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WANL-TME-1387

March 1966

Westinghouse Astronuclear Laboratory

**WANEF ANNUAL OPERATIONS REPORT
1965**

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SECTION 1

INTRODUCTION

This report is submitted in accordance with the requirements of Section 7.4 of WANL-TNR-099, Safety Report for the Westinghouse Astronuclear Experimental Facility (WANEF), which specifies that Westinghouse shall submit to the AEC an annual report of operating experience and activities.

Included in this report is information on:

- A) Facility operational history of experimental reactor runs, integrated power and number of unscheduled shutdowns.
- B) A description and hazards evaluation of actual experiments.
- C) Items referred to, and actions taken, by the Westinghouse Astronuclear Laboratory Nuclear Safety Committee (WANL NSC), the Space Nuclear Propulsion Office (SNPO) and the Aerojet-General Corporation (AGC) Safety Organization.

The WANEF facility is located in a group of buildings at a Westinghouse site near the town of Waltz Mills, Pennsylvania, approximately 20 miles southeast of Pittsburgh. An eight-foot high fence for purposes of security and operational safety surrounds the WANEF facility.

While the Westinghouse Reactor Evaluation Center (WREC), a component of the Westinghouse Atomic Power Division, is in the same building as WANEF, a concrete wall completely divides the two facilities.

During 1965, critical experiments were performed in support of the NRX-A3, NRX-A4 and NRX-A5 reactors. The NRX design is a high power density, graphite moderated, beryllium-reflected reactor using fully enriched U-235. The equivalent Permanent Assembly Experiment (PAX) reactors PAX-B, PAX-C and PAX-D were nearly identical to previous PAX¹ cores with minor exceptions. These exceptions reflect the changes in various NRX reactor designs and the addition of various modes of flexibility for PAX operation. The basic PAX assembly is shown in figure 1.

Experiments performed include initial criticality, integral and differential drum worths, fuel reactivity checks (FRC), reactor shutdown determinations utilizing the pulsed neutron generator (PNG), attenuation measurements through a mockup shield and reject NRX-A3 privy roof mounted shield (PRMS), power distributions and various material reactivity coefficients.

In addition to operations on the PAX assembly, several months were required to install hardware for the Flexible Critical Experiment (FCX). The FCX is a reactor designed by WANEF personnel to be used in basic physics studies and to provide a capability for simulating future NERVA reactors. The FCX assembly is designed to use either NRX-type fueled elements or elements designed especially for the FCX reactor. The fuel envelope for FCX and NRX is the same, allowing support and clustering hardware to be used interchangeably. Control rods are used in FCX rather than control drums allowing flexibility in radial buildup of the core or reflector. A more complete description of the FCX reactor may be found in Reference 2. The mechanical and electrical assembly of the FCX reactor was completed. Other than installation of the fueled followers of the control rods, no fueled operations were performed. The unfueled FCX is shown in figure 2.

The WANEF staff is comprised of one supervisor (the Scientist-in-Charge), six scientists and engineers, seven technicians and one secretary. The average number of years worked in critical facilities and nuclear related work is 11.9 for each scientist and engineer and 9 for each technician. The average critical experiment experience of technical personnel and technicians is 6.2 and 2.6 years, respectively.

The total number of qualified reactor operators at WANEF is ten as compared to six operators one year ago. The qualification of these additional four operators was accomplished by training lectures, operational experience and a test equivalent to that given by the AEC.

The overall organizational relationship of WANEF-Westinghouse is shown in figure 3.

Figure 1. PAX Reactor

Figure 2. FCX Reactor

Figure 3. WANEF - Westinghouse Organizational Relationship

SECTION 2

SUMMARY OF ACTIVITIES

The PAX-D reactor was in operation at the beginning of 1965. Disassembly was accomplished 8 March 1965. PAX-C attained initial criticality 14 June 1965, and was disassembled 13 August 1965. The PAX-D assembly attained initial criticality 2 December 1965, and was in operation at the end of 1965.

