

October 28, 2014

MEMORANDUM TO: Michael C. Cheok, Director  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

FROM: Edward H. Roach, Chief */RA/*  
Mechanical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

SUBJECT: VENDOR OVERSIGHT WORKING GROUP REPORT

In accordance with memorandums dated March 7, 2014, (Agencywide Document Access Management System (ADAMS) Accession No. ML13357A259) and March 20, 2014 (ADAMS Accession ML14028A028), the staff was directed to evaluate lessons in the area of vendor oversight from the Part 52 Implementation Self-Assessment Working Group report and the San Onofre Nuclear Generating Station steam generator tube degradation event.

A Vendor Oversight Working Group (VOWG) was formed to provide recommendations, if applicable, on vendor oversight enhancements. The VOWG consisted of members from the Region II and IV Offices, the Office of Nuclear Reactor Regulation and the Office of New Reactors. The attached enclosure provides the recommendations developed by the VOWG for vendor oversight enhancements.

Enclosure:  
Vendor Oversight Working  
Group Report

CONTACT: Yamir Diaz-Castillo, NRO/DCIP  
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**Vendor Oversight Working Group Report**

**FINAL REPORT  
September 2014**

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Enclosure

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## EXECUTIVE SUMMARY

The Vendor Oversight Working Group (VOWG) was established in response to the Post-Combined License (COL) of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52 Implementation Self-Assessment Working Group report and the San Onofre Nuclear Generating Station (SONGS) steam generator tube degradation event lessons learned. The Charter directed the VOWG to provide recommendations to the Director of the Division of Construction Inspection and Operational Programs (DCIP) in the Office of New Reactors (NRO) on vendor oversight enhancements. In addition, the VOWG was directed to consider whether (1) the SONGS steam generator degradation event expose any new or unique vendor lessons that the NRC's Vendor Inspection Program (VIP) should take into account and (2) the NRC's VIP should be more focused on the design aspects of safety-related major plant modifications.

Based on its review, the VOWG developed 6 recommendations for enhancements to the VIP on vendor oversight. The recommendations are as follows:

1. Perform pilot design verification inspections at selected phases of the design process for safety-related major plant modifications (MPMs) at vendor facilities regardless of the results from the screening processes associated with 10 CFR 50.59 review. This may include developing new or modifying existing inspection procedures (please refer to Recommendations No. 2 and 3 below for more information on identifying major plant modifications).
2. Develop and pilot screening and evaluation processes to determine if a plant change is a MPM, and whether such a modification should be subject to a vendor inspection:
  - a. Develop screening criteria to determine if a plant change is a major modification.
  - b. Develop evaluation criteria to determine whether a major plant modification should be subject to a vendor inspection.
3. Enhance communications between the Vendor Inspection Center of Expertise and other NRC staff [primarily the Regions and the Office of Nuclear Reactor Regulation (NRR)] about potential vendor-related issues at operating plants. These data should be analyzed and trended, then used to inform the vendor selection process. Examples include:
  - a. major plant modifications
  - b. Operating and construction experience
4. Supplement the current NRC staff biannual observations of the Nuclear Procurement Issues Committee (NUPIC) audits with observations of Limited Scope Audits (LSAs).
5. Add attributes for "Risk Significance" and "Vendor Experience with the Design and Fabrication of the Component", and the associated attribute scores and weighting factors, to Appendix B, "Strategy for Vendor Selection," of the Vendor Inspection Program Plan (VIPPP).
6. Consider incorporating aspects of the Reactor Oversight Process (ROP) and Construction Reactors Oversight Process (cROP) safety culture programs into the VIP. Examples include elements of reactive safety culture assessments and trending identified safety culture weaknesses.

In addition, the VOWG evaluated the following two items as directed:

**Did the SONGS steam generator degradation event expose any new or unique vendor lessons that the NRC's VIP should take into account?**

The SONGS steam generator degradation event did not expose new or unique vendor lessons that the NRC's VIP should evaluate. However, the VOWG identified two attributes that in the future the VIP should include in selecting vendors. These attributes are not individually unique. The VOWG believes that their concurrence prevented the vendor and the licensee from identifying and correcting the apparent design issues. These attributes will be considered in the selection of a vendor for inspection, and weigh in the determination of an NRC vendor inspection. The attributes identified were:

- The vendor used proprietary design software that had not been accepted as an industry standard or approved by a regulatory body.
- The analytic methods used to develop and evaluate the design lacked rigorous acceptance criteria or generally accepted best practices, such as the application of safety factors.

**Should the NRC's VIP be more focused on the design aspects of major plant modifications?**

The VIP verifies that reactor applicants and licensees are fulfilling their regulatory obligations with respect to providing effective oversight of the supply chain. The VIP has constantly evolved since it started in the 1980's. In the mid 1990's, NRC was performing mostly reactive and special inspections of operating nuclear power plant vendors. These inspections were performed mostly based on operating experience, an incident, or an allegation concern. In the 2000's, the NRC started expanding the VIP in preparation for construction and procurement activities for new reactors. However, the vendor inspections for operating reactors were still mostly reactive or were related to specific issues or circumstances. The VOWG recommends that the VIP should continue the trend to be more focused on the design aspects of safety-related major plant modifications. While the occurrence of vendor design-related issues of the magnitude identified at SONGS may be anomalous, the VOWG does not have sufficient data to judge whether these issues are systemic instead. Therefore, the VOWG recommends performing an initial set of design-focused inspections at selected phases of the design processes for MPMs at vendor facilities, regardless of the results associated with the 10 CFR 50.59 screening process. The findings and observations identified from this initial set of inspections would then be used to make an appropriately informed decision as to whether the NRC should conduct regular, design-focused vendor inspections.

This report and the recommendations above are the result of the VOWG effort. The recommendations, including the pros and cons for each recommendation, were developed by the VOWG based on reviews of documents and discussions with NRC staff. Quantitative costs and implementation plans were not developed for each recommendation. The objective was to provide recommendations with pros and cons on vendor oversight enhancements and the decision to implement the recommendations would be decided at a later time by NRC Senior Management. It is important to note that the current VIP is not a substitute for licensee oversight of vendors, nor does it relieve the licensee of its responsibility for vendor oversight. The VIP is the NRC's quality assurance check of the effectiveness of licensee oversight.

