

August 21, 2007

Mr. Theodore A. Sullivan
Site Vice President
Entergy Nuclear Operations, Inc.
Vermont Yankee Nuclear Power Station
P.O. Box 0500
185 Old Ferry Road
Brattleboro, VT 05302-0500

SUBJECT: VERMONT YANKEE NUCLEAR POWER STATION – NRC SUPPLEMENTAL
INSPECTION REPORT 05000271/2007009

Dear Mr. Sullivan:

On July 12, 2007, the U. S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection at your Vermont Yankee Nuclear Power Station. The enclosed report documents the inspection results which were discussed on July 12, 2007, with Mr. Norman Rademacher and other members of your staff.

The NRC performed this supplemental inspection to assess your evaluation of a low to moderate (White) safety significant finding involving an August 31, 2006, radioactive material shipment from your facility to the Susquehanna Steam Electric Station, that arrived with one package in excess of regulatory radiation limits. This was a self-revealing event which involved inadequate decontamination and survey of equipment prior to shipment to preclude the migration of radioactive material to the bottom of a package during transport. The supplemental inspection was conducted to determine if the root and contributing causes of the White finding were understood, to assess the extent of the condition review, and to determine if the corrective actions were sufficient to address causes and prevent recurrence. The inspection was conducted in accordance with Inspection Procedure 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area," and examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations, and with the conditions of your license.

Based on the results of this inspection, we concluded that you have adequately completed a root cause analysis of the performance deficiencies surrounding the event, and have identified appropriate corrective actions. No findings of significance were identified concerning the root cause evaluation and corrective actions. Given your acceptable performance in addressing the radioactive shipment packaging issue, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program."

Mr. T. Sullivan

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Sincerely,

/RA/

John R. White, Chief
Plant Support Branch 2
Division of Reactor Safety

Enclosure: Inspection Report 05000271/2007009
w/Attachment: Supplemental Information

Mr. T. Sullivan

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Sincerely,

/RA/

John R. White, Chief
Plant Support Branch 2
Division of Reactor Safety

Enclosure: Inspection Report 05000271/2007009
w/Attachment: Supplemental Information

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cc w/encl:

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C. Pope, State of New Hampshire, SLO
D. O'Brien, State of Vermont, SLO
J. Giarrusso, SLO, MEMA, Commonwealth of Massachusetts

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No.: 50-271

Licensee No.: DPR-28

Report No.: 05000271/2007009

Licensee: Entergy Nuclear Operations, Inc.

Facility: Vermont Yankee Nuclear Power Station

Location: 320 Governor Hunt Road
Vernon, Vermont 05354-9766

Dates: July 9-12, 2007

Inspector: J. Noggle, Senior Health Physicist, DRS

Approved by: J. White, Chief
Plant Support Branch 2
Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000271/2007009; 07/09/07 - 07/12/07; Vermont Yankee Nuclear Power Station; Supplemental Inspection; IP 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area."

The inspection was conducted by one region-based inspector. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Public Radiation Safety

NRC Inspection Report 05000271/2006011, dated November 7, 2006, identified a self-revealing finding, having low to moderate (White) safety significance, involving a failure to properly prepare and ship a package containing radioactive material in a manner that assured, under conditions normally incident to transport, conformance with Department of Transportation (DOT) radiation level limitations specified by 49 CFR 173.441(a), i.e., 200 millirem per hour (mrem/h) on any external surface of the package. Accordingly, the finding was also considered an apparent violation of the requirements of 10 CFR 71.5 and 49 CFR 173.441(a). The finding involved an August 31, 2006 radioactive material shipment, via an exclusive-use open transport vehicle, that was determined to have 820 mrem/h on the external surface of a package upon receipt at the shipping destination. The licensee entered this performance deficiency in its corrective action program; completed a root cause evaluation; and initiated corrective measures, including various process improvements to prevent recurrence.