A standard set of experiments were performed on each of the PAX reactors. These measurements include fuel loading and initial criticality, power distributions, integral and differential drum worths and reactivity coefficients for various reactor materials. Additional types of experiments performed as required included: reactor shutdown determinations utilizing the pulsed neutron generator (PNG), attenuation experiments with three different shield configurations, and neutron streaming experiments. Results of these experiments are given in References 3, 4, 5 and 6.

The WANL Nuclear Safety Committee, as well as AGC and SNPO, reviewed and approved various WANEF requests for reactor experiments, facility modifications, and revised documentation. A summary of these requests, the actions taken, descriptions of the experiments and their associated hazards evaluations are given in Section 5.

A safety audit was conducted by Mr. S. Klein of the AGC REON Safety Division, and Mr. R. Hartfield of the SNPO/C Health and Safety Office during July. No hazardous conditions were observed. AGC/SNPO recommendations and WANL actions taken are given in Section 5.

In conclusion, reactor operations were conducted safely at WANEF during 1965 with no indication of possible hazards or unsafe conditions.

SECTION 3

OPERATIONAL EXPERIENCE

During 1965 a total of 292 reactor startups were made producing a total of 7.91 kw-hrs of integrated power. In addition, 21 inadvertent reactor scrams occurred. Seventeen of these unscheduled scrams occurred as a result of instrument malfunction, principally as a result of noise transients in the linear picoammeters actuating the electronic trips. These transients were primarily due to noise pickup in the patch panels used in selecting reactor instrumentation (PAX or FCX). It appears that a 60-cycle noise pickup is superimposed on the signal from the patch panel, and the width of the noise band is such that on low ranges the upper level trip can be activated. A new patch panel, which provides more complete shielding from neighboring signals, grounds, and high voltage leads, is planned for installation during the first extended period of reactor shutdown. Three scrams were caused by the tripping of the drive motor armature current overload device. This overload device is provided to initiate a scram in the event a drum or control rod binds or for other reasons draws excessive current. One scram was attributed to operator error; that is, failure to change the range on the linear amplifier. A breakdown of 1965 Operating History is given in table 1.

Personnel radiation exposures for the year were under the permissible level with an average of 30 mr/wk/man. The highest exposure for any one employee for the year was 3.89 rem, well under the yearly limit of 5 rem. The quarterly dose limit of 1.25 rem was not exceeded.

Table 1

WANEF OPERATIONAL HISTORY FOR 1965

	<u>PAX-B</u>	<u>PAX-C</u>	<u>PAX-D</u>
Number of Startups	85	129	78
Integrated Power (watt hours)	2908	4281	104
Run Time (hours)	68	115	83.5
Unscheduled Shutdowns			
1) Instrument Malfunction	3	9	5
2) Operator Error - Failure to switch range on Linear Amplifier resulting in electronic trip	0	1	0
3) Other Causes - Armature Current overload trip due to marginal setting	0	0	3

SECTION 4

REACTOR EXPERIMENTS AND HAZARDS CONSIDERATIONS

The PAX reactor, described in detail in Reference 7, is an almost exact nuclear mockup of the NERVA reactor except for the use of various non-standard components such as fuel elements, inner graphite reflector and support blocks.

Hazards analyses were made for each type of experiment prior to the initiation of measurements. Standard measurements (initial criticality, drum worths, power distributions, etc.) were analyzed in the WANEF Safety Report.⁸ Experiments with possible unresolved safety problems were analyzed and approved by the WANL Nuclear Safety Committee, SNPO, and AGC prior to initiation.

Limitations given in the WANEF Operating Limits⁹ define the boundaries within which the WANEF reactors can be operated with reasonable assurance that no undue hazard will result. The Operating Limits document is supplemented by the WANEF Operations Manual⁸ which contains the administrative controls, personnel responsibilities, and operating procedures utilized to insure compliance with the Safety Report and Operating Limits. The limits on the operating variables for PAX and FCX are given in table 2.

In addition to the tests conducted on the PAX reactor during 1965, considerable effort was applied to assembly of the FCX electrical and mechanical hardware. This involved the erection of a test stand, core support plate, control rods and respective drive units, core assembly frame and installation of reactor instrumentation. Patch panels were installed to allow control of either of the two reactors from a common console. A large quantity of NRX type fuel, rejected for use in NERVA reactors due to lack of conformance to reactor grade element standards, was accumulated to be used in the FCX assembly. The mechanical and electronics tests, including control rod scram and detector response, were completed. Due to higher priority experiments in the PAX assembly and lack of approval, the FCX reactor was not loaded and operated. A complete description of the FCX is given in Reference 2.

