over the past 25 years and improved approaches of inspecting and assessing safety performance at NRC licensed plants.

The new process monitors licensee performance in three broad areas (called strategic performance areas): reactor safety (avoiding accidents and reducing the consequences of accidents if they occur), radiation safety (protecting plant employees and the public during routine operations), and safeguards (protecting the plant against sabotage or other security threats). The process focuses on licensee performance within each of seven cornerstones of safety in the three areas:

Reactor Safety	Radiation Safety	Safeguards
● Initiating Events	● Occupational	● Physical Protection
● Mitigating Systems	● Public	
● Barrier Integrity		
● Emergency Preparedness		

To monitor these seven cornerstones of safety, the NRC uses two processes that generate information about the safety significance of plant operations: inspections and performance indicators. Inspection findings will be evaluated according to their potential significance for safety, using the significance determination process, and assigned colors of GREEN, WHITE, YELLOW, or RED. GREEN findings are indicative of issues that, while they may not be desirable, represent very low safety significance. WHITE findings indicate issues that are of low to moderate safety significance. YELLOW findings are issues that are of substantial safety significance. RED findings represent issues that are of high safety significance with a significant reduction in safety margin.

Performance indicator data will be compared to established criteria for measuring licensee performance in terms of potential safety. Based on prescribed thresholds, the indicators will be classified by color representing varying levels of performance and incremental degradation in safety: GREEN, WHITE, YELLOW, or RED. GREEN indicators represent performance at a level requiring no additional NRC oversight beyond the baseline inspections. WHITE corresponds to performance that may result in increased NRC oversight. YELLOW represents performance that minimally reduces safety margin and requires even more NRC oversight. RED indicates performance that represents a significant reduction in safety margin but still provides adequate protection to public health and safety.

The assessment process integrates performance indicators and inspection so the agency can reach objective conclusions regarding overall plant performance. The agency will use an Action Matrix to determine in a systematic, predictable manner which regulatory actions should be taken based on a licensee's performance. The NRC's actions in response to the significance (as represented by the color) of issues will be the same for performance indicators as for inspection findings. As a licensee's safety performance degrades, the NRC will take more and increasingly significant action, which can include shutting down a plant, as described in the Action Matrix.

More information can be found at: http://www.nrc.gov/NRR/OVERSIGHT/index.html.