



## VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

NUCLEAR REACTOR LABORATORY

January 11, 1983

## SAFETY ANALYSIS REPORT.

RE: License No. R-62, Docket No. 50-124

SUBJECT: Manual Withdrawal of a Control Rod for Control Rod Drop Time Measurements and Analysis for Technical Specifications

TYPE: Mechanical/Nuclear

PROPOSAL: We propose that the manual withdrawal of a single control rod under the following conditions:

- (1) Reactor Shutdown/Control Rods inserted
- (2) Core devoid of water moderator
- (3) Dump Valve Interlock enabled and activated;

will not cause a Reactivity Addition Accident,  
 will not impede or hinder the Reactor Safety Systems,  
 will not exceed Safety System limiting settings,  
 will not cause an uncontrolled radioactive release and  
 that the reactivity input rate of 0.02%  $\Delta K/K$ /sec.  
 is not applicable when the the core is devoid of water moderator,

Therefore, this proposed manual withdrawal of a single control rod should be allowed in the Control Rod Droptime Measurement Procedure (IV.15) in order to expedite trouble shooting time prior to dismantling the core.

EFFECTS: The Argonaut Research Reactor at VPI & SU has a shutdown condition defined as: all rods inserted, the water moderator "dumped" to the dump tank and the console key removed. By "dumping" the moderator, we void the core region of coolant/moderator and achieve a negative 30.0%  $\Delta K/K$  reactivity. The control rods then add an additional 2.16%  $\Delta K/K$  of negative reactivity. When using Procedure IV.15, the reactor is not technically shutdown; however, as specified in procedure IV.15, the Dump Valve Interlock must be activated and this condition prevents filling the core tanks.

A Reactivity Addition Accident cannot occur because with the moderator "dumped" the core reactivity is negative by 30.0%  $\Delta K/K$ . Thus with manual withdrawal of a single rod (maximum reactivity of any rod is 0.77%  $\Delta K/K$ ) a shutdown reactivity of -29.24%  $\Delta K/K$  is maintained.

$$(-30.0\% \Delta K/K + 0.77\% \Delta K/K = -29.24\% \Delta K/K)$$

EFFECTS: (continued)

Therefore, even with a single complete rod ejection the minimum shutdown margin of 0.5%  $\Delta K/K$  will not be exceeded and a manual rod withdrawal will have no adverse effects on the core.

A manual rod withdrawal with core devoid of water moderator will not impede or hinder any Reactor Safety System owing to the fact that the safety system will be energized, operable and in compliance with any specific provisions listed in Technical Specifications for the VPI & SU Reactor, while the manual withdrawal is taking place.

As shown in the following analysis: no Safety System limiting settings will be exceeded:

- (1) Neutron Count rate: not applicable, core devoid of water moderator
- (2) Coolant/moderator;
  - A) Temperature not applicable, core devoid of water moderator
  - B) Flow
  - C) Operating level
- (3) Reactor Room Ventilation; No effect - fans remain on
- (4) Safety Rods 1 & 2 fully withdrawn;  
has bypass provision - only withdrawn singly
- (5) Reactor period/power set points;  
never reached due to -29.24%  $\Delta K/K$  reactivity in core with core devoid of water moderator
- (6) Automatic controller servo set point;  
never effected, reactor not operating
- (7) Regulating Rod at upper or lower limit;  
rod not moved past upper or lower limits - also manual steps present
- (8) Activation of manual SCRAM switch (remote/manual);  
not applicable - core not operating (-29.24%  $\Delta K/K$ )
- (9) Shield tank level;  
not applicable, core not operating
- (10) Earthquake SCRAM;  
not applicable core not operating

EFFECTS: (continued)

- (11) Radiation levels; operable - with core not operating levels will not change
- (12) Radiation level fission products monitor;  
not applicable - core devoid of water moderator,  
no flow to detector.

SUMMARY: As mentioned in the previous statements, the reliability or safety of our facility will not be degraded nor will a safety hazard be posed by manually withdrawing a single rod when the core is devoid of water moderator. By not exceeding the Safety System limiting settings we are protected against an uncontrolled radioactive release and therefore the requirements set forth in the proposal are met. We propose that the manual rod withdrawal be included in the Control Rod Droptime Procedure (IV.15) and that a reactivity input rate of  $0.02\% \Delta K/K/sec.$  not be applicable when the core is devoid of water moderator.



