

January 15, 2003

Dr. B. Don Russell, Deputy Director
Texas Engineering Experiment Station
1095 Nuclear Science Road
3575 TAMU
College Station, TX 77843--3575

SUBJECT: NRC INSPECTION REPORT NO. 50-128/2002-201 AND NOTICE OF
VIOLATION

Dear Dr. Russell:

This letter refers to the inspection conducted on September 17-20, 2002 at your Nuclear Science Center (NSC) Reactor. The enclosed report presents the results of that inspection.

This special inspection was conducted in response to your loss of reactor pool water that resulted in a declared Unusual Event and an uncontrolled radioeffluent release to the environment. Areas of your reactor operations and health physics programs, directly related to this event, were inspected. This included selective examinations of procedures and representative records, interviews with personnel, and observations of the facility.

Based on the results of this inspection, the Nuclear Regulatory Commission (NRC) has determined that a violation of NRC requirements occurred. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is of concern because it suggests a lack of compliance with the requirements stated in your license. In addition, we are concerned that operator inattention to detail appears to be a primary cause of the event.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

Dr. B. D. Russell

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In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice", a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Stephen Holmes at 301-415-8583.

Sincerely,

/RA/

William D. Beckner, Program Director
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures: 1) Notice of Violation
2) NRC Inspection Report No. 50-128/2002-201

cc w/enclosures:
Please see next page

Texas A&M University

Docket No. 50-59/128

cc:

Mayor, City of College Station
P.O. Box Drawer 9960
College Station, TX 77840-3575

Governor's Budget and
Planning Office
P.O. Box 13561
Austin, TX 78711

Bureau of Radiation Control
State of Texas
1100 West 49th Street
Austin, TX 78756

Dr. Warren D. Reece
Director, Nuclear Science Center
Texas Engineering Experiment Station
Texas A&M University
System F.E. Box 89, M/S 3575
College Station, TX 77843

Test, Research, and Training
Reactor Newsletter
202 Nuclear Sciences Center
University of Florida
Gainesville, FL 32611

Dr. B. D. Russell

-2-

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ACCESSION NO.: ML030020750

TEMPLATE #: NPR-106

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NOTICE OF VIOLATION

Texas A&M University
Texas Engineering Experiment Station Nuclear Science Center

Docket No. 50-128
License No. R-83

During an NRC inspection conducted on September 17-20, 2002, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violation is listed below:

10 CFR 50.10 (a) states that "Except as provided in §50.11, no person within the United States shall transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, or use any production or utilization facility except as authorized by a license issued by the Commission."

Section II.C.(2) of NRC License No. R-83, Amendment No. 15 dated November 1, 1999, states that; "The Technical Specifications contained in Appendix A, as revised through Amendment No. 15, are hereby incorporated in their entirety in the license. Texas Engineering Experiment Station/Texas A&M University System shall operate the facility in accordance with the Technical Specifications."

Technical Specifications, dated March 1983, Section 6.3 requires that operating procedures "shall be in effect" for startup, operation, and shutdown of the reactor.

Contrary to the above, as demonstrated by the following examples, the licensee failed to operate its facility in accordance with the Technical Specifications.

- 1) On September 17, 2002, the change in operating procedures for the diffuser system was not documented in the shift change notebook as required by Standard Operating Procedure II.D.5.
- 2) On September 17, 2002, the diffuser pump was not shutdown at the end of operations as required by Nuclear Science Center Form 534, Facility Security Shutdown Checklist--Daily Surveillance.
- 3) On September 18, 2002, four hundred eighty gallons of liquid effluents were release to the environment prior to being analyzed as required by Standard Operating Procedure VII.C9.

This is a Severity Level IV violation (Supplement IV).

Pursuant to the provisions of 10 CFR 2.201, Texas A&M University is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555 within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately

addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/NRC/ADAMS/index.html>. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Dated at Rockville, Maryland
this 15th day of January 2003

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-128

Report No: 50-128/2002-201

Licensee: Texas A&M University

Facility: Texas Engineering Experiment Station
Nuclear Science Center

Location: College Station, Texas

Dates: September 17-20, 2002

Inspector: Stephen W. Holmes, Reactor Inspector

Approved by: William D. Beckner, Program Director
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

This special reactive, announced inspection was conducted in response to a declared Unusual Event that included an uncontrolled radioeffluent release to the environment. The inspection included onsite review of selected aspects of the reactor operations and health physics programs. This facility is a one megawatt research reactor and at the time of this event was operating four to five days a week with a second shift two to three days a week. Three apparent related failures to follow procedures were identified.