Table 2
OPERATING LIMITS FOR PAX AND FCX

	<u>PAX</u>	<u>FCX</u>
1) Maximum Reactivity Worth of Individual Control Element	1.00\$	4.00\$
2) Minimum Shutdown Control Margin in Control Elements	2.8\$	10.00\$, 5.00\$***, with personnel present
3) Minimum Physical Shutdown of Reactor not Connected to Control Console	10.00\$	10.00\$
4) Minimum Effective Shutdown of Reactor not Connected to Control Console with People Present	9.55\$*	5.00\$**
5) Maximum Reactivity Addition Rate by Control Element	0.064\$/second	0.2\$/second
6) Maximum Reactivity Increase to be Allowed in any Single Increment for any Experiment by Hydrogen Addition, Poison Removal, Fueled Experiment Addition, or Other Method	0.33\$ steps to max. excess of 6.2\$	0.33\$ steps to max. excess of 0.50\$
7) Maximum Operating Power	1000 watts	1000 watts
8) Setting of Scram Points	2000 watts (max.) 5 second period (min.)	2000 watts (max.) 5 second period (min.)
9) Maximum Excess Reactivity	6.2\$	0.50\$
10) Maximum Number of Control Elements to be Moved Out at One Time	1	1
11) Maximum Total Scram Delay Time and Safety Element Insertion Time	1 second	1 second

* Based upon +15¢ worth for each of 3 people.

** Based upon +2.50\$ worth for each of 2 people.

*** The 5.00\$ represents the maximum permissible reduction in shutdown due to the presence of personnel.

The various types of PAX experiments and their associated hazards considerations are described in the following paragraphs.

PAX-B EXPERIMENTS

Initial criticality of the PAX-B reactor was performed during 1964 and the experiments performed during that year are given in the WANEF Annual Operations Report, WANL-TME-1128. Additional experiments performed on this assembly during 1965 included:

A) NRX -A4 Fuel Reactivity Check (FRC)

Experiments designed to determine reactivity differences between PAX-B fuel elements and NRX-A4 candidate fuel elements were performed. The experimental procedure involved measuring reactivity variations in the PAX reactor as a result of exchanging two types of NRX-A4 fuel, one manufactured at the Westinghouse Astrofuel Facility, the other at the Oak Ridge Y-12 Facility. The experiment involved an exchange of approximately 10 percent of the fuel. Expected reactivity changes for all constituents in the elements, including fuel, graphite and coating material were carefully analyzed prior to the insertion of fuel into the reactor. Data packages, provided with each element, gave the masses of each constituent in the elements, to give the analyst basis for his determinations. The addition of these materials to the reactors was always made in quantities equivalent to a reactivity value less than the 33¢ restriction imposed at WANEF.

B) Reactivity Worths of NRX-A2, NRX-A3 and NRX-A4 Type Negative Shims

The PAX-B reactor was used to measure the reactivity worth of the negative shims which are built into the NRX reactor to give correct control drum angle positions. The worths of NRX-A2 and NRX-A3 type shims were measured as a function of radial core positions. The ratio of the two types of shims was calculated. In addition, the reactivity worths of preproduction impregnated graphite elements were measured as a function of core radial position. In all cases the positive reactivity changes did not exceed the 33¢ limit for reactivity insertion. No hazards were anticipated or encountered.

C) Power Calibration in Support of NRX-A3

The power calibration of the NRX-A3 at the Nevada Site utilized the radio-chemical analyses for fission products in uranium-aluminum test wires which were inserted into the core. A similar low power measurement at PAX-B, where accurate core flux distribution measurements were available, permitted an analytical integration of the number of fission events in the complete core and hence, the power level by comparison with similar test wires in the central element. The PAX-B operation thus provided a calibration in numbers of fission events or watt-hours for the fission product content found in the wires exposed at the test site. The results are reported in WANL-TME-1198.³ The measurement involved standard activation techniques using wires and foils. No hazardous condition existed at any time. A dummy aluminum nozzle worth about 8¢ was also utilized during part of this experiment.