This supplemental inspection was performed in accordance with Inspection Procedure 95001 to confirm that Entergy's assessment of this issue included a formal, structured root cause evaluation to identify the root and contributing causes. This inspection confirmed that Entergy's root cause evaluation was thorough and effectively documented weaknesses associated with decontamination, survey, and packaging activities relative to the shipment preparation. Entergy identified the following two primary root causes: inadequate procedures for preparing equipment for shipment with the potential for discrete radioactive particles; and an insufficient questioning attitude of personnel involved in shipment preparation activities.

Based on the results of the inspection, the inspectors concluded that Entergy had adequately completed a root cause evaluation of the performance deficiencies associated with the event, and planned and completed corrective actions that were reasonable to address the root and contributing causes. Accordingly, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program."

REPORT DETAILS

01 INSPECTION SCOPE

The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection to review and assess Entergy's evaluation associated with an August 31, 2006, radioactive material shipment that was in excess of regulatory limits, and constituted a finding having low to moderate (White) safety significance. This inspection was performed in accordance with NRC Inspection Procedure 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area." This performance issue was previously reported in NRC Inspection Report No. 05000271/2006011, dated November 7, 2006, and is related to the public radiation safety cornerstone in the radiation safety strategic performance area.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

- a. Determination of who identified the issue and under what conditions:

On September 1, 2006, Susquehanna Steam Electric Station identified this matter to the licensee, Vermont Yankee, upon receipt inspection and survey of the package at its facility in Berwick, Pennsylvania. Accordingly, this finding was considered self-revealing.

Upon receipt at Susquehanna, one of the packages, which contained contaminated equipment (i.e, an Advanced Crusher/Shear), was found to have radiation levels on the external surface (underside) in excess of the Department of Transportation's radiation limit for external surface of packages shipped by exclusive use vehicles, as specified in 49 CFR 173.441(a). Title 49 CFR 173.441(a) limits the radiation level on package surfaces to 200 millirem per hour (200 mrem/h). When received at Susquehanna, the radiation level on the surface of one of the packages was measured as 820 mrem/h.

Upon further inspection of the package contents, several discrete radioactive particles (DRP) were found on the bottom of the package, and determined to be the cause of the excessive radiation level on the external surface of the package.

Vermont Yankee's surveys of the package, prior to shipment, indicated a maximum dose rate of 60 mrem/hr on contact with the external surfaces, conforming to DOT requirements. Subsequent investigation indicated that, under conditions normal to transportation, discrete radioactive particles migrated from the package contents to the bottom of the package, resulting in the higher radiation level, on the external surface of the package.

- b. Determination of how long the issue existed, and prior opportunities for identification:

Enclosure

Entergy's root cause evaluation (RCE) determined that the subject shipment left Vermont Yankee at 1500 hrs on August 31, 2006, and arrived at Susquehanna at 2045 hrs on the same day. Susquehanna radiation protection personnel surveyed the incoming shipment, and identified the package regulatory non-compliance condition at 1115 hrs on September 1, 2006. Therefore, the condition existed for about 20 hours prior to discovery. The RCE did not identify any previous opportunity to identify the shipment condition.

- c. Determination of the plant-specific risk consequences and compliance concerns associated with the issue:

Entergy's evaluation of the performance deficiencies associated with the August 31, 2006 shipment were assessed as having a low to moderate importance to safety (White), in accordance with the NRC significance determination process. Based on both Vermont Yankee and Susquehanna transport vehicle radiation surveys, the actual location of the affected surface, and the conditions associated transportation, the general public could not have been reasonably exposed to radiation levels found in a small location on the bottom of the package. Entergy estimated that the driver received approximately 0.7 mrem during transport; and that personnel associated with package receipt received no exposure due to the normally applied radiological control practices and the distance maintained. Accordingly, there was no actual radiological consequence associated with this matter.

02.02 Root Cause, Extent of Condition, and Extent of Condition Evaluation

- a. Evaluation of methods used to identify root causes and contributing causes:

Entergy utilized an event and causal factors analysis ("Why Staircase"), a barrier analysis, and a human performance evaluation (How-To-Why Matrix) to identify the events and conditions that led up to the event.

Entergy identified two root causes and three contributing causes. The inspectors reviewed the root cause analysis methods employed and concluded that a formal, structured approach was utilized to identify root and contributing causes.

