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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-001

Subject: GEH Annual Nuclear Test Reactor (NTR) Operating Report for the Year 2021

Reference: NRC License R-33, Docket 50-73 (NTR)

Enclosed is the Annual Operating Report No. 62 for the GE Hitachi Nuclear Test Reactor (NTR) located at the Vallecitos Nuclear Center in Sunol, California.

If there are any questions regarding this report or additional information required, please contact me at the number above.

Sincerely,

Digitally signed by Carlos
Martinez
Reason: Approved
Date: 2022-04-26 11:23-07:00

Carlos Martinez
Site Manager
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Enclosure: 1) NTR Annual Operating Report Number 62 for the year 2021

cc: D. Hardesty, NRC NRR
CM 22-001



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NUCLEAR TEST REACTOR

**ANNUAL REPORT NO. 62
FOR THE YEAR 2021**

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

APRIL 26, 2022

GE Hitachi Nuclear Test Reactor

Annual Report No. 62

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 10 CFR 50, Section 50.59, for the period of January 1, 2021 through December 31, 2021.

I. General

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

1. In 2021 there were 201 reactor startups with the reactor operating at or above critical for 618.62 hours. Total power generation equaled 603.85 EFPH; equivalent to 2.516 MW days. The majority of this time was spent in the performance of approved experiments, either neutron radiography or small sample irradiations.
2. The highest radiation exposure to any worker at NTR was 0.718 Rem.
3. There were five unscheduled shutdowns of the reactor in 2021 and five unscheduled shutdowns prior to criticality. See section V for details.
4. One 2020 technical specification violation was cited in NRC Inspection Report 2021-201 when the operator requalification program activities were not completed by the required due date. 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

The Level 1 & 2, Level 3, and VNC site Regulatory Compliance managers were unchanged in 2021.

B. Operator Licenses

There were no changes to the status of operator licenses under the Vallecitos Nuclear Test Reactor, Facility License No. R-33 in 2021.

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

There were two facility changes implemented in 2021 requiring Facility Manager and Regulatory Compliance approval.

1. Primary coolant system conductivity probe and readout were replaced as described in Change Authorization (CA)-317. The original probe could not safely be removed from the system for calibration against a known standard as documented in Condition Report (CR) 37268. The new system allows easy removal and planned maintenance procedure Standard Operating Procedure (SOP) 12.46 describes the calibration process.
2. Primary coolant pump failed and was replaced under Engineering Release (ER) 21-19. The pump inlet valve (TV-103), sample sink return valve (V-121), and the section of aluminum pipe between the pump and TV-103 were also replaced. NTR CA-322 documents this valve and piping change and the associated 50.59 evaluation.

B. Tests

Pursuant to 10 CFR 50.59(a), no special tests were performed during 2021.

C. Experiments

Pursuant to 10 CFR 50.59(a), two previously approved experiment types were performed in 2021.



1. Experiment types described as neutron radiography and slide sample irradiations, were properly authorized utilizing experiment authorization forms throughout 2021.

D. Procedure Changes

Pursuant to 10 CFR 50.59, the administrative revision of all NTR Standard Operating Procedures that was begun in 2020 and documented in NTR CA-318, was completed in 2021. Additionally, eleven procedural changes were initiated during 2021 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
1	SOP 2.7, Process Instrumentation	Added description of recently installed conductivity probe and meter.
1	SOP 4.2, Safety Rod Repairs	Added new section on adjusting the flexible coupling.
2	SOP 6.4, Daily Surveillance Check Sheet	Added a check that the On-Duty Emergency Director is on site prior to operating NTR.
1	SOP 6.5, Monthly Surveillance Check Sheet	Changes reflect simplified conductivity meter checks.
1	SOP 8.2, Non-Reactor Emergencies	Updated references to “SEP” site emergency procedures to recently approved “SEC” procedures.
1	SOP 8.4, Off-Normal Alarm Response	Rewritten to clarify the definition of a “seismic occurrence”, reference the VNC earthquake procedure, and simplify emergency response for different modes of reactor operation.
1	SOP 8.5, Seismic Activity	Clarification of 1) actions to seismic events when the reactor is operating, and 2) definition of Modified Mercalli IV. Intent of procedure is not affected by this change.
1	SOP 9.14, Reactor Operator Requalification Program	Added clarifications on 1) time interval between annual operating tests, 2) preserving exam integrity when multiple operators are taking the same test, and 3) using a calendar-based reminder system to track annual requalification requirements .



1	SOP 10.6, Cable-Held Retractable Irradiation System	Authorized SROs to sign the VNC 706 form when transferring irradiated samples on-site.
1	SOP 12.3, Safety Rod Drives	Added annual visual checks of the anvil roll pin and flexible coupling.
1	SOP 12.31, Stack Gas Monitor	Changed the stack gaseous activity alarm point to match the values in SOP 5.2 and SOP 8.4 Alarm #22.

IV. Major Preventative or Corrective Maintenance

During this reporting period, all routine preventive maintenance and surveillance checks were completed as scheduled with the exception of the third quarter, semi-annual, Emergency Diesel Generator Load Test, PM-00301S-BN. The site generator is being repaired and a rental unit has been acquired to fulfill this emergency function.

The following lists the noteworthy corrective maintenance activities performed in 2021.

1. 1/8/21 Replaced the startup source drive belt

During maintenance, the startup source could not be withdrawn from the reactor within the required timeframe. The drive belt was replaced and all re-tests per SOP 12.4 completed satisfactorily.

2. 2/8/21 Replaced SR #4 magnet S-3 with magnet S-13

A broken lead wire was discovered on magnet S-3 during the investigation into Scram 21-02. The magnet was replaced. See section V Item A.2 below for details.

