

FINAL REPORT ON DEACTIVATION
OF
VALLECITOS BOILING WATER REACTOR

Docket 50-18

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General Electric Company
Irradiation Processing Operation
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CONTENTS

I. INTRODUCTION

Purpose of Report

Description of Site and Retired Facilities

II. FACILITY CHANGES DURING VBWR DEACTIVATION

A. Primary and Auxiliary System Changes

B. Deactivation of Auxiliary Systems

III. FACILITY DEACTIVATION DESCRIPTION

A. Reactor Enclosure

1. Main Floor
2. Spent Fuel Pit
3. Reactor Vessel
4. Enclosure Basement

B. External Areas

1. Main