On the morning of September 17, 2002 the Texas A&M TRIGA Reactor staff notified NRC Headquarters of an Unusual Event. The notification was triggered, according to their Emergency Plan (EP), when the reactor pool low-level alarm activated due to the loss of approximately 8,000 gallons of water from the pool. The water was lost from the reactor pool when a leak developed in the diffuser pump discharge piping. The water drained to the building sump and was automatically pumped to the outside waste tanks.

At approximately 7:00 A.M. EDT Tuesday, September 17, 2002, during their checks of the research center, the university police observed water spewing from the top of one of the three 10,000 gallon outside waste tanks. They immediately contacted the reactor supervisor (RS) at his home. The RS arrived at the research center within 20 minutes and reconfigured the waste tank valves to halt the overflow. He entered the reactor building and identified the loss of reactor pool water. The RS then located the source of the leak (the diffuser pump pumping water out through a separated discharge line connection) and secured the pump and associated valving. The RS started refilling the pool using the demineralizer system in accordance with procedures. During this time the low level alarm had activated putting the facility into an Unusual Event as described in their EP. Reactor staff performed their notifications to the NRC and other entities as required by the EP. At 9:20 A.M. EDT that morning the event was terminated when the low-level alarm reset as the pool refilled to its normal level.

A conference call regarding this event was held on September 17, 2002 with representatives of the Texas Engineering Experiment Station Nuclear Science Center and the NRC Research and Test Reactors Section staffs. The licensee stated that at no time could the reactor core be uncovered during this event. The licensee estimated that less than 1000 gallons overflowed from the tank onto the tank pad and then to the surrounding ground. Additionally, the licensee's preliminary analysis of the tank contents identified Sodium-24 at a concentration of about 4 percent of 10 CFR 20, Appendix B, Table 2, Column 2, limits for continuous release to the environment.

An NRC inspector was dispatched from headquarters that afternoon and began an inspection of the event Wednesday morning, September 18, 2002.

In investigating the root cause of this event the licensee has preliminarily identified a number of items that may have contributed to it. The licensee has performed a number of corrective actions for this event and is evaluating further corrective and preventive actions.

Plant Operations

- Written procedures for reactor operations were available as required by Technical Specification Section 6.3.

- Operating logs and records reviewed provided an indication of operational activities. However, they did not document the modified operating condition of the diffuser system. Specifically, this condition was not noted in the shift change notebook as required by Standard Operating Procedure II.D.5. This was a failure to follow procedure.
- The diffuser pump was not turned off at shutdown as required by Nuclear Science Center Form 534, a second instance of failure to follow procedures.
- The inspector confirmed that, as required by Technical Specification Section 5.7, the diffuser pump intake was no deeper than fifteen feet from the top of the reactor pool. Therefore, the reactor core could not have become uncovered due to loss of water through the diffuser system as a minimum of thirteen feet of water would have covered the core when system draining would have stopped.

Radiation Counting Equipment

- Counting lab instruments were being maintained and calibrated as required by licensee procedures. Counting system results would be acceptable to determine compliance with NRC requirements.

Liquid Effluent Monitoring and Release

- Current procedures for sampling, analyzing, and releasing liquid wastes were clear, concise, and accurately reflected liquid effluent amounts, concentrations, and release fractions to the environment. The unintentional liquid effluent release was less than 5 percent of 10 CFR 20, Appendix B, Table 2 limits for continuous release to the environment and thus did not exceed regulatory requirements. However, since this release was not analyzed before release, as required by Standard Operating Procedure VII.C9, this constitutes a third instance of failing to follow procedures.

Licensee Corrective Actions

- The connections on the diffuser pump discharge are going to be modified to reduce the chance of future failure and other piping connections would be evaluated for similar modifications.
- The waste tanks are going to be modified to allow them to overflow into each other, reducing the likelihood of an uncontrolled release.
- Tag-out procedure will be used when equipment is operated outside its normal parameters.
- The shift change log is going to be evaluated to insure it is relevant and useful to turnover requirements.
- The facility shutdown checklist is going to be evaluated for inclusion of a final physical walk through of the facility after reactor shutdowns.