- b. Level of detail of the root cause evaluation:

The inspectors determined that the root cause evaluation was thorough, and identified the appropriate root and contributing causes to a sufficient level of detail. Entergy's evaluation was self critical, and identified weaknesses in human performance and procedure adequacy.

- c. Consideration of prior occurrences of the problem and knowledge of prior operating experience:

The licensee's evaluation included a review to determine if similar problems had previously been reported involving migration of DRPs during transport. The evaluation indicated that this was the first known instance that resulted in exceeding DOT package limits. The NRC issued Information Notice 2002-03, "Highly Radioactive Particle Control

Problems During Spent Fuel Pool Cleanout”, which described use of the same equipment as used at Vermont Yankee, and emphasized the radiological hazard to workers associated with highly radioactive particle exposure.

The inspectors determined that Entergy provided sufficient operating experience review of prior industry occurrences.

- d. Consideration of potential common causes, and extent of condition of the problem:

The RCE included an extent of condition review that was reasonable and included other refueling equipment that had the potential to contain inaccessible areas where DRPs may be undetected by normal radiological survey methods, and result in similar conditions. In addition, this concern was addressed by Entergy at the corporate level, which directed attention to vendor equipment designs that have the potential to result in locations that are inaccessible to normal radiological survey techniques and methods. The inspectors found the extent of condition reviews to be acceptable both in scope and detail.

02.03 Corrective Actions

- a. Appropriateness of corrective actions:

Entergy staff initiated a corrective action condition report on September 1, 2006 (CR-VTY-2006-2723) and implemented immediate corrective actions that included: dispatching RP personnel to Susquehanna to investigate the regulatory non-compliance issue; placing a temporary hold on all radioactive material shipments from the refuel floor; and performing a survey of the refuel floor for DRPs. These corrective actions effectively addressed potential, immediate safety concerns, pending the completion of an effective root cause investigation and analysis.

Subsequently, Entergy’s formal root cause investigation identified and documented two root causes and three contributors to this condition. This analysis also identified corrective actions taken or planned to address each identified cause.

Root causes and associated corrective actions

The two root causes identified in the RCE included: 1) Insufficient procedural guidance on the potential for DRPs due to control rod and local power range monitor shearing and crushing activities; and lack of sufficient contingency measures to address any residual DRPs during shipment activities; and 2) Insufficient questioning attitude that resulted in failure to anticipate the potential for DRPs to affect decontamination, surveying and packaging of the crusher/shearing equipment. The corrective actions implemented by Entergy that address both of these root causes include: 1) Issuance of a standing order requiring a review of all outbound shipments to determine the potential for DRP migration incident to normal transportation; and the imposition of additional requirements, as necessary, such as the use of wrapping barriers to seal any inaccessible areas, the provision of additional shielding, and the use of a closed transport vehicle (to allow for higher package contact radiation limits); 2) Revision of the radwaste shipping procedure (EN-RW-102) to provide additional shipping and

packaging requirements for items that have the potential for DRP contamination and migration during shipment handling and transport. These requirements are the same as contained in the standing order listed above; and 3) Review the details of this event with equipment vendors in an effort to improve equipment design by the reduction or elimination of inaccessible areas, increase package shielding, and revise the vendor procedures to alert workers to the potential for DRP migration during shipment, and consideration of sealing of inaccessible areas to prevent possible DRP migration.

Contributing causes and associated corrective actions

The contributing causes included: 1) The survey instruments used to survey the control rod crushing and shearing equipment were too large to access the small recesses in the equipment and detect residual DRP contamination; 2) Packaging was not sufficiently robust to provide adequate shielding margin to accommodate potential DRP contamination; and 3) Equipment design allowed many small inaccessible areas that were difficult to decontaminate or survey successfully. Corrective actions implemented to address these contributing causes were: 1) Procurement of radiation instruments with smaller detectors to access small crevices and recesses; 2) Revision of the radwaste shipping procedure (EN-RW-102) to provide additional shipping and packaging requirements for items that have the potential for DRP contamination; and 3) Stipulations for equipment vendors to review the design for changes to enhance accessibility for decontamination and survey; and to establish contract terms that will require future shipments of the subject equipment to be provided with more robust shielding and to be shipped in a closed transport vehicle.