## 1.0 INTRODUCTION

### 1.1 Objective

The Vendor Oversight Working Group (VOWG) was chartered to provide recommendations to the Director of the Division of Construction Inspection and Operational Programs (DCIP) on vendor oversight enhancements in response to the Post-Combined License (COL) of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52 Implementation Self-Assessment Working Group report and the San Onofre Nuclear Generating Station (SONGS) steam generator tube degradation event lessons learned.

### 1.2 Background

In a memorandum dated March 8, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13066A739), the Director of the Office of New Reactors (NRO) approved the charter of a working group (WG) to assess the NRC's requirements, policies, procedures, and practices during the first year of post-COL implementation of Part 52. As discussed in the charter, the WG was directed to select, with internal and external stakeholder input, the most significant licensing, inspection, and other regulatory actions during the first phase of post-COL Part 52 implementation. The WG was directed to evaluate whether the outcomes of new reactor program activities have been effective, realistic, and timely.

One of the areas where the post-COL Part 52 WG proposed enhancements was vendor oversight. The post-COL Part 52 WG report stated, in part, that "The vendor oversight program would benefit from further clarification of its objectives and its relationship to the Reactor Oversight Program (ROP) and the Construction Reactor Oversight Program (cROP); and enhanced communications of vendors' performance issues with operating reactor and construction licensees." The report discusses several avenues for increased efficiency and effectiveness of vendor oversight. One of the recommendations proposed by the post-COL Part 52 WG was:

- 1) *The staff should continue to communicate and clarify the Vendor Inspection Program objectives and the program's relationship to the cROP, and document its relationship to the ROP.*

In a memorandum to the NRO Office Director, dated March 7, 2014 (ADAMS Accession No. ML13357A259), the Director of DCIP discussed the status of the action plans in response to the post-COL Part 52 implementation lessons learned report. The memorandum stated that with regards to the recommendation above, and in light of the SONGS replacement steam generators (RSGs) issues, other enhancements to the Vendor Inspection Program (VIP) may also be warranted. Consequently, the memorandum stated that the staff would establish a working group to provide recommendations in the area of vendor oversight.

Then, in a memorandum dated March 20, 2014, (ADAMS Accession No. ML14028A028), the Executive Director for Operations (EDO) directed the staff to evaluate lessons from the recent experiences related to the SONGS RSGs tube degradation event and to identify and implement appropriate actions. One of the topical

areas identified in the memorandum was Vendor Inspection. In addition, the memorandum identified the following specific items for consideration:

- a) Did the SONGS steam generator degradation event expose any new or unique vendor lessons that the NRC's VIP should take into account?
- b) Should the NRC's VIP be more focused on the design aspects of major plant modifications (MPMs)?

Based on its review of the existing policy and practices for continued vendor oversight, this report documents the recommendations identified by the VOWG for enhancements to the VIP and it also answers the two questions described above.

## **2.0 SCOPE AND METHODOLOGY**

The VOWG consisted of members from the Region II and IV Offices, the Office of Nuclear Reactor Regulation (NRR) and NRO. The VOWG conducted a review of the VIP to provide recommendations to the Director of DCIP on vendor oversight enhancements. The VOWG reviewed existing policy and practices for the continued vendor oversight of suppliers providing items and services to new and currently operating reactors and identified areas where enhancements are needed to ensure the NRC is performing an effective vendor oversight. During its review, the VOWG interviewed or held discussions with several NRC staff. The NRC's policies, procedures, and other guidance documents reviewed by the VOWG are listed in Appendix E to this report.

## **3.0 DISCUSSION OF RECOMMENDATIONS**

### **3.1 Recommendation No. 1**

*Perform pilot design verification inspections at selected phases of the design process for safety-related major plant modifications at vendor facilities regardless of the results from the screening processes associated with 10 CFR 50.59 review. This may include developing new or modifying existing inspection procedures (please refer to Recommendations No. 2 and 3 below for more information on identifying major plant modifications).*

#### **3.1.1 Discussion**

The EDO's tasking memorandum inquired whether the VIP should be more focused on the design aspects of MPMs, and the VOWG concluded that it should. The VOWG also concluded that the VIP should focus on the design aspects of safety-related major plant modifications during the design phase regardless of the results from the screening processes associated with Title 10 of the Code of Federal Regulations (10 CFR) Part 50.59, "Changes, Tests, and Experiments."

Since the occurrence of vendor design-related issues of the magnitude identified at SONGS may be anomalous, the VOWG does not have sufficient data to determine whether these issues are systemic instead. Therefore, the VOWG recommends performing a pilot program of design verification inspections at vendor facilities during selected phases of the design process for safety-related major plant modifications at

vendor facilities. The findings and observations identified from this initial set of inspections would then be used to make an appropriately informed decision on whether the NRC should institute a framework for regular, design-focused vendor inspections.

Lately, the vendor inspections performed for operating reactors were reactive and special inspections. These reactive inspections were performed mostly due to operating experiences, an incident or an allegation. After studying this type of inspections, the VOWG noted that some components went through the 10 CFR 50.59 screening process and some components did not before performing the inspection. For example, the vendor inspection of Babcock and Wilcox Canada in 2007 focused on the manufacturing activities associated with the replacement reactor vessel closure heads for Palisades Nuclear Power Plant which required a 10 CFR 50.59 review. The vendor inspection of Sulzer, Inc. focused on the manufacturing of safety-related service water pump bowl casting replacements for Farley Nuclear Power Plant and service water pump impeller casting replacements for Hatch and Indian Point nuclear power plants as result of a 10 CFR Part 21 report to the NRC. The VOWG noted that some replacement parts for safety-related components (i.e., breakers), the use of reverse engineering for safety-related components replacements and using new technology for the same component may not require a screening through 10 CFR 50.59. Consequently, the VOWG recommends allowing the screening process, discussed in Recommendation 2, to consider safety-related components replacements, which may not require a license amendment, to be considered for a vendor inspection as a major plant modification.