D) NRX-A3 Privy Roof Mounted Shield Mockup

A shield was designed for mounting on the roof of the test car at the Nevada Site during high power operations. Before fabricating this shield it was decided to experimentally determine its gamma ray and fast neutron attenuation and to evaluate the effect of the shield on the flux in the reactor. To accomplish this, a paraffin mockup was constructed with the same approximate dimensions around the PAX-B reactor. Fission flux measurements in the core and reflector and between the reactor and the shield show the effect of the shield on the reactor flux distribution. Fast neutron and gamma dose measurements around the shield permitted an evaluation of its attenuation characteristics. Care was used to provide rigid support for the paraffin mockup to prevent tipping in the direction of the reactor; in addition, an aluminum plate was attached to the top of the pressure vessel to completely seal the reactor. The reactivity worth of the mockup was about 6¢.

E) Drum Actuator Exposure through the Privy Roof Shield

A measurement was performed to determine the magnitude of the gamma rays and neutrons streaming through a control drum actuator hole in a mockup of the shield mounted on top of the test car at the Nevada site. A paraffin-steel ball mockup of the privy roof

shield was made with a replica of the actuator hole and operating mechanism. Thermal and fast neutron fluxes and the gamma ray doses were measured by the standard activation technique on the outside of the shield and in detail around the actuator mechanism. The results of this measurement are given in WANL-TME-1198.³ Hazards analysis of this experiment consisted of calculations to assure that sufficient structural support was available to allow the shield to be placed on top of the nozzle end of the PAX pressure vessel. In addition, the reactor was completely separated from the shield mockup by a 1.5 inch aluminum plate bolted to the top of the pressure vessel. The paraffin for the shield mockup was contained in a 16-inch deep aluminum can. The mockup, worth about 40¢, was assembled in reactivity steps less than 33¢.

F) Dosimetry Experiments

Thermal neutron and gamma measurements were performed about the PAX-B assembly to determine the effects of wall scattering. Measurements were also made through approximately 12 inches of concrete to determine the magnitude of neutrons captured in the concrete wall. Detailed fast neutron and gamma measurements on the pressure vessel were performed to determine if scalloping exists. Fast neutron streaming was observed adjacent to the poison plate on the control drum. The increase was about 20 percent. Gamma scalloping, if present, is less than the reproducibility of the thermoluminescent and glass rod gamma detectors used to measure the effect, about 5 and 10 percent, respectively. This experiment involved standard activation techniques and constituted a no hazard condition.

PAX-C EXPERIMENTS

A) Initial Criticality

PAX-C was assembled using eleven beryllium reflector sectors and ten control drums from the NRX-A2 and one sector, two drums, and fuel from the PAX-B. The PAX-C was designed with the capability for removing a beryllium sector with drum, without unloading the core and disassembling the reflector. This capability was not utilized during PAX-C experiments. The PAX-B graphite barrel without the aluminum barrel was also used. After completely assembling the PAX-C reactor with poisoned fuel, poison wires were withdrawn in increments to attain initial criticality. Four data channels, utilizing BF_3 proportional counters,

amplifiers and scalers, were used to obtain counts after each poison wire removal. Excellent results were obtained using the $1/M$ data to predict the initial delayed critical position. No hazards were anticipated and none were encountered during the performance of this experiment.

B) Drum Calibration

A calibration of the 12 control drum bank was made from the initial delayed critical drum bank setting (approximately 180 degrees) to the delayed critical position with the drum bank at 89.9 degrees. This was accomplished by reactivity shimming the control drums against the poison wire removal. Drums were scrambled from various delayed critical positions during the poison removal to provide an integral as well as differential determination of drum worth. Differential and integral drum worths were also determined for individual drums and it was found that the total control drum worth for PAX-C was the same as that of the PAX-B ($\sim 8.9\%$). Reactor shutdown from clean critical angle of 89.9 degrees was $\sim 4.4\%$. Each type of experiment employed standard techniques and involved no hazard since the required K_{sd} ($> 2.8\%$) was maintained at all times.

C) Cluster Plate Measurements

The reactivity worth of the special Ag-In-Cd and Gd-SS cluster plates was checked by placing a layer of the plates on the nozzle end of the PAX-C reactor. In order to determine the worth of the cluster plates under conditions similar to those in the final reactor, layers of plastic and aluminum were placed on top of the cluster plates to mock up the number densities and positions of the materials in the final reactor. A stainless steel container was fabricated that completely enclosed the plastic, aluminum and cluster plate material during the course of the measurement.

D) Evaluation of In-Flight Poison Wires

It was proposed to fly the NERVA reactor with poison wires placed in the central part of the reactor in such numbers as to prevent the reactor from being critical even when flooded. These wires were comprised of sintered boron carbide material enriched in the B_{10} isotope and covered with a Nylon and Teflon coating. The reactivity worth of prototype poison wires designed by the WANL Safeguards Engineering section was measured in the

PAX-C reactor. Measurements were performed with the reactor "dry" and in a mockup flooded condition using polyethylene rods. The results of this experiment are reported in References 4 and 6. An investigation into the hazards associated with placing polyethylene rods in the core was made. Since the rods were designed to completely fill individual flow channels it was concluded that in the event of core heat-up and subsequent melting of the polyethylene, a more reactive condition could not be obtained by the flow of polyethylene. No other hazardous conditions were encountered during the course of the experiment.

E) Privy Roof Mounted Shield

Fast neutron and gamma ray attenuation measurements as well as the effect of edge peaking of core flux was measured with the NRX-A3 privy roof mounted shield placed adjacent to the PAX-C reactor. This shield, designed to provide protection to instrumentation and mechanical hardware during the Nevada test of the NRX-A3 reactor was constructed of aluminum and filled with steel balls and water. Stringent precautions were taken to prevent any possibility of water entering the PAX reactor. Filling the shield with water and steel balls was performed near the test cell truck door. During this time the reactor was sealed by a 1.5 inches thick aluminum plate bolted to the top of the reactor pressure vessel. The shield was sealed and bolted to large I-beams welded to the test cell floor, thus providing assurance that the shield could not fall in the direction of the reactor, resulting in an inadvertent reactivity insertion. Procedures required that both the shield and reactor were sealed during operations. When access into either the reactor/shield was required (e.g., retrieval of dosimetry foils), the shield/reactor remained sealed. No hazards or problems were encountered during the course of this experiment. Details and results of these measurements are reported in Reference 4.

F) Reactivity Worths of NRX-A4 Negative Shims

The PAX-C reactor was employed to measure the reactivity worth of production grade impregnated shim elements. In all cases the positive reactivity changes did not exceed the 33¢ limit for reactivity insertion. No hazards were anticipated or encountered.

PAX-D EXPERIMENTS

Limited measurements were made on the PAX-D reactor since the assembly of the reactor during the month of December 1965. These experiments are listed below.

A) Initial Criticality

The only changes between the PAX-C and PAX-D reactors were in the graphite reflector region. A new graphite barrel and lateral support mechanism was installed in the PAX-D. The new reflector included a removable 30 degree sector to allow one-sector mockups to be performed on new reactor designs such as the NRX-A6. The PAX-D reactor was fully loaded with poisoned fuel and initial criticality obtained by the incremental removal of poison wires on 2 December 1965. The inverse multiplication data obtained during the approach to critical was found to be capable of detecting less than a 70¢ change in core reactivity. No hazardous conditions were anticipated or encountered during the course of this experiment.

B) Drum Calibration

Calibration of the 12 control drum bank was made from the initial delayed critical drum bank setting (approximately 180 degrees) to the delayed critical position with the drum bank at approximately 86 degrees. This was accomplished by reactivity shimming the control drums against the poison wire removal. Drums were scrambled from various delayed critical positions during the poison removal to provide an integral as well as differential determination of drum worth. Differential and integral drum worths were also determined for individual drums and it was found that the total control drum worth for PAX-D was approximately 8.6\$. Shutdown from 85 degrees was about 4\$. Each type of experiment employed standard techniques and involved no hazard since the required K_{sd} (> 2.8) was maintained at all times.

C) 30 Degree Mockup Sector in Support of NRX-A6

An NRX-A5 beryllium sector, modified to mockup the new NRX-A6 lateral support scheme, replaced a PAX-D sector and a 30 degree sector of the graphite reflector was removed to permit addition of beryllium rods to mock up the thicker NRX-A6 beryllium reflector. The reflector changes were performed after poisoning the core to 10\$ shutdown with poison wires. The wires were then removed using the approach to critical technique. Preliminary measurements indicated that the reflector changes increased core reactivity by approximately 50¢

and individual drum worth was decreased by approximately 4 percent. Measurements are in progress to determine (1) the effect of the 30 degree sector change on overall PAX-D reactivity; (2) the drum worth and the power distribution in the NRX-A6 type sector; (3) reactivity coefficients of various reactor materials in the area of the 30 degree sector.

D) Reactor Shutdown Measurements Using the Pulse Neutron Generator (PNG)

Measurements of the prompt neutron decay constant, α , were performed by introducing a pulse of fast neutrons into the subcritical reactor by means of a pulsed Cockcroft-Walton neutron generator and measuring the subsequent decay of the reactor neutron population. The constant α is connected with the negative reactivity of the reactor and can be used as a measure of the reactor shutdown. Work has been initiated on the development of fast instrumentation, particularly detectors, for use in conjunction with the generator. These include miniature detectors for in-core spatial-time flux studies. The hazards involved in the use of the PNG were evaluated with regard to the effects upon the reactor and to operating personnel. No unevaluated hazards were found.

SECTION 5

NUCLEAR SAFETY COMMITTEE

The function of the WANL Nuclear Safety Committee (NSC) is to review and consult on all major problems concerned with the nuclear safety of the WANEF facility. It is the responsibility of the committee to review and recommend for approval all experimental programs, operation procedures and proposed modifications to system or facility designs which may affect or change the safety of the facility operation and to provide assurance that boundaries of operational approvals will not be exceeded.

Items which must be reviewed by the Safety Committee include:

- 1) Changes and addenda to the Operating Limits document and the supporting changes and addenda to the Safety Report.
- 2) Changes to the Operations Manual.
- 3) Experimental Details Checklists (EDC) which are not clearly (a) within the limits of the operating limits document, or (b) consistent with portions of one or more standard operating procedures (SOP), or (c) involve unevaluated questions of safety* or (d) operations which are expected to exceed the radiation exposure limits (AEC Manual Chapter 0524).
- 4) Proposed changes to WANL-TME-644, The Criticality Hazards Control Procedure, which do not fall within its present intent or the ground rules of the Criticality Hazards Control Guide.
- 5) Changes to a reactor, the test stands or the facility (a) which are not clearly within the limits of the operating limits document or (b) may constitute an unevaluated safety question.

* Unevaluated questions of safety exist if (1) there is a possibility of an accident occurring which has not been analyzed in the WANEF Safety Report or its supplements, or if (2) there is an increase in either the probability of an accident previously analyzed or if (3) there is an increase in the consequences of an accident previously analyzed.

Items in categories 2, 3, and 5, which the Safety Committee decides are within the scope of the Operating Limits document and the framework of the WANEF Safety Report and its supplements, may be recommended for approval to the Project Manager; otherwise they require modifications to the controlling documents and must be handled as an item in category 1. Items in category 1 may be recommended to AGC/SNPO for approval by the Safety Committee.