REPORT DETAILS

Summary of Event Follow-up

In response to this event, the inspector reviewed the operational circumstances that attributed to the drain down of the reactor pool and the inadvertent release of liquid effluent to the environment. Additionally, the inspector reviewed pertinent sections of the licensee's instrument calibration and effluent programs to confirm and verify the licensee's evaluation of the release to the environment.

1. PLANT OPERATIONS

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed selected aspects of:

- operational logs and records
- staffing for operations
- selected operational, startup, or shutdown activities
- Standing Operating Procedure (SOP) Reactor Startup II.C, Revision 4, March 2, 2001
- SOP Steady State Operation II.D, Revision 1, September 3, 1999
- NSC Form 532, September 18, 2002, "TRIGA Reactor Pre-Startup Checklist"
- NSC Form 533, March 25, 2002, "Reactor Operations Facility Checklist-Daily Surveillance"
- NSC Form 534, January 25, 2000, "Facility Security Shutdown Checklist--Daily Surveillance"
- SOP Maintenance and Surveillance of Support systems, VII.D, Revision 1, June 6, 1999

b. Observations and Findings

1) Diffuser System

The diffuser system draws water from the mid pool level (no deeper than fifteen feet from the top of the pool as required by TS Section 5.7.C.) The water is directed through nozzles over the top of the reactor core. This water stream disrupts the thermal column rising from the core and breaks up the bubbles of radioactive nitrogen sixteen (N-16) in the column, increasing the time it takes for the gas to reach the surface of the pool. This results in decreasing the radiation exposure at the pool surface produced by the short half life N-16. Although not required by TS nor considered a part of the reactor safety systems, licensee SOP II.C.3.b requires that the diffuser be operating during power levels of 400 kilowatts or greater.

During startup, Monday, September 16, 2002, the console switch for the diffuser pump failed. The licensee subsequently bypassed the control room switch and used the diffuser pumps' breaker box switch directly to operate the diffuser. Operations staff then continued with the reactor startup and normal operations.

Although the facility SOP contains a tag-out procedure, it was not used. The reactor staff stated that they did not consider using it because it only addresses equipment actively being maintained/repared or undergoing surveillance testing. The inspector confirmed that for this operating condition the tag-out procedure was not required to be used. The licensee stated that the tag-out procedure will be revised and used when equipment is operated outside its normal parameters. This procedure revision will be reviewed in a future inspection. This item is identified as Inspector Follow-up Item (IFI) 50-128/2002-201-01.

2) Shift Turnover

At the time of this event, the reactor was operating on a two-shift schedule. During the shift turnover briefing that afternoon, the oncoming senior reactor operator (SRO) was verbally briefed by the day shift SRO of the modified operating condition of the diffuser system. A short time later the electronics technician showed the SRO where the breaker switch was and how to use it to operate the diffuser pump. Although the oncoming SRO was thus informed of the change from normal operating procedures, it was not documented in the shift change notebook as required by SOP II.D.5. The failure of the licensee to operate its facility in accordance with TS Section 6.3 by not adequately following operating procedures for startup, operations, and shutdown of the reactor is identified as Violation 50-128/2002-201-01. The licensee stated that the shift change log will be used to ensure relevant and useful turnover requirements are communicated. This will be reviewed during a subsequent inspection. This item is identified as Inspector Follow-up Item 50-128/2002-201-02.

3) Shutdown

At 8:55 P.M. CST reactor power operations were terminated for the evening. As part of the shutdown the reactor needed to be moved to the opposite side of the pool to provide irradiation of samples using decay gammas from the core. This requires disconnecting the diffuser discharge piping at the top of the reactor bridge. When the SRO disconnected the piping to move the reactor, the diffuser pump was deadheading against the closed quick disconnect. After moving the reactor, which took more time than normal due to multiply difficulties, the SRO turned the control room diffuser pump switch to the off position. Since the switch was bypassed this did not turn off the pump. The SRO neither noted that the pump on light was still illuminated nor remembered to turn the pump off at the breaker box as instructed. The licensee's failure to follow a procedure and not shut off the diffuser pump is another example of Violation 50-128/2002-201-01. The SRO then finished the facility security shutdown checklist-daily surveillance (NSC Form 534, January 25, 2000), annotated that the diffuser pump had been turned off, and secured and left the reactor. The licensee stated that the facility shutdown checklist will be revised to include a final physical walk through of the facility after reactor shutdowns. This will be reviewed during a subsequent inspection and is identified as IFI 50-128/2002-201-03.