Currently, the VIP has different procedures for use depending of the objective of the vendor inspection. For example, NRC's Inspection Procedure (IP) 37805, "Engineering Design Verification Inspections," focuses on verifying, through a detailed technical review of selected systems, that the design authority's implementation of its design and design control processes are consistent with NRC regulations, Final Safety Analysis Report and if applicable, NRC's Safety Evaluation Report. However, the VOWG noted that this procedure focuses mostly on systems instead of single components, and concluded that the VIP may not have adequate processes and procedures to perform a detailed design-focused vendor inspection related to single components. As a result, current inspection procedures might need to be modified or a new procedure might need to be developed to perform design-focused vendor inspections. It is important to note that the VIP has been performing technically-focused vendor inspections, including aspects of design control, at vendor facilities. However, the focus has not been vendors designing major plant modifications.

During the implementation phase of the pilot program, the VIP should consider the possibility of potential duplicate work with other NRC offices and processes (e.g., licensing process) if there is lack of coordination. In addition, the timeliness of the inspection should be considered with respect of the design development. If the design verification inspection is scheduled in the earlier phases of design, there is a potential of the vendor trying to consult with the NRC or seek for NRC approval during the inspection. Finally, the pilot program should consider the administrative overhead associated with (1) revising or creating an inspection procedure and/or process; (2) increase of the number of inspections; (3) the location of the vendor; and (4) the duration inspections.

## **3.2 Recommendation 2**

*Develop and pilot screening and evaluation processes to determine if a plant change is a major plant modification, and whether such a modification should be recommended for a vendor inspection:*

- a. Develop screening criteria to determine if a plant change is a major modification.*
- b. Develop evaluation criteria to determine whether a major plant modification should be recommended for a vendor inspection.*

### **3.2.1 Discussion**

As stated in Recommendation No. 1, the VIP should be more focused on the design aspects of MPMs. However, as currently structured, the VIP may not have adequate processes and procedures to perform a design-focused vendor inspection related to a major plant modification. Therefore, the VOWG recommends developing screening and evaluation processes to ensure that inspection resources are applied to appropriate vendors and major plant modifications.

The VOWG concluded that developing and piloting these screening and evaluation processes would help mitigate the resource burden associated with implementing Recommendation No. 1 by ensuring that a modification subject to a vendor design inspection meets rigorous criteria to ensure the modification is major, and by ensuring that vendors are selected for design inspections with appropriate justification. Thus, although developing and implementing such a new process carries its own administrative resource burden, the VOWG believes that having a screening and evaluation process would result in net savings associated with the implementation of Recommendation 1, by reducing the frequency with which inspections are actually performed. Note that this screening and evaluation process could be implemented as a means to focus existing vendor inspection resources, regardless of whether Recommendation No. 1 is implemented. Therefore, the WG considers the screening and evaluation processes to be separate from Recommendation No. 1.

The VOWG also determined that the development of these screening and evaluation processes will establish a framework, which NRC staff external to the Vendor Inspection Center of Expertise (COE) could use to relay information concerning vendor-related aspects of major plant modifications back to Vendor Inspection COE. The implementation of this recommendation would also result, therefore, in an added communications benefit, consistent with Recommendation No. 3 (Enhance Communications).

The VOWG recognizes that the use of a screening and evaluation process to focus inspection resources on justified major plant modifications will result in other major plant modifications to go uninspected by the NRC; however, this process would result in an overall improvement in that it will allow the VIP to focus its inspection resources on significant major plant modifications, based on their uniqueness or complexity. In addition, if the pilot set of inspections were to suggest the existence of systemic problems, additional inspections could be performed or the screening and evaluation process could be revised to allow for more frequent major plant modification vendor inspections. Throughout its assignment, the VOWG discussed possible selection criteria for performing vendor design inspections of major plant modifications.

The VOWG expects that the criteria would fall within several categories. These may include functional criteria tied to the safety significance of a modification, such as:

- The SSCs being modified function to terminate or mitigate the consequences of a design basis accident, or
- The SSCs being modified form part of a fission product barrier.

Some criteria may also be related to the overall complexity of the modification, such as:

- The modification involves replacing all, or a significant portion, of an SSC, or
- The modification will substantially change the design of an SSC or the way that it operates.

In the pilot stage, the major plant modification screening process should also include a subjective criterion to allow consideration of overall risk or safety significance, and recent operating experience. Implementers of this recommendation may wish to consider consulting with risk analysts from other NRC offices and/or divisions regarding the most appropriate criteria.

In regards to the evaluation process, the VOWG determined that Appendix B, "Strategy for Vendor Selection," of the Vendor Inspection Program Plan (VIP), already contains a process for selecting a particular vendor for inspection that could be readily adapted for use in selecting a vendor for a design inspection. The VOWG is also recommending the inclusion of additional factors in the selection process that would also be relevant to the adaptation of a selection process for MPM vendor design inspections.

In conclusion, the VOWG recommends the development of a screening and evaluation process for identifying major plant modifications and selecting vendors for design inspections in order to ensure that proactive vendor design inspection activities are justified. In addition to ensuring an adequate allocation of resources to the inspection activity, the development and implementation of these processes will facilitate communication between DCIP, the Regions and other NRC offices.

### **3.3 Recommendation No. 3**

*Enhance communications between the Vendor Inspection Center of Expertise and other NRC staff (primarily the Regions and NRR) about potential vendor-related issues at operating plants. These data should be analyzed and trended, then used to inform the vendor selection process. Examples include:*

- c. major plant modifications
- d. *Operating and Construction Experience*

#### **3.3.1 Discussion**

A general weakness identified by the VOWG in the VIP is access to information about vendor performance. Information about vendor performance from any source would be useful in informing the VIP and helping to focus on potential problem vendors. As the VIP completes its list of nuclear vendors, potential problems associated with the vendors should also be documented and retained. The VOWG identified some specific sources

of information about vendor performance that should be enhanced, but other sources may also be available.