The inspectors determined that initial corrective actions effectively addressed the immediate safety concerns; and the corrective actions specified in the root cause evaluation effectively addressed the root and contributing causes of the issue. The inspectors found the completed and proposed corrective actions to be reasonable with regard to addressing the performance deficiencies identified with this issue.

b. Prioritization of corrective actions:

Entergy's implementation of the immediate corrective actions were successful in mitigating a recurrence of this condition prior to the root cause investigation being completed. Corrective measures taken or planned as a result of the RCE were appropriately prioritized. All corrective actions within the licensee's control were implemented prior to resuming radioactive shipments with the potential for DRP contamination.

c. Establishment of schedule for implementing and completing the corrective actions:

Entergy's corrective actions and proposed corrective action plan provided dates for completion of corrective actions described in their root cause evaluation. The inspectors reviewed the schedule and determined that most corrective actions have been completed. Remaining corrective actions are those that require action on the part of equipment vendors. Notwithstanding, the engineered solutions devised by the licensee, appear effective methods to prevent recurrence. The inspectors considered the schedule for completing remaining corrective actions was appropriate.

- d. Establishment of quantitative and qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence:

The inspectors determined that the root cause evaluation included actions with regard to effectiveness reviews for completed and proposed corrective actions. The actions consisted of a "snapshot" self-assessment completed in June 2007, which reviewed the previous 9 months of radioactive material shipments to evaluate the effectiveness of the corrective actions, with no recurrence observed. In addition, Entergy Corporate also performed an effectiveness review of this event to evaluate the response of the equipment vendor to ensure adequate precautions were taken in utilizing the vendor's fuel pool cleanout equipment at other Entergy facilities. The inspectors concluded that Entergy's actions for determining the effectiveness of their corrective actions were of broad scope and reasonable.

03 MANAGEMENT MEETINGS

Exit Meeting Summary

The results of this inspection were discussed with Mr. N. Rademacher and other members of their staff at the conclusion of the inspection on July 12, 2007. The meeting was considered a Regulatory Performance Meeting in accordance with Manual Chapter 0305, "Operating Reactor Assessment Program," and focused on discussion involving the performance deficiencies associated with the issue and proposed corrective actions. No proprietary information was discussed.

ATTACHMENT
SUPPLEMENTAL INFORMATION
KEY POINTS OF CONTACT

Entergy Personnel

J. Dreyfuss, Director of Nuclear Safety
J. Geyster, Acting Radiation Protection Manager
D. Mannai, Licensing Manager
N. Rademacher, Director of Engineering
M. VanDale, Radiation protection Supervisor, Radwaste
S. Wender, Radiation Protection Manager

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Closed

| | | |
|---------------------|-----|---|
| 05000271/2006011-01 | FIN | Radioactive Material Shipment Package Dose Rate Exceeded. |
|---------------------|-----|---|

LIST OF DOCUMENTS REVIEWED

Condition Report CR-VTY-2006-2723 and associated Root Cause Analysis Report
EN-RW-102, Rev. 4, Radioactive Shipping Procedure
FP-OP-012, Rev. 12, Operation of the Advanced Crusher Shear Procedure
Energy Solutions Evaluation of the Advanced Crusher-Shear for Decontamination, Packaging and Shipping
Energy Solutions Condition Report No. 07-0355
Radiation Protection Action Plan for EA-06-253 White Finding
Radiation Protection Department Standing Order SO No. 06-022
AP-0517, Rev. 6, Hot Particle Control and Zone Establishment Procedure
DP-4531, Rev. 32, Radioactive Contamination Surveys Procedure

LIST OF ACRONYMS

| | |
|-----|-----------------------------------|
| CR | condition report |
| DOT | U.S. Department of Transportation |
| DRP | discrete radioactive particle |
| FIN | finding |
| RCE | root cause evaluation |