



**HITACHI**

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**NUCLEAR TEST REACTOR**

**ANNUAL REPORT NO. 57  
FOR THE YEAR 2016**

**LICENSE R-33  
DOCKET 50-73**

**MARCH 31, 2017**

## GE Hitachi Nuclear Test Reactor

### Annual Report No. 57

This report summarizes the operations, changes, tests, experiments, and major maintenance at the GE Hitachi (GEH) Nuclear Test Reactor (NTR), which were authorized pursuant to License R-33, Docket 50-73, and 10CFR50, Section 50.59, for the period of January 1, 2016 through December 31, 2016.

#### I. General

Specific information about the operation of the NTR during the reporting period is presented as follows:

- In 2016 there were 237 reactor startups with the reactor operating at or above critical for 700.83 hours. Total power generation equaled 689.19 EFPH; equivalent to 2.87 MW days. The majority of this time was spent in the performance of approved experiments, either neutron radiography or small sample irradiations.
- The highest radiation exposure to any worker at NTR was 0.862 Rem.
- There was one unplanned shutdown of the reactor in 2016 and one unplanned shutdown prior to criticality. See section V for details.
- Two operator's NRC licenses expired unbeknownst to the operators. See details in section II.
- There were two Severity Level IV violations of NRC requirements found during a Nuclear Regulatory Commission routine announced Operations Inspection (report no. 50-73/2016-202). See section V for details.

#### II. Organization

The details of changes in the status of personnel and operator licenses, which occurred during the reporting period, are described as follows:

##### A. Personnel

- Mr. Daniel Thomas continued as Manager NTR performing licensed SRO activities and radiography NDT Level III activities. December 19, 2016, he stepped down as NTR, Manager assuming a consultant role.

- Mr. Thomas McConnell continued performing licensed SRO activities. He also worked as a radiographer, NDT Level II. He was promoted to NTR, Manager on December 19, 2016.
- Mr. Tim Peterson continued performing radiography NDT Level III activities. He also performing licensed SRO activities through March 10, 2016, when it was discovered his license had expired January 6, 2016. License renewal will not be pursued. See details below.
- Mr. Max Paronable continued performing licensed RO activities through March 10, 2016 when it was discovered his license had expired January 6, 2016. The license was abandoned. Mr. Paronable retired March 31, 2016. See details below.
- Mr. Jorge Garcia continued performing licensed RO Trainee activities and NDT Level I associated radiography activities.
- Mr. Martin Whitman continued performing NDT Level I associated radiography activities.
- Mr. Stephen Neel continued licensed RO Trainee activities and NDT Level I associated radiography activities.
- Ms. Carmen Holmes continued performing NDT Level II associated radiography activities.
- Mr. James Graham, under contract, continued performing NDT Level I associated radiography activities.
- Ms. Margie Rillamas was hired under contract on March 11, 2016 and qualified as NDT Level I on September 23, 2016. She performed radiography associated activities.
- Ms. Maralynn Segars, under contract, returned to work for NTR to support the operation as a radiographer assistant.
- Mr. Mark Leik continued to perform as the Vallecitos Nuclear Center (VNC) Manager for EHS and RC in 2016 with overall responsibilities for the Vallecitos site, including NTR.
- Mr. Matt Feyrer assumed the duties of VNC Site Manager and the NTR License Level III Manager as of November 7, 2016.
- Mr. Thomas Caine continued performing as the VNC Site Manager and the NTR License Level III Manager through November 6, 2016. He retired in December 2016.

## **B. Expiration of Operator Licenses**

On the 10th of March it was discovered that the licenses for two of the active operators at the Nuclear Test Reactor were unintentionally allowed to lapse. Both were due for

relicensing on January 6, 2016. This was not recognized for the period between January 6th and March 10th 2016.

The event was reported to NRC on March 14, 2016 (EN 51789) as a deviation from TS 6.1.3.1 Staffing, where the minimum staffing levels for reactor operations is specified.

A follow up written report was made to NRC on March 24, 2016 under the requirements of TS 6.6.2.a.2.-, Special Reports which states –An observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to reactor operations. This report provided event details, safety significance, a probable cause and corrective actions.

Condition Report # 18665 was initiated in the GEH Corrective Action Program to track the investigation findings, causes, and corrective and preventive actions.

GE has no plans to pursue renewal of either of these operator licenses.