The most significant source of information about vendor performance is the Operating Experience (OE) and Construction Experience (ConE) Center of Expertise. NRC staff in the OE/ConE center of expertise routinely screen events and information from operating plants and plants being constructed. However, there is no direct feedback mechanism to the VIP, other than 10 CFR Part 21 reports. Creating a direct feedback mechanism to the VIP would immediately provide a relatively large amount of information and would require relatively little resource allocation. The OE/ConE data base is populated with OE/ConE items several times per week. Modifying the database to indicate potential vendor-related issues and assigning VIP personnel access to the data base would be one efficient way to increase VIP awareness of these issues.

The VOWG's recommendation to focus more on major plant modifications, as described in Recommendation 1 of this report, will require that the VIP be informed of upcoming major plant modifications at reactor sites. The VOWG recommends that NRC staff aware of information about major plant modifications at existing reactor sites be contacted by the VIP. And a protocol be established for passing this information to the VIP. At a minimum, NRC staff at the region (especially resident inspectors) and NRR staff such as plant project managers should be aware of the need for the VIP to have such information. Since this information is currently collected by the Regional staff for inspection planning purposes, the administrative impact should be minimal.

### **3.4 Recommendation No. 4**

*Supplement the current NRC staff biannual observations of the Nuclear Utility Procurement Issues Committee (NUPIC) audits with observations of Limited Scope Audits (LSAs).*

#### **3.4.1 Discussion**

One of the current VIP outreach activities includes interaction with NUPIC. The vendor inspection staff routinely observes NUPIC joint utility audits in order to verify the effectiveness of the NUPIC audit. The NRC inspection team uses IP 43005, "NRC Oversight of Third Party Organizations Implementing Quality Assurance Requirements," during NUPIC observation activities.

The typical NUPIC audit scope is to determine the overall acceptability and verify the effective implementation of a vendor's quality assurance (QA) requirements through use of the NUPIC audit checklist, which is structured in accordance with the requirements of the American Society of Mechanical Engineers (ASME) NQA-1, "Quality Assurance Requirements for Nuclear Facility Applications," Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," 10 CFR Part 21, "Reporting of Defects and Noncompliance." While observing the audit, the vendor inspection staff sample and review audit checklist evaluation areas, observe NUPIC's review of the implementation of the vendor's QA program, and evaluate the adequacy of NUPIC's process for documenting audit findings in the associated trip report. The vendor inspection staff continuously interacts with NUPIC auditors during the NUPIC audit observation. If the vendor inspection staff observes any potential violations of regulations during the audit and NUPIC auditors fail to act on the issue, the

vendor inspection staff will bring the issue to the attention of the NUPIC utility lead auditor for resolution. In addition, if significant weaknesses in oversight are observed, the NRC staff may choose to engage directly with the lead licensee on a case by case basis

Currently, the vendor inspection staff observes two NUPIC audits a year and participates in NUPIC meetings three times per year. The vendor inspection staff recently evaluated the NRC's oversight of NUPIC to make sure our interactions meet current regulatory standards and our process is appropriately holding licensees accountable for their oversight of vendors. The results from that evaluation concluded that our current interactions with NUPIC (1) are effectively communicating regulatory concerns/initiatives and industry issues between organizations and has served as a catalyst for several NUPIC process improvements, and (2) provide valuable insights into vendor performance issues used as a key parameter in the NRC's criteria for selecting vendors for inspection.

During its assessment of our interactions with NUPIC, the VOWG identified that in addition to the normal scheduled audits; NUPIC performs limited scope audits (LSAs) of vendors. An LSA is a supplemental audit scheduled outside the normal NUPIC audit frequency focused at specific performance deficiencies. The VOWG noted that the vendor inspection staff does not observe LSAs. The VOWG believes that observing LSAs will provide a more complete observation of the NUPIC interactions with vendors and provide more details on how the licensees deal with vendors with known deficiencies. As such, the VOWG recommends that the vendor inspection staff supplement the current biannual observations of NUPIC audits with observations of LSAs. It is important to note that the current VIP is not a substitute for licensee oversight of vendors, nor does it relieve the licensee of its responsibility for vendor oversight. The VIP is the NRC's QA check of the effectiveness of licensee oversight.

### **3.5 Recommendation No. 5**

*Add attributes for "Risk Significance" and "Vendor Experience with the Design and Fabrication of the Component", and the associated Attribute Scores and Weighting Factors, to Appendix B, "Strategy for Vendor Selection," of the VIPP.*

#### **3.5.1 Discussion**

Section 06.01, "Vendor Selection," of NRC's Inspection Manual Chapter (IMC) 2507, "Vendor Inspections," addresses the vendor inspection selection process, and states that the selection be based, in part, on the "significance to safety of the equipment or service provided." Additionally, the NRC's Probabilistic Risk Assessment (PRA) Policy Statement states that, "The use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy." However, Appendix B of the VIPP does not include an attribute to represent the risk associated with products or services supplied by vendors. Therefore, the VOWG believes that PRA insights should be sought when selecting which vendors to inspect. This could be accomplished by adding a "Risk Significance" attribute to Appendix B of the VIPP. Adding the Risk Significance attribute should be based on the risk associated with the product or service provided by the vendor. For example, a firm supplying an AP1000 squib valve would most likely rate

higher than one providing a containment flood-up level sensor. Importance measures such as Risk Achievement Worth or Risk Reduction Worth should be considered for plants with well-developed PRAs. For facilities without a well-developed PRA such as a new reactor, the Design Reliability Assurance Program list would provide useful insights. These measures further increase the objectivity of the vendor selection process since they are based on rigorously defined parameters. Additionally, the effectiveness of NRC vendor inspections would increase by adding additional focus on vendors who impact nuclear safety the most and unnecessary inspection burden on vendors not supplying risk-significant components would be reduced. It is recognized that the Risk Significance attribute may be difficult to implement and will most likely require the participation of a senior risk analyst. In addition, adding another component to the vendor selection score sheet may dilute the influence of other attributes.