4) Diffuser pump connection failure

The diffuser pumps are located on the mid-level equipment area, called the chase. The pumps' outlets are connected to the system PVC piping through flexible piping using a screw on compression fitting. In discussion with licensee staff, the inspector found that the connection had unscrewed. This allowed the pump to discharge pool water onto the chase floor. The water then flowed through floor grates down to the lower floor and into the demineralizer sump. From here the water was automatically pumped to the waste tank header and filled the open tank.

The licensee could not determine if the connection's failure was caused by the pump deadheading, normal operation vibrations, or other factors. The licensee stated that the connections on the diffuser pump discharge would be modified to reduce the chance of future failure and that other piping connections would also be evaluated for similar modifications. These modifications will be evaluated during a subsequent NRC inspection and is identified as IFI 50-128/2002-201-04.

5) Inspector Findings

By review of design drawings and direct measurements, the inspector verified that the suction for the diffuser pump was less than fifteen feet from the top of the reactor pool, as required by TS Section 5.7. Thus, a minimum of thirteen feet of water would have covered the core. The inspector therefore determined that the reactor core could not have become uncovered due to loss of water through the diffuser system.

c. Conclusions

Based on the procedures and records reviewed and the observations made during the inspection, the inspector determined that two cases of failure to follow procedures had occurred.

2. RADIATION COUNTING EQUIPMENT

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- maintenance and calibration of radiation monitoring equipment
- periodic checks, quality control, and test source certification documentation
- SOP Calibration of Gas Flow Proportional Counters, VII.B16, Revision 4, December 19, 1997
- SOP Operation of NSC Gamma-Spectroscopy System, Revision 4, September 3, 1999
- HPGe (high purity germanium) Gamma Spectroscopy System Procedures, October 2000

- calibration source certificates

b. Observations and Findings

Gamma analyses of liquid effluents are performed on an ORTEC HPGe GEM--20180 gamma spectroscopy system utilizing a Canberra GENIE 2000 software package. When appropriate, representative samples are evaporated and counted for alpha/beta constituents on a Ludlum 2200 gas flow proportional counter. Efficiency calibrations are done annually using a three-liter merinelli mixed gamma source, and Technetium-99 and Thorium-230 planchet sources, respectively. Additionally, energy calibrations, using a Europium-152 secondary source, are performed on the HPGe system prior to each analysis.

The inspector confirmed that the licensee's gamma spectroscopy and gas flow proportional counter system calibration procedures and frequencies satisfied licensee and 10 CFR 20.1501(b) requirements, and the American National Standards Institute N323 "Radiation Protection Instrumentation Test and Calibration" or instrument manufacturers' recommendations. The inspector verified that the calibration and check sources used were traceable to the National Institute of Standards and Technology and that the sources' geometry and energies matched those used in actual detection/analyses.

Based on the review the inspector determined that licensee analytical results of liquid effluents using their counting systems would be acceptable to determine compliance with NRC requirements.

c. Conclusions

The inspector determined that counting lab instruments were being maintained and calibrated as required by licensee procedures. Counting system results would be acceptable to determine compliance with NRC requirements.

3. LIQUID EFFLUENT MONITORING AND RELEASE

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Sections 3.7, and 6.6.1.f)1).

- SOP Radioactive Liquid Waste Disposal, VII.C.9, Revision 3, May 10, 2000
- daily pool water sample analysis sheets
- alpha, beta, and gamma analyses for the September 17, 2002, overflow
- Environmental Analysis Report dated, September 19, 2002
- TS Section 3.7

b. Observations and Findings

The research center is located at a remote area off campus and is not serviced by a sanitary sewer system. This situation requires that the NSC discharge liquid waste directly to the environment. Therefore, the licensee purposely maintains the reactor pool water radioactive material concentrations as low as possible. At the time of the overflow, the facility had just completed their two-week annual shutdown of the reactor. This resulted in a core power history less than 10 percent of normal, thus minimizing concentrations in the pool even further.

