HITACHI

Nuclear Energy

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# NUCLEAR TEST REACTOR

## ANNUAL REPORT NO. 56
## FOR THE YEAR 2015

LICENSE R-33
DOCKET 50-73

MARCH 31, 2016

# GE Hitachi Nuclear Test Reactor

## Annual Report No. 56

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, 2015 through December 31, 2015.

## I. General

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

- IN 2015 there were 256 reactor startups with the reactor operating at or above critical for 826.05 hours. Total power generation equaled 810.82 EFPH; equivalent to 3.38 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 0.706 Rem.
- There were two unplanned shutdowns of the reactor in 2015.
- There were no occurrences that required notification of the NRC during 2015.

## II. Organization

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

- Mr. Daniel Thomas continued as Manager NTR performing licensed SRO activities and radiography NDT Level III activities.
- Mr. Thomas McConnell continued performing licensed SRO activities. He also worked as a radiographer, NDT Level II.
- Mr. Tim Peterson continued performing licensed SRO activities. He also continued performing his radiography NDT Level III activities.
- Mr. Max Paronable continued performing licensed RO activities. He also continued his radiography NDT Level I activities.

- Mr. Jorge Garcia continued performing licensed RO Trainee activities. He qualified as NDT Level I and continued the associated radiography activities.
- Mr. Martin Whitman continued performing licensed RO Trainee activities. He qualified as NDT Level I and continued the associated radiography activities.
- Mr. Stephen Neel continued licensed RO Trainee activities. He qualified as NDT Level I and continued the associated radiography activities.
- Ms. Carmen Holmes qualified as an NDT Level II and continued performing radiography activities.
- Mr. James Graham, under contract, qualified as NDT Level I and continued performing radiography activities.
- Ms. Maralynn Segars, under contract, returned to work for NTR to support the operation as a radiographer assistant.
- Mr. Mark Leik was hired to perform as the Vallecitos Nuclear Center (VNC) Manager for EHS and RC in 2015 with overall responsibilities for the Vallecitos site, including NTR.
- Mr. Earl Saito moved on to another position within GE Hitachi EHS and is no longer directly associated with the daily management of the VNC EHS and RC.
- Mr. Thomas Caine continued performing as the VNC Site Manager and the NTR License Level III Manager.

## 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 2015 requiring Facility Manager, Regulatory Compliance and VTSC approval. The changes and associated activities were comprehensively reviewed using a 50.59 analysis.

CA-307, Change of Material used in the Primary Makeup System

- This change allowed for the replacement of an elbow and pipe connection in the Primary Makeup System that was leaking. The original material was aluminum. The significant change introduced by this repair was when the material of choice for the repair became stainless steel.

CA-213R3, ETA for the Neutron Radiography of Explosives

- This change recorded a review to an Experiment Type Approval (ETA). The ETA was updated to the current license and regulatory compliance environment to ensure its continued relevancy for the neutron radiography of objects containing explosive materials at the GE Hitachi Nuclear Test Reactor (NTR).

### B. Tests

Pursuant to 10CFR50.59(a), no special tests were performed during 2015.

### C. Experiments

Pursuant to 10CFR50.59(a), there were no new experiments in 2015 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 2015.

## D. Procedure Changes

Pursuant to 10CFR50.59, three procedural changes were initiated during 2015 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 |
|---|---|---|
| 1016 | SOP 10-4, Explosives Handling | Incorporates the necessary changes to add a flagging requirement when explosive setups exceed 70 grams TNT equivalent for Technical Specification compliance assurance. |
| 1017 | SOP 3-5, Manual Poison Sheet | In conjunction with the change in the manual poison sheet (MPS) configuration, changed Table 1 to record the new nomenclature for the 1/8 MPS. |
| 1018 | SOP 10-4, Explosive Handling | Clarified posting requirements for explosives. Corrected acronyms of IHCP and SDS. Updated location and quantity allowances to include both Tech Spec and the Site Plan for Explosives information. |
| 1019 | SOP 7-5, Radiation Exposure Control | Makes applicable the VNC VSS exposure control procedures to NTR. Updates the dose estimating process for NTR. |
| 1020 | SOP 5-2, Stack Gas | Updates the technical specification release rate limits and action level tables. Updates the record keeping and reporting process. |
| 1021 | SOP 10-4, Explosive Handling | Consolidates the allowed explosives locations rule for HD 1.1, 1.2, and 1.3 materials to correspond to the rules in the revised Site Plan for Explosives and ETA 213R3, Radiography of explosives. The change simplifies the handling rules and will enhance compliance. |
| 1022 | SOP 6-7 Startup Summary | Adds a precaution during the reactor startup during the time period soon after attaining 100% power when temperature and reactivity are quickly changing which will require frequent control rod adjustments to maintain power below the trip point. |

## 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 2015.

Manual Poison Sheet Modification

- During the January maintenance outage, made modifications to one of the ¼ manual poison sheets (MPS) to cut the amount of cadmium poison on the sheet in half to 1/8 of an original full sheet. This 1/8 MPS was then used to replace the other ¼ MPS in the core to boost the available reactivity to a sustainable value for normal reactor operations supporting the radiography experiment. This MPS adjustment was routine and necessary due to fuel burnout.

Linear Reactor Power (PICO) Detector

- On 6/23/14, replaced the coaxial cables supplying the detector for one power instrument ion chamber detector to eliminate noise that was causing fluctuations in the readings at low power levels.

Primary Makeup Piping

- On 7/6/15, implemented repairs to the deionized water supply piping for the primary makeup system. A pipe weld at a valve flange had a slow dripping leak. Since the weld connected aluminum components, it was decided to change the materials to stainless steel to avoid the complications of attempting an aluminum weld repair in a radiation controlled environment. A 50-59 impact evaluation was conducted for this change in material and documented with CA 307.

Radiation Monitoring Instrumentation (Victoreen)

- On 11/2/15, performed corrective maintenance on one of the five Radiation Area Monitors involving the replacement of the PC boards in the detector. This is a continuing effort to maintain the system. Having only this one failure in 2015 supports the current premise that the system remains viable and relevant.

Log N Reactor Power Instrument

- On 11/16/15, replaced the pre-amp board for the Log N instrument after erratic readings were noted before a routine startup.

## V. Unscheduled Shutdowns

During the reporting period, there were two unscheduled reactor shutdowns after reaching criticality.

### Scram Report 15-01

#### Description of the Event

At 13:22 on Thursday the 5th of February 2015, an unplanned shutdown occurred while operating at power. Two of three Pico-ammeter nuclear instruments locked in at their trip point of 120% to initiate a Pico-ammeter high level nuclear scram of the reactor. The Reactor Operator observed all normal indications of a reactor scram and proceeded to shutdown and secure the reactor. All safety rods automatically scrammed to full-in positions. All control rods and the source rods automatically drove in to their full-in positions. The Manager, NTR was notified of the scram.

#### Sequence of Events

After completing a four hour reactor run and while awaiting the results of the final experiment, rods were bumped in to place the reactor power on a slight down slope as is common practice. It was later decided that experiment rework was required to complete the work plan for the day. Power had drifted down to approximately 60% so the reactor operator pulled control rods to raise reactor power back to 100% which was a pre-condition for the experiment.
Almost immediately following the control rod pull, the control room phone rang, the reactor operator answered the phone and began a conversation.
From the chart recording trace, it can be seen that approximately 60 seconds after first pulling control rods, the reactor scrammed on high power.

#### Primary causes for the Event

The act of taking the phone call by the operator created a distraction at just the wrong time and for long enough to allow the high power trips to lock in.

#### Immediate Corrective Actions

The operator was interviewed and reminded that his primary responsibility when operating the reactor is to monitor and maintain control of the reactor and reactor experiments such as NRay.
The operator agreed that he must block out all distraction during periods when known reactivity changes have occurred in the reactor.

## Scram Report 15-02

### Description of the Event

An unplanned shutdown occurred at 12:03 PM on 11/2/2015. A preemptive manual scram was inserted by the operator after receiving a CIC trip on Pico channel #3 caused by a high power condition during a power transient (startup). This avoided a CIC High Power Protective System Scram. The reactor was subsequently secured.

### Sequence of Events

A normal rector startup was being conducted on 11/2/15. During the startup, a lightning strike monitor alarm was activated and noted by the reactor operator in the control room. Having heard the alarm, the Manager, NTR got involved and started an investigation of the lightning strike monitor alarm. The reactor startup was temporarily suspended with the reactor sub-critical. Confirmation of the weather condition was being sought by checking the Doppler radar site on the internet using the control room computer. The Manager, NTR concluded that there was no immediate indication that lightning was upon the site. The reactor operator was made aware of this assessment. The Manager, NTR then authorized the reactor operator to finish the reactor startup and moved the monitoring of the Doppler radar site to his office where he would not be a distraction to the operator.

After achieving 100% indicated power, the reactor operator felt compelled to additionally check the Doppler site to verify the nearby weather status. While performing this action, he was distracted from his primary responsibilities long enough for one of the three CIC channels to reach the trip point at 120%. He then inserted a manual scram.

### Primary causes for the Event

The operator did not fulfill his primary responsibility, to maintain control of the reactor.

### Immediate Corrective Actions

This was the second time this year that this operator was involved in an unplanned shutdown with very similar causes. On November 2, 2015, the Manager, NTR placed a suspension on this operator's license restricting him from control panel operations. A corrective action program was implemented on November 30, 2015. On January 15, 2016, the Manager's suspension for this operator was lifted.

## 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 2015 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 2015 are as follows:

Alpha Particulate: 6.68E-08 Ci (predominantly radon-thorium daughter products)
Beta-Gamma Particulate: 3.42E-07 Ci
Iodine-131: 3.14E-06 Ci
Noble Gases: 2.62E+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, 2.03 E-14 μCi/cc
Weekly Average, 2.30 E-15 μCi/cc
Beta Concentration:
Weekly Maximum, 3.49 E-14 μCi /cc
Weekly Average, 1.34 E-14 μCi/cc

### C. Gamma Radiation

The yearly dose results for the year 2015 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 2015, the highest annual exposure to any full time radiation worker while working at NTR was 0.706 Rem and the lowest exposure for this category of worker was 0.501 Rem. The average radiation exposure for the nine workers involved was 0.521 Rem per person.

The 2015 collective radiation exposure for all workers while performing work at NTR was 4.688 Rem.

## VIII. Conclusion

GE Hitachi concludes that the overall operating experience of the NTR reflects another year of safe and efficient operations. There were no reportable events.

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