The VOWG also recommends that a “Vendor Experience with the Design and Fabrication of the Component” attribute be added as another vendor selection criterion under Appendix B of the VIPP. This criterion should attempt to evaluate the specific circumstances of the product or service being provided. For example, with regards to SONGS, while MHI had previously provided numerous replacement steam generators without an issue, in this instance they were attempting to provide a SG with twice the thermal output and a different internals arrangement. This attribute would supplement the “Industry Experience with product or service...” attribute by specifically considering those vendors who may have little experience with the product they are attempting to provide. Again, adding an additional criteria to the vendor selection score-sheet may dilute the influence of already existing factors, and an evaluation should be performed to consider whether the attribute scoring should be revised.

### **3.6 Recommendation No. 6**

*Consider incorporating aspects of the Reactor Oversight Process (ROP) and Construction Reactors Oversight Process (cROP) safety culture assessments into the VIP. Examples include reactive safety culture assessments in response to specific safety culture or safety conscious work environment issues, or in cases when a trend is identified which shows potential safety culture weaknesses.*

#### **3.6.1 Discussion**

The NRC’s Final Safety Culture Policy Statement issued June 14, 2011, states, in part, “that safety culture applies to everyone, including vendors, who work on or supplies safety-related components.” Currently, the NRC staff indirectly verifies a vendor’s safety culture through the evaluation of the vendor’s Corrective Action and 10 CFR Part 21 programs since there is no specific guidance for evaluating a vendor’s safety culture. As such, the VOWG concluded that the VIP would benefit by incorporating aspects of the ROP/cROP safety culture programs. The VOWG concluded that the VIP could modify existing processes and procedures used in the ROP to evaluate and assess safety culture.

The VOWG determined that the basis for incorporating safety culture insights into the VIP should be similar to the Reactor Oversight Process use of safety culture. IMC 0308, “Reactor Oversight Process (ROP) Basis Document,” already contains the basis for reviewing safety culture at operating reactors and the NRC has in-depth experience in the review and use of safety culture components. In addition, IMC 0310, “Components

Within The Cross-Cutting Areas,” could be used as a guide to inform the VIP as they develop a more simplified process to identify performance weaknesses relative to the vendor’s failure to identify the impact of safety culture on their performance. The VIP should also consider developing guidance on when to request vendors to conduct an independent safety culture assessment based on inspection and/or event-based criteria. The VOWG recognizes that any aspects of the ROP/cROP programs that could be incorporated into the VIP would not be enforceable; however, this process would increase awareness of safety culture amongst vendors and would encourage vendors to focus on safety first over other competing priorities.

#### **4.0 ANSWERS TO THE QUESTIONS FROM THE EDO’S TASKING MEMORANDUM**

##### **4.1 Did the SONGS steam generator degradation event expose any new or unique vendor lessons that the NRC’s VIP should take into account?**

The SONGS steam generator degradation event did not expose new or unique vendor lessons that the NRC’s VIP should evaluate. However, the VOWG identified two attributes that in the future the VIP should include in selecting vendors. These attributes are not individually unique. The VOWG believes that their concurrence prevented the vendor and the licensee from identifying and correcting the apparent design issues. These attributes will be considered in the selection of a vendor for inspection, and weigh in the determination of an NRC vendor inspection. The attributes identified were:

- The vendor used proprietary design software that had not been accepted as an industry standard or approved by a regulatory body.

MHI used FIT-III for the design of the SONGS RSGs. FIT-III is a proprietary software that had not been validated or bench marked against industry accepted software (EPRI ATHOS - also has not been validated, but has been extensively used). It is important to note that in 1986 there was a comparison (CLOTAIRE) made by Framatome in France in collaboration with the Commissariat à l'Énergie Atomique (French Atomic Energy Commission) and Électricité De France (electric utility in France) on various vendor steam generator design software, but it is unclear if any of the vendors modified their software based on this proprietary test. MHI did not make any changes to the FIT-III software even though their software did not track with a number of the mockup test measure parameters. Each of the various vendors had software issues not tracking with the measured test parameters; depending on the parameter, some tracked well and others did not. It is important to note that even after the steam generators were analyzed using ATHOS, the tubes that exhibited fluid elastic instability still showed stability ratios of < 1.0, which were acceptable per Appendix N, “Dynamic Analysis Methods,” of Section III, “Rules for construction of Nuclear Facility Components,” of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel code. Only a couple of tubes on the periphery showed stability ratios of >1.0 and these tubes showed no signs of unusual tube wear. Once the error in the FIT-III code was corrected, the stability ratios calculated were comparable to ATHOS results.

- The analytic methods used to develop and evaluate the design lacked rigorous acceptance criteria or generally accepted best practices, such as the application of safety factors.

There was a lack of detail in the FSAR concerning the design characteristics, functions, and acceptance criteria of the various components within the steam generator. The FSAR had little if any details concerning the design of the steam generator internals. Most of the information contained within the FSAR for the steam generators dealt with the Reactor Coolant System flow through the steam generators, secondary thermal output, steam quality output, but contained no details on the design of the steam generator internals or thermohydraulic characteristics.

Industry standards for steam generator design were extremely limited. In looking for historical information, steam generator materials, chemistry control, and inspection techniques were the focus of both the NRC and industry. There was no specific design information concerning acceptable design values for internals construction and thermohydraulic conditions including stability ratios (other than the ASME stability ratio limit of  $< 1.0$ ), void fraction, recirculation ration, anti-vibration bar-to-tube clearance, etc. Each vendor has established their own acceptance criteria and these criteria are considered proprietary. Several other prominent steam generator vendors did have criteria for void fraction and took design or fabrication actions to limit its value, while MHI had no guidance on void fraction. In discussions with their engineers, staff indicated that MHI had no acceptance criteria and were not concerned with the high void fraction values. Their concern was only with stability ratios for the tubes and not the steam/water mixture environment. MHI engineers indicated that the anti-vibration bars were the answer to issues with vibration concerns, regardless of the lack of dampening associated with low moisture content steam. In addition, MHI had no limit or safety margin associated with tube stability ratio, other than the ASME guidance of a stability ratio  $< 1.0$ .