Radioactive liquid waste at the NSC flows to the sump in the demineralizer room, where it is pumped to the outside liquid waste tanks. Liquid waste from the NSC is held in three above ground fiberglass tanks, each having a capacity of 10,000 gallons. Since the tanks cannot overflow into each other, a vent is located near the top of each tank to equalize pressure during filling operations. When the volume of water exceeded the capacity of tank three, the excess overflowed through this opening onto the concrete pad and then to the ground. The licensee stated that the waste tanks will be modified to allow them to overflow into each other, reducing the likelihood of an uncontrolled release. This modification will be reviewed during a subsequent inspection and is identified as IFI 50-128/2002-201-05.

The tanks have a recirculating water system to stir the liquid waste providing a homogeneous mixture prior to sampling. Liquid wastes are routinely sampled and analyzed in accordance with SOP VII.C.9, verified to meet 10 CFR 20, Appendix B, Table 2, Column 2, concentrations, and then released to the environment. The inspector verified that the current procedures for sampling, analyzing, and releasing liquid wastes were clear, concise, and accurately reflected liquid effluent amounts, concentrations, and release fractions to the environment.

Reactor pool water levels and waste tank effluent levels are checked and recorded each day. Based on the September 16 and 17, 2002, readings the licensee determined that 480 gallons of reactor pool water was discharged unanalyzed from waste tank No. three to the environment during this event. The licensee performed gamma spectrum and alpha/beta analyses on water samples from the affected tank in accordance with SOP VII.C.9. Gamma analyses identified Sodium 24 (Na-24) and Manganese 54 (Mn-54), activated contamination and corrosion products normally found in research reactor pool water. Gas flow proportional counting of evaporated samples identified beta activity consistent with that attributed to the Na-24 concentration. No alpha activity was identified. The licensee calculated the total effluent concentrations to be less than 5 percent of 10 CFR 20, Appendix B, Table 2 limits for continuous release to the environment.

The inspector reviewed the September 16 and 17, 2002, reactor pool water and waste tank effluent level documentation and confirmed the licensee's determination that 480 gallons of water was released to the environment during this event. The inspector also verified the licensee's gamma and alpha/beta analyses showing that the effluent concentrations were less than 5 percent of 10 CFR 20, Appendix B, Table 2 limits for continuous release to the environment.

Although the effluent concentrations were within regulatory limits for release to an unrestricted area, the inspector determined that a violation of NRC requirements had

occurred. Since the release was not analyzed prior to discharge, this is a violation of both TS Section 3.7, which states in part that liquid effluents "shall be analyzed" before discharge and SOP VII.C9 which states in part that liquid waste concentrations "must be determined" prior to release. The licensee's failure to follow procedure and determine the liquid waste concentration prior to release is another example of Violation 50-128/2002-201-01.

c. Conclusions

Liquid effluent releases satisfied regulatory requirements. A third case of failing to follow procedure was identified.

4. EXIT MEETING SUMMARY

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on September 20, 2002. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

M. Spellman	Assistant Director, NSC
B. Smith	Senior Reactor Operator
D. Bagley	Senior Reactor Operator
J. Remlinger	Operations Manager, NSC
D. Reece	Director, NSC
L. Vasudevan	Radiation Safety Officer, NSC

INSPECTION PROCEDURE (IP) USED

IP69001 Class II Non-Power Reactors

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

VIO 50-128/2002-201-01	Failure to follow procedures on three individual incidences
IFI 50-128/2002-201-01	The licensee would evaluate the tag-out procedure for use when equipment is operated outside its normal parameters.
IFI 50-128/2002-201-02	The licensee would evaluate the shift change log to insure it is relevant and useful to turnover requirements.
IFI 50-128/2002-201-03	The licensee would evaluate the facility shutdown checklist for inclusion of a final physical walk through of the facility after reactor shutdowns.
IFI 50-128/2002-201-04	The licensee would modify the connections on the diffuser pump discharge to reduce the chance of future failure and evaluate other piping connections for similar modifications.
IFI 50-128/2002-201-05	The licensee would modify the waste tanks to allow them to overflow into each other.

Closed

NONE

PARTIAL LIST OF ACRONYMS USED

EP	Emergency Plan
HPGe	High Purity Germanium
NRC	Nuclear Regulatory Commission
NSC	Nuclear Science Center
RS	Reactor Supervisor
SRO	Senior Reactor Operator
SOP	Standing Operating Procedure
TS	Technical Specification