Specific requests submitted to the Safety Committee during 1965 were of three types:

A) WANEF Requests recommended for approval and submitted to AGC/SNPO for approval

- 1) Operation of the PAX reactor utilizing the patch panel arrangement that allows operation of the PAX or FCX reactors from a single console.
- 2) Storage of fuel in a rack installed on the WANEF test cell shelf.
- 3) Removal of fuel from the PAX reactor to storage facilities during installation of the FCX reactor hardware.
- 4) Execution of pulse neutron experiments on the PAX assembly.
- 5) Execution of experiments in the PAX reactor with a 30 degree sector of the assembly mocking up the NRX-A6 reactor.
- 6) Execution of "Fat Man" experiment on FCX reactor.
- 7) Installation and use of the PAX Auxiliary Shutdown System.
- 8) Enlargement of the test cell fuel storage rack.
- 9) Facility documentation:
 - a) Supplement 1, WANL-TNR-099, WANEF Safety Report for FCX (including operation of FCX)
 - b) Revisions to WANL-TME-383, WANEF Operating Limits for FCX.
 - c) WANL-TME-1295, WANEF Operating Limits (new issue)
 - d) Revisions to WANL-TME-267, WANEF Operations Manual for FCX.
 - e) WANL-TME-267, Rev. B, WANEF Operations Manual.

- f) FCX Experimental Plan and Schedule for 1965 (new issue)
- g) WANL-TME-1296, WANEF Experimental Program NERVA Contract Years 1966-1967, October 1965.
- h) WANEF-793, Addendum to WANL-TNR-099

Of these, AGC and SNPO have not approved items 6, 7, 8, 9a and 9h. Items 9b, 9d, and 9f, which were not approved have been superseded by 9c, 9e and 9g, respectively.

B) WANEF requests recommended for approval by the Safety Committee

- 1) Experiment utilizing the Privy Roof Mounted Shield.
- 2) Experiment with a mockup of the Privy Roof Mounted Shield.
- 3) Experiments involving the use of on-core and /or in-core radiation detectors.
- 4) Experiment with a mockup of the Privy Roof Shield.

C) Additional items reviewed by the Safety Committee

- 1) Relocation of the test cell personnel entrance.
- 2) Modification of PAX cluster hardware.

In addition to requests by WANEF listed above, several items were requested by AGC/SNPO. The nature of these recommendations and the action taken is given below.

AGC/SNPO Recommendations

- 1) Updating of WANEF documentation.

WANEF Action

All WANEF facility documentation except WANL-TME-646, WANEF Criticality Hazards Control Procedures, and the WANEF Safety Report, has been updated and submitted for approval. A preliminary draft of the revised safety report was submitted to WANL Safeguards Engineering and AGC/SNPO for comments. WANL-TME-646 is being revised.

- 2) Operator training with regard to the FCX reactor.

The entire WANEF staff has undergone training lectures which point out basic differences between PAX and FCX. Additional training and

AGC/SNPO Recommendations

- 3) Installation of an auxiliary shutdown system on the PAX reactor.
- 4) A better means of communication should be used to inform AGC/SNPO of anticipated WANEF experiments.
- 5) Revision to the EDC review and approval procedure which includes an independent safety review of each EDC by an individual or committee not in the WANEF line management prior to approval by line management.

WANEF Action

an operator's test will be given prior to FCX operation.

An auxiliary shutdown system has been fabricated, installed and mechanically tested. However, use of this system awaits approval by AGC/SNPO.

Frequent telephone communications are being used to keep AGC/SNPO up-to-date on WANEF operations.

This recommendation was not incorporated in the approved Operating Limits document.

SECTION 6

REFERENCES

- 1) WANL-TME-1128, WANEF 1964 Annual Operations Report, March 1965
- 2) WANL-TNR-099, Supplement 1, Safety Report for the Flexible Critical Reactor (FCX), January 1965
- 3) WANL-TME-1198, PAX Critical Experiments in Support of NRX-A4, August 1965
- 4) WANL-TME-1255, PAX Experiments in Support of NERVA Quarterly Report, 4th Quarter CY 1965, September 1965
- 5) WANL-TME-1349, Critical Experiments in Support of NERVA Quarterly Report, 1st Quarter 1966, April 1966
- 6) WANL-TNR-206, Rover Flight Safety Program Volume III - Part A, Program Report on the Anti-Criticality Poison Wire System, September 1965
- 7) WANL-TNR-099, Safety Report for the Westinghouse Astronuclear Experiment Facility, May 1963 (CRD)
- 8) WANL-TME-1295, Westinghouse Astronuclear Experimental Facility Operating Limits, December 1965
- 9) WANL-TME-267, Revision B, WANEF Operations Manual, October 1965