Appendix N of ASME Section III was also general as it only contains methods for calculating out-of-plane stability analysis, where the tube damage was associated with in-plane instability. Industry experts and researchers assumed that if out-of-plane vibration was prevented from occurring, then in-plane vibration could not occur. Section N-1310 of Appendix N, "Introduction and Scope," states in part, that "Because of the developing nature of the subject, more than one set of design data or methods may be recommended with the implication to the designer to use either the more appropriate or the more conservative predictions."

#### **4.2 Should the NRC's Vendor Inspection Program be more focused on the design aspects of major Plant modifications?**

The VIP verifies that reactor applicants and licensees are fulfilling their regulatory obligations with respect to providing effective oversight of the supply chain. The VIP has constantly evolved since it started in the 1980's. In the mid 1990's, NRC was performing mostly reactive and special inspections of operating nuclear power plant vendors. These inspections were performed mostly based on operating experience, an incident, or an allegation concern. In the 2000's, the NRC started expanding the VIP in preparation for construction and procurement activities for new reactors. However, the vendor inspections for operating reactors were still mostly reactive or were related to specific issues or circumstances. The VOWG recommends that the VIP should continue the trend to be more focused on the design aspects of major plant modifications. While the occurrence of vendor design-related issues of the magnitude identified at SONGS may be anomalous, the VOWG does not have sufficient data to judge whether these issues are systemic instead. Therefore, the VOWG recommends performing an initial

set of design-focused inspections at selected phases of the design processes for MPMs at vendor facilities, regardless of the results associated with the 10 CFR 50.59 screening process. The findings and observations identified from this initial set of inspections would then be used to make an appropriately informed decision as to whether the NRC should conduct regular, design-focused vendor inspections.

## **5.0 CONCLUSION**

Based on its review of the existing policy and practices for continued vendor oversight of suppliers providing items and services to the new and current operating reactors, the VOWG identified six recommendations that if implemented, would enhance the VIP. Accordingly, the VOWG provided answers to two specific items from the EDO's memorandum.

The recommendations, including the pros and cons for each recommendation, were developed by the VOWG based on reviews of documents and discussions with NRC staff. Quantitative costs and implementation plans were not developed for each recommendation. The objective was to provide recommendations with pros and cons on vendor oversight enhancements and the decision to implement the recommendations would be decided at a later time by NRC Senior Management. It is important to note that the current VIP is not a substitute for licensee oversight of vendors, nor does it relieve the licensee of its responsibility for vendor oversight. The VIP is the NRC's QA check of the effectiveness of licensee oversight.

**APPENDIX A**

**CONSOLIDATED TABLE OF RECOMMENDATIONS**

Recommendations	Pros	Cons
<p>1. Perform pilot design verification inspections at selected phases of the design process for safety-related major plant modifications at vendor facilities regardless of the results from the screening processes associated with 10 CFR 50.59 review. This may include developing new or modifying existing inspection procedures (please refer to Recommendations No. 2 and 3 below for more information on identifying major plant modifications).</p>	<ul style="list-style-type: none"> <li>• May head off potential nuclear safety issues in design processes as opposed to during/post installation</li> <li>• Using a pilot will allow further evaluation to determine whether expanded efforts are necessary.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for duplicated work if not good coordination with other NRC offices (e.g., licensing process)</li> <li>• Potential to consult vs. inspect based on timing of the inspection</li> <li>• Increased costs depending on location of the vendor</li> <li>• Administrative overhead associated with revising or creating an inspection procedure</li> </ul>

Recommendations	Pros	Cons
<p>2. Develop and pilot screening and evaluation processes to determine if a plant change is a major plant modification, and whether such a modification should be recommended for a vendor inspection:</p> <ul style="list-style-type: none"> <li>a. Develop screening criteria to determine if a plant change is a major modification.</li> <li>b. Develop evaluation criteria to determine whether a major plant modification should be recommended for a vendor inspection.</li> </ul>	<ul style="list-style-type: none"> <li>• Formal process for identifying and inspecting major plant modifications</li> <li>• Optimal resource use</li> <li>• Facilitates better communication among NRC staff</li> </ul>	<ul style="list-style-type: none"> <li>• Administrative overhead associated with implementing a new process.</li> <li>• Potential for major plant modifications to go uninspected by NRC</li> </ul>
<p>3. Enhance communications between the Vendor Inspection Center of Expertise and other NRC staff (primarily the Regions and NRR) about potential vendor-related issues at operating plants. These data should be analyzed and trended, then used to inform the vendor selection process. Examples include:</p> <ul style="list-style-type: none"> <li>a. Major plant modifications</li> <li>b. Operating and Construction Experience</li> </ul>	<ul style="list-style-type: none"> <li>• Identify potential nuclear safety issues proactively</li> <li>• Identify adverse trends in vendor performance</li> </ul>	<ul style="list-style-type: none"> <li>• Administrative overhead associated with implementation</li> </ul>
<p>4. Supplement the current NRC staff biannual observations of the Nuclear Procurement Issues Committee (NUPIC) audits with observations of Limited Scope Audits (LSAs).<sup>1</sup></p>	<ul style="list-style-type: none"> <li>• Provide a more complete observation of NUPIC interactions with the vendors</li> </ul>	<ul style="list-style-type: none"> <li>• More resources depending on the number of LSAs observed.</li> </ul>

<sup>1</sup> LSAs are supplemental audits scheduled outside the normal NUPIC audit frequency, focused at specific performance deficiencies.