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TECHNICAL SPECIFICATION CHANGE PROPOSAL

RE: License No. R-62, Docket No. 50-124

SUBJECT: Proposed Change to Technical Specifications Section 8.0,  
Paragraph 8.1

TYPE: Administrative

EFFECTS: In paragraph 8.1 several references are made to the Vice President for Administration of Virginia Polytechnic Institute and State University. Recently the position title has been changed to the following: Vice President for Administration and Operations of Virginia Polytechnic Institute and State University. This title change encompasses more accurately the functions of the office holder.

SUMMARY: The position of Vice President does not directly involve reactor operations however, he is referenced in several procedures and there are four Vice-Presidents in the University Organization.

The possibility of misconstruing one Vice-President for another exists until the procedures have all been changed, but this is an extremely remote possibility.

All personnel in the Virginia Polytechnic Institute and State University organization have a working knowledge of University Administration and operators are required to learn the administration as part of their qualification.

In any event the procedures which reference the Vice-President shall be changed to reflect this following approval of the proposed change.



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TECHNICAL SPECIFICATION CHANGE PROPOSAL

RE: License No. R-62, Docket No. 50-124

SUBJECT: Proposed Change to Technical Specifications Section 7.0,  
Paragraph 7.11

TYPE: Equipment Performance Specifications

EFFECTS: Paragraph 7.11 lists the portable survey instruments and re-  
quired ranges for availability at the facility.

The Virginia Polytechnic Institute and State University reactor staff proposes to change the range and type of detection characteristics previously listed.

The following changes are desired: (1) For beta-gamma exposure rates change from 0.01 to 50 millirem per hour to "0.0 to 20 Rem per hour." (2) For fast and thermal neutron dose rates simply combine into "neutron dose rates from 0.0 millirem per hour to .5 Rem per hour."

These changes are desired due to acquisition of newer portable radiation monitoring equipment.

Our neutron monitors are of the type which thermalize fast neutrons and therefore provide the capability of detecting both thermal and fast neutrons into an integrated dose rate.

Since both upper and lower scales are being expanded this results in an increased surveillance capability. Obviously, with regards to safety this is a definite improvement. Additionally, this ensures portable radiation monitoring equipment with a range wide enough to accommodate any credible accident scenario.



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TECHNICAL SPECIFICATION CHANGE PROPOSAL

RE: License No. R-62, Docket No. 50-124

SUBJECT: Proposed Change to Technical Specifications Section 6,  
Paragraph 6.1.2

TYPE: Materials

EFFECTS: Paragraph 6.1.2 refers to the low power fuel elements useage, and physical characteristics. The Virginia Polytechnic Institute and State University reactor staff proposes a deletion of this paragraph in its entirety. The low power fuel elements were originally used for approach to critical and other experiments several years ago. These fuel elements were returned to the Department of Energy and there are none remaining at the facility.

There are no future plans for useage of a low power element of the type described in paragraph 6.1.2.

SUMMARY: Since the low power fuel elements have not been at the facility or utilized in any form for several years and there are no future plans for useage, this change will not affect reactor safety, pose an unreviewed safety question, or affect facility operations in any manner.



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## TECHNICAL SPECIFICATIONS CHANGE PROPOSAL

RE: License No. R-62, Docket No. 50-124

SUBJECT: Proposed Change to Technical Specifications Section 7.0, Para. 7.6

TYPE: Equipment Performance Specifications

EFFECTS: Paragraph 7.6 refers to the desired range of radiation monitoring equipment. We propose to change "...minimum range of 0.01 to 10 millirem per hour." to "minimum range of .1 to  $10^4$  millirem per hour."

We ascertain no difficulty with raising the minimum level from 0.01 to .1 millirem per hour as current shutdown background levels on all monitors are well above this value (average is approximately .2 millirem per hour). This is due primarily to the residual activation of core materials and the accumulated fission product inventory. Additionally, the limestone used as building material contributes to the post shutdown level indicated.

The upper limit being raised to  $10^4$  would reflect the recently installed radiation-monitoring system and assure capability for monitoring over the range of credible accidents for our facility. Obviously, the capability for monitoring a higher level is an improvement in a more conservative direction.

The entire listing of this system in Table I Safety System Functions is not affected in any manner by this range change.

SUMMARY: The capability to monitor radiation-levels within the facility over a wider range than previously used is a definite improvement in a safe and conservative direction, does not provide a reduction in safeguards, and does not propose an unreviewed safety question. The capability to monitor the range from .01 millirem per hour to .1 millirem per hour is lost but this low level does not affect operational or shutdown indications and operations because the normal shutdown radiation levels on all monitors are greater than .1 millirem per hour - deviations from this could thus be observed and no required actions in our research reactor procedures, Technical Specifications, or federal regulations/guides are based on this range.