3. 3/2/21 Reglued stop (rubber) onto the anvil of Safety Rod (SR) #4

During maintenance, SR #4 failed to meet the required in-flight scram time. The stop (rubber) on the anvil was found to be detached. The part was reattached per ER 21-10 and re-tested satisfactorily.

4. 4/27/21 thru 6/15/21 On multiple occasions, SR #4 exhibited an abnormally high resistance to outward movement

A deliberate and controlled approach was used to address this recurring but non-repeatable issue resulting in the following actions: 1) replaced the anvil roll pin and o-ring, 2) replaced the dashpot bearing, 3) replaced inner bearing surface (bushing), and 4) disassembled and

cleaned the entire safety rod assembly. Issue documented and addressed by CR 36854 and ERs 21-13, 21-15, and 21-17.

5. Spurious high stack particulate alarms 1/11/21 thru early June 2021

Received frequent high stack particulate activity alarms that were determined to be spurious between January and June 2021. Efforts documented in CR 36408 to troubleshoot and correct this condition.

V. Unscheduled Shutdowns

During the reporting period, there were five unscheduled reactor shutdowns after reaching criticality and five unscheduled shutdowns prior to reaching criticality.

A. Unscheduled Shutdowns

1. Scram Report 21-01

An unscheduled shutdown occurred at 11:45 AM on 2/3/2021 with the reactor operating at 100% power. A Reactor Safety System scram was automatically inserted. There were no indications of the cause of the scram. A visual inspection and operational tests of all four safety rods were completed with no abnormalities observed. Actions documented under CR 36141.

2. Scram Report 21-02

An unscheduled shutdown occurred at 11:45 AM on 2/3/2021 with the reactor operating at 100% power. A Reactor Safety System scram was automatically inserted and there were no indications of the cause of the scram. ER 21-06 was generated to guide troubleshooting on all 4 safety rods. Subsequently, issues found and corrected included 1) a bare lead wire on SR #2 magnet, 2) a broken lead wire upon inspecting SR #4 magnet requiring replacement, and 3) mating surfaces between the magnets and anvils for safety rods 2, 3 and 4 were adjusted for a more optimal alignment. The scram report and CR 36196 documented corrective actions.

3. Scram Report 21-03

An unscheduled shutdown occurred at 10:24 AM on 5/21/2021 during a reactor startup. A Reactor Safety System scram was automatically inserted as the operator started to move control rods outward after establishing critical rod height while in 1 out of 2 safety system coincidence logic. While switching ranges on one of the two on-line power picoammeter

instruments, a “noise” spike occurred resulting in the automatic scram. The scram report and CR 37060 documented corrective actions.

4. Scram Report 21-04

An unscheduled shutdown occurred at 9:16 AM on 7/23/2021 just after reaching 100% power. The operator became distracted while restoring the plant to normal safety system coincidence logic after performing a test under ER 21-09 during the startup. A Reactor Safety System scram was automatically inserted based on the high power signal from one power picoammeter instrument. The scram report and CR 37413 documented corrective actions.

5. Scram Report 21-05

The operator performed an unscheduled shutdown at 10:09 AM on 10/15/21. Shortly after reaching 100% power, the operator observed unexpected, fluctuating instrument indications for reactor coolant flow, reactor power, and stack gaseous and particulate activities. A precautionary manual shutdown was performed. The scram report and CR 38121 documented corrective actions.

6. Prior to Criticality

On 5 occasions during 2021, issues with safety rods occurred upon initial movement precluding a reactor startup. Three had to do with resistance to movement of safety rod # 4 (see Section IV Item 4 above) and the other two involved 1) the flexible coupling disengaging on SR #4, and 2) a safety rod magnet wire nut coming loose on SR #2. All occurrences were investigated, repaired and the affected components retested satisfactorily. The Facility Manager authorized reactor restarts.

B. 2020 Technical Specification Violation Cited

NRC Inspection Report 2021-201 cited a severity Level IV violation pursuant to 10 CFR 55.59(a)(2) for a lapse in 2020 of licensed operator qualifications resulting from failure to pass an annual operating test within the time constraints of the approved requalification program as per 10 CFR 55.59(c). This was reported as Event Notification 55113 on February 24, 2021 and further described in the written follow-up report contained in GEH letter M210030 dated March 10, 2021. This event is also described in NTR Annual Report No. 61 for the Year 2020.

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 2021 reporting period. Except for the NTR stack data, the data below covers the entire VNC site and include the effects of operations other than the NTR.

A. NTR Stack

Total airborne releases (stack emissions) for 2021 are as follows:

Alpha Particulate: 1.11E-08 Ci (predominantly radon-thorium daughter products)

Beta-Gamma Particulate: 4.93E-07 Ci

Iodine-131: 1.15E-05 Ci

Noble Gases: 1.30E+02 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. Gamma Radiation

The yearly dose results for the year 2021 as determined from evaluation of site perimeter environmental monitoring dosimeters showed no departure from normal stable backgrounds.

C. 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.

D. 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.

E. Off-Site

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

VII. Radiation Exposure

In 2021, the highest annual exposure to any fulltime radiation worker while working at NTR was 0.718 Rem and the lowest exposure for this category of worker was 0.019 Rem. The average radiation exposure for the ten workers involved was 0.401 Rem per person.

The 2021 total radiation exposure for all workers while performing work at NTR was 4.010 Rem.

VIII. Conclusion

GE Hitachi concludes that the NTR is staffed and organized for efficient operations. Extensive use of our Corrective Action Program will continue contributing to making us a more safe and compliant operation.

GE-Hitachi Nuclear Energy Americas LLC
Vallecitos Operations

Thomas
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