### III. Facility Changes, Tests, Experiments, and Procedure Changes Approved by the Facility Manager

In accordance with written procedures, facility manager approval is required for changes to the facility, procedures, tests, and experiments. Specific information about the reporting period is presented as follows:

#### A. Facility Changes

Pursuant to 10CFR50.59(a), the following facility changes were implemented in 2016 requiring Facility Manager, Regulatory Compliance and VTSC approval. The changes and associated activities were comprehensively reviewed using a 50.59 analysis.

##### CA-308, Stack Gas/Particulate Recorder Replacement

- This change allowed for the replacement of the existing NTR Control Room dual input Stack Gas/Particulate Recorder with an equivalent or better recorder. The new recorder has a digital readout providing a more accurate and consistent reading.

##### CA-309, Safety Rod Magnet Assembly repair

- This change recorded the fabrication of a new safety rod magnet assembly in accordance with GE drawing 661B671. Some minor machining of parts is documented in the CA to allow the components to fit together.

#### B. Tests

Pursuant to 10CFR50.59(a), no special tests were performed during 2016.

#### C. Experiments

Pursuant to 10CFR50.59(a), there were no new experiments in 2016 requiring Facility Manager, Regulatory Compliance and VTSC approval. The two routine experiment types described as neutron radiography and Schafer slide sample irradiations were properly authorized utilizing experiment authorization forms throughout 2016.

#### D. Procedure Changes

Pursuant to 10CFR50.59, thirteen procedural changes were initiated during 2016 to incorporate editorial or typographical corrections, technical data, and changes to requirements, or to provide for the addition or clarification of information and reliability of performance. Changes were made with Facility Manager and Regulatory Compliance review when required. A summary of the changes is presented in the table below.

Revision	Procedure	Summary of Changes
1023	SOP 12-15, Primary Chemistry	Changes entire procedure to update the units of conductivity to make them consistent with the chemistry procedures. Corrected the formatting on the data sheet to include the section references for 2.7 and 2.8. Clarified the wording found in the data sheet for the conductivity instrumentation check, section 2.8.
1024	SOP 6-1, Staffing Requirements	Updated the emergency call number, made clarification to the requirements for NO SOLO operations. Made minor editorial changes for clarity. Deleted security related requirement not relevant to this procedure.
1025	SOP 6.4, Daily Surveillance Check Sheet and SOP 12-14, Routine Patrol	Adds specific requirement to perform (6.4) daily and (12.14) annual surveillance of the newly installed elbow in the Makeup Water System per CA 307.
1026	SOP 5.2, Stack Gas and SOP 12-25, Recorders	(5.2) Changes system description for the replacement recorder. (12.25) Updates the annual surveillance (PM) for the replacement Stack recorder.
1027	SOP 9.4, Change Authorizations	Replaces the NTR procedure with the approved site CA procedure VSS 2.0
1028	SOP 12-30 Stack Particulate Monitor	Changed the High Voltage Adjustment set point specification in Section 6 to allow the flexibility to customize the High Voltage set point to that determined in Section 11 of this procedure.
1029	SOP 9-12 Security	Made changes to address terminology inconsistencies between this SOP and VNC SOP 3-D. Added requirements for Owner Controlled area.
1030	SOP 6-5, Monthly Surveillance Check Sheet	Made changes to the check sheet to include units of measure where applicable.
1031	SOP 7.3, Radiological Surveys	Add requirement to conduct a whole body scan using a portal monitor after exiting a radiation materials area or contamination zone prior to leaving site.

1032	SOP 7-13, Reactor Cell Entry	Clarify the requirements for Reactor Cell Entry
1033	SOP 9.13, Operator Qualification Program	New SOP intended to define the operator qualification program roles and responsibilities
1034	SOP 9.14, Operator Requalification Program	Revise to remove two section that were incorporated into new SOP 9-13
1035	SOP 7.9, Radiation Work Permits	Revised to include process to document the Manager, NTR review and approval for use of VSS 5.5.

#### IV. Major Preventative or Corrective Maintenance

During this reporting period, all routine preventive maintenance and surveillance checks were completed as scheduled. The following lists the noteworthy corrective maintenance activities performed in 2016.

##### Victoreens, Area Radiation Monitors

- On 1/7/16, replaced the "high" alarm relay on the power supply for Victoreen #3 and the detector for Victoreen #5. On 5/13/16, replaced the high range board in both victoreens #3 and 4. On 10/17/16, replaced the Reactor Cell Victoreen detector cable running from the reactor control console to the detector in the reactor cell.

##### Linear Reactor Power (PICO) Detector

- On 5/2/16, replaced the coaxial cables supplying the detector for PICO #1. one power instrument ion chamber detector to eliminate noise that was causing fluctuations in the readings at low power levels.

##### Replaced Log N signal cable

- On 8/15/16, replaced the Log N signal cable in the reactor cell that runs between the lower distribution panel and the upper distribution panel on top of the fuel tank. This eliminated instrument noise below 100 watts.

#### V. Unscheduled Shutdowns and Notice of Violations

During the reporting period, there were one unscheduled reactor shutdown after reaching criticality, one unscheduled shutdown prior to reaching criticality, and two NTC Notice of Violations.

##### A. Unscheduled Shutdowns

###### Scram Report 16-01

###### **Event Summary**

An unplanned shutdown occurred at 10:50 AM on 12/8/2016. A Reactor Safety System scram was automatically inserted. All Safety Rods scrammed as designed. All Control Rods drove in as designed. The reactor was subsequently secured.

###### **Sequence of Events**

A normal reactor startup was being conducted on 12/8/16. During the startup, after critical rod height had been established and during the subsequent ascension towards full power operations (at approximately 1 watt), downscale and upscale alarms were received



from the Linear Reactor Power Instrument #3. The instrument displayed low and then high signals sequentially and in short order. The audible alarm was noted by the Senior Reactor Operator on watch immediately followed by indications of a reactor scram. Upon confirmation that all rods had driven to their full in positions as indicated by the rod position indicators on the reactor control panel, it was noted that the safety rod disconnect alarm was locked in as is expected after a scram but could not be reset. A reactor cell entry was performed and #3 Safety Rod disconnect switch was found to be not actuated. Safety Rod #3 and its associated drive assembly were verified in the position that should have actuated the rod disconnect switch and the switch was actuated manually. An audible click was heard as the switch actuated and the safety rod disconnect alarm was then able to be cleared.

### **Conclusions**

It is believed the maintenance issue with the Safety Rod #3 rod disconnect switch sticking was not a causal factor for the reactor scram. Subsequently, rod testing was conducted on Safety Rod #3. The Safety Rod passed all operational tests and the disconnect switch's failure to actuate could not be replicated.

During this startup, all three linear power instruments were operating in 2 of 3 scram trip logic. Normally a trip on one of the three instruments would not cause a scram. Based upon the observed indications, paper chart traces, and other reactor control panel warning indicator lights, no apparent cause can be attributed to this scram other than a spurious electrical transient possibly involving Linear Reactor Power Instrument #3. The Regulatory Compliance Manager (Mark Leik) was informed of the event.

### **Unplanned Shutdown prior to Criticality**

On 6/10/16, a safety rod disconnect occurred during a startup while pulling safety rod #4. This was a result of a short in SR magnet #1 that was addressed in CA 309.

## **B. Notice of Violations**

A summary follows of Notice of Violations 01 and 02 dated December 13, 2016 associated with NRC Inspection Report 50-73/2016-202 from an NRC inspection conducted October 3-6, 2016.

### **VIOLATION NO. 2016-202-01**

In accordance with Technical Specification (TS) 1.2.20.2.b, the reactor is considered secured when the console key is in proper custody. Nuclear Test Reactor (NTR) Standard Operating Procedure (SOP) 6.1, "Staffing Requirements," Section 4.3.2 also states that the reactor is considered secured when the console key is locked in the safe or in the custody of a

licensed operator. Additionally, TS 6.1.3.1.a, states that the minimum staffing when the reactor is not secured shall be composed of a licensed operator in the control room.

Contrary to the above, a non-licensed operator had access to the safe where the console key was stored. Additionally, General Electric (GE) did not meet the minimum staffing TS requirement because there was not a licensed operator in the control room when the reactor was not secured.

This is a Severity Level IV violation Section 6.1.d.

**GEH's Response to Violation:**

GEH does not contest the violation.

1) The reason for the violation

An investigation determined that the violation was caused by the NTR Manager giving a verbal instruction to a reactor operator trainee to obtain a cell door key, but did not clarify and address that the instruction also made the operating console key unsecure.

2) Short term corrective actions taken

- The console key was returned to a licensed reactor operator.
- The combination to the console key safe was immediately changed so that only licensed operators have access to the key.
- Reactor operators were briefed regarding the event and proper operating console key custody/security.

3) Longer term preventive actions

- Revise NTR Operating Procedure to clarify that only licensed operators have access to the key control safe.
- Update the lock-box configuration such that cell door entry key and operating console key are maintained separately.

Full compliance has been achieved. Two longer term preventive actions have been scheduled.

**VIOLATION NO. 2016-202-02**

Additionally, in accordance with TS. 6.4.1.h, GE is required to have procedures for Radiation protection. NTR SOP 7.6, "Protective Clothing," Section 5.6 requires the use of protective clothing, including gloves. Vallecitos Safety Standards (VSS) 8.1 states that visitors are not allowed in High Radiation areas. Also, VSS 5.5 "Radiation Work Permits," requires workers to move away from the source of any dose rate alarm and notify a radiation monitoring technician (RMT), and workers to exit the radiological controlled area upon receipt of an accumulated dose alarm and immediately notify the RMT responsible for job coverage.

Contrary to the above, there was a failure to adhere to the radiation safety procedures in place on three occasions during the facility walkthrough portion of an operator license exam.

This is a Severity Level IV violation Section 6.7.d.

**GEH's Response to Violation:**

GEH does not contest the violation.

1) The reason for the violation

The violation was caused by a lack of understanding by a reactor operator trainee of contamination control and radiation work permit requirements.

2) Short term corrective actions taken

- A radiation monitor technician was immediately notified and performed a survey of the individual to confirm there was no contamination.
- The NTR reactor operators responsible for controlling reactor cell entries were briefed of the event and acknowledged they understand radiation safety procedures and radiation work permit requirements.
- Additional training was provided to NTR personnel on the proper use of personal protective equipment and alarming dosimeters.

3) Longer term preventive actions

- Revise or replace the NTR operating procedure on the use of protective clothing in posted radioactive materials areas, to ensure the VNC site personal protective clothing requirements are appropriate for NTR; reconcile with the VNC site procedure(s) governing use of protective clothing/equipment.
- Revise the VNC site radiological training procedure to allow visitor access to areas posted as high radiation and radiologically contaminated areas, subject to escort and/or other appropriate controls.

Full compliance has been achieved. Two longer term preventive actions have been scheduled.

## VI. Radiation Levels and Sample Results at On-Site and Off-Site Monitoring Stations

The data below are from sample and dosimeter results accumulated during the 2016 reporting period. Except for the NTR stack data, these data are for the entire VNC site and include the effects of operations other than the NTR.

### A. NTR Stack

Total airborne releases (stack emissions) for 2016 are as follows:

Alpha Particulate: 1.92E-08 Ci (predominantly radon-thorium daughter products)  
Beta-Gamma Particulate: 3.59E-07 Ci  
Iodine-131: 1.80E-05 Ci  
Noble Gases: 1.86E+2 Ci

Noble gas activities recorded from the NTR stack integrate both background readings and the actual releases. Background readings may account for as much as 50% of the indicated release.

### B. Air Monitors (Yearly average of all meteorological stations.)

Four environmental air-monitoring stations are positioned approximately 90 degrees apart around the operating facilities of the site. Each station is equipped with a membrane filter, which is changed weekly and analyzed for gross alpha and gross beta-gamma.

Alpha Concentration:  
Weekly Maximum, 1.27 E-14  $\mu\text{Ci}/\text{cc}$   
Weekly Average, 1.35 E-15  $\mu\text{Ci}/\text{cc}$   
Beta Concentration:  
Weekly Maximum, 1.45 E-13  $\mu\text{Ci}/\text{cc}$   
Weekly Average, 1.76 E-14  $\mu\text{Ci}/\text{cc}$

### C. Gamma Radiation

The yearly dose results for the year 2016 as determined from evaluation of site perimeter environmental monitoring dosimeters showed no departure from normal stable backgrounds.

### D. Vegetation

No alpha, beta or gamma activity attributable to activities at the NTR facility was found on or in vegetation in the vicinity of the site.

**E. Water**

There was no release of radioactivity in water or to groundwater greater than the limits specified in 10CFR20, Appendix B, Table 2, and Column 2.

**F. Off-Site**

The results of samples collected from off-site locations indicate normal background for the regional area.

**VII. Radiation Exposure**

In 2016, the highest annual exposure to any fulltime radiation worker while working at NTR was 0.862 Rem and the lowest exposure for this category of worker was 0.153 Rem. The average radiation exposure for the ten workers involved was 0.428 Rem per person.

The 2016 total radiation exposure for all workers while performing work at NTR was 4.391 Rem.

**VIII. Conclusion**

GE Hitachi concludes that the NTR is organized for continued operation. While it has been a challenging year in the operation of the reactor, procedural and cultural changes resulting from our Corrective Action Program will lead to a safer and more compliant operation.

GE-Hitachi Nuclear Energy Americas LLC  
Vallecitos Operations



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Thomas J. McConnell, Manager  
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