Recommendations	Pros	Cons
<p>5. Add attributes for “Risk Significance” and “Vendor Experience with the Design and Fabrication of the Component”, and the associated Attribute Scores and Weighting Factors, to Appendix B, “Strategy for Vendor Selection,” of the VIPP.</p>	<ul style="list-style-type: none"> <li>• Focus vendor inspection resources on vendors that impact nuclear safety the most.</li> <li>• Focusing vendor inspection resources on inexperienced vendors</li> </ul>	<ul style="list-style-type: none"> <li>• Establishing a reliable and appropriate risk significance factor may be challenging</li> <li>• Adding attributes reduces the relative weight of the existing attributes</li> </ul>
<p>6. Consider incorporating aspects of the Reactor Oversight Process (ROP) and Construction Reactors Oversight Process (cROP) safety culture assessments into the VIP. Examples include reactive safety culture assessments in response to specific safety culture or safety conscious work environment issues, or in cases when a trend is identified which shows potential safety culture weaknesses.</p>	<ul style="list-style-type: none"> <li>• Increase awareness of safety culture amongst vendors</li> <li>• Encourages vendors to focus on safety first over other competing priorities</li> </ul>	<ul style="list-style-type: none"> <li>• Not enforceable</li> <li>• Possible cultural differences with international vendors</li> <li>• Administrative overhead associated with implementation</li> </ul>

## APPENDIX B

### VENDOR OVERSIGHT WORKING GROUP CHARTER

May 22, 2014

MEMORANDUM TO: Michael C. Cheok, Director  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

FROM: Edward H. Roach, Chief */RA/*  
Mechanical Vendor Inspection Branch  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

SUBJECT: CHARTER FOR THE REVIEW OF THE VENDOR OVERSIGHT  
PROGRAM IN RESPONSE TO THE PART 52 AND SAN ONOFRE  
STEAM GENERATOR TUBE DEGRADATION EVENT LESSONS  
LEARNED

The purpose of this memorandum is to inform the Director of the Division of Construction Inspection and Operational Programs of the formation of a Working Group to provide recommendations on vendor oversight enhancements in response to the Part 52 and the San Onofre Nuclear Generating Station steam generator tube degradation event lessons learned. The enclosed charter provides the purpose, scope, proposed schedule and milestones, team members, and a brief description of the deliverable.

Enclosure:  
Vendor Oversight Working Group Charter

CONTACT: Yamir Diaz-Castillo, NRO/DCIP  
301-415-2228

May 22, 2014

MEMORANDUM TO: Michael C. Cheok, Director  
Division of Construction Inspection  
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Vendor Oversight Working Group Charter

CONTACT: Yamir Diaz-Castillo, NRO/DCIP  
301-415-2228

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**ADAMS ACCESSION No.:** ML14128A267

NRO-002

<b>OFFICE</b>	NRO/DCIP/MVIB	NRO/DCIP/MVIB	NRO/DCIP
<b>NAME</b>	YDiaz-Castillo	ERoach	MCheok
<b>DATE</b>	5/08/2014	05/12/2014	05/22/2014

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# CHARTER FOR THE NUCLEAR REGULATORY COMMISSION'S REVIEW OF THE VENDOR OVERSIGHT PROGRAM IN RESPONSE TO THE PART 52 AND SAN ONOFRE STEAM GENERATOR TUBE DEGRADATION EVENT LESSONS LEARNED

## Purpose

The objective of this Working Group (WG) is to provide recommendations to the Director of the Division of Construction Inspection and Operational Programs (DCIP) on vendor oversight enhancements in response to the Part 52 and the San Onofre Nuclear Generating Station (SONGS) steam generator tube degradation event lessons learned.

## Scope

This WG will review the existing policy and practices for continued vendor oversight of suppliers providing items and services to the new and current operating reactors and identify areas where enhancements are needed to ensure the NRC is performing an effective vendor oversight.

Areas to be considered should include, but are not limited to: descriptions of roles and responsibilities for the various NRC organizations; potential guidance/criteria for inspecting major plant modifications; management responsibility for approving and initiating plant design/modification inspections; and a process for determining (1) inspection prioritization; (2) inspection scope; (3) inspection timing; and (4) inspection resources.

In addition, this WG will try to answer these specific questions:

1. Did the SONGS steam generator degradation event expose any new or unique vendor lessons that the NRC's Vendor Inspection Program should take into account?
2. Should the NRC's Vendor Inspection Program be more focused on the design aspects of major plant modifications?

The WG may not identify any enhancements based on its review of the existing policy and practices for continued vendor oversight. If no enhancements are identified, the WG will describe the basis for its finding.

## Proposed Schedule and Milestones

Kick-Off Meeting	April 24, 2014
Bi-Weekly Teleconferences	5/8, 5/22, 6/5, 6/19, and 7/1
WG Meeting to Discuss Preliminary Recommendations with Pros and Cons	Week of July 14 (Location TBD)
Present Preliminary Recommendations to DCIP Senior Management	Week of July 28

Develop Final Report	Week of August 11
Final Report Out for Concurrence	Week of August 18

**Staffing**

The team will consist of the following members:

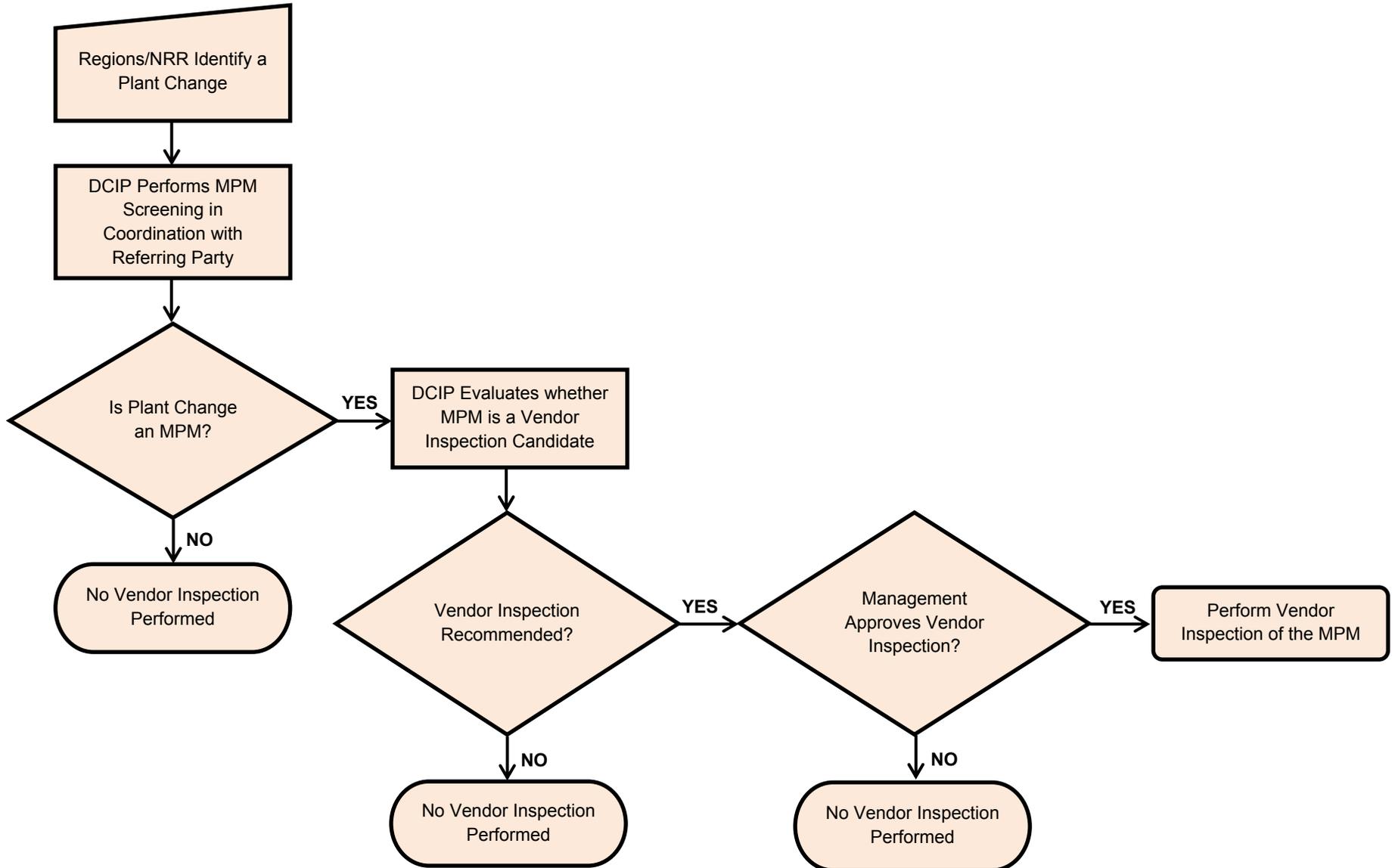
Yamir Diaz-Castillo	NRO/DCIP/MVIB	Team Leader
Aixa Belen	NRO/DCIP/MVIB	
Phillip O'Bryan	NRO/DCIP/CIPB	
Benjamin Parks	NRR/DSS/SRXB	
Eric Michel	RII/DCI/CIB3	
Greg Werner	RIV/DRP/RPB-E	

**Deliverable**

The team will write a report addressed to the DCIP Division Director with a list of recommendations for vendor oversight enhancements.

APPENDIX C

MAJOR PLANT MODIFICATION DESIGN INSPECTION FLOWCHART



## APPENDIX D

### LIST OF ACRONYMS

ADAMS	Agencywide Document Access Management System
ASME	American Society of Mechanical Engineers
CE	Combustion Engineering
CFR	Code of Federal Regulations
CFSI	Counterfeit, Fraudulent, and Suspect Items
COL	Combined License
ConE	Construction Experience
cROP	Construction Reactor Oversight Process
DCIP	Division of Construction Inspection and Operational Programs
IMC	Inspection Manual Chapter
IP	Inspection Procedure
LSA	Limited Scope Audit
MHI	Mitsubishi Heavy Industries
MPM	Major Plant Modifications
NRO	Office of New Reactors
NRR	Nuclear Reactor Regulation
NUPIC	Nuclear Procurement Issues Committee
OE	Operating Experience
ROP	Reactor Oversight Process
RSGs	Replacement Steam Generators
SONGS	San Onofre Nuclear Generating Station
VIP	Vendor Inspection Program
VIPP	Vendor Inspection Program Plan
VOWG	Vendor Oversight Working Group
WEC	Westinghouse Electric Company

## APPENDIX E

### REFERENCES

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8. U.S. Nuclear Regulatory Commission, "Steam Generator Replacement Inspection," NRC IP 50001, dated November 8, 2011
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17. Memorandum from Glenn Tracy, NRO Director, to Frederick Brown, Deputy Regional Administrator, Region II; Charles E. Ader, Director, Division of Safety Systems and Risk Assessment, NRO; Michael C. Cheok, DCIP Director; Scott Flanders, Director, Division of Site Safety and Environmental Analysis, NRO; David B. Matthews, Director, Division of New reactor Licensing, NRO; Michael E. Mayfield, Director, Division of Advanced Reactors and Rulemaking, NRO; Mohammed A. Shuaibi, Acting Director, Division of Engineering, NRO, "New Reactors Program Actions in Response to the Part 52 Implementation Self-Assessment Working Group Report," dated August 29, 2013 (ADAMS Accession No. ML13238A145)
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19. Memorandum from Kerri Kavanagh, Chief, Quality Assurance Branch, Division of Construction Inspection and Operational Programs (DCIP), Office of New Reactors (NRO), to Laura Dudes, Director, DCIP, "Vendor Inspection Program Plan Assessment," dated September 13, 2012 (ADAMS Accession No. ML12244A180).
20. Memorandum from Michael C. Cheok, DCIP Director, to Glenn M. Tracy, NRO Director, "Status of Action Plans in Response to the Post-Combined License Part 52 Implementation Lessons Learned Report," dated March 7, 2014 (ADAMS Accession No. ML13357A259).
21. Memorandum from Mark A. Satorius, Executive Director for Operations, to Marc L. Dapas, Regional Administrator, Region IV; Eric J Leeds, NRR Director; and Glenn M. Tracy, NRO Director, "Review of Lessons Learned from the San Onofre Steam Generator Tube Degradation Event," dated March 20, 2014 (ADAMS Accession No. ML14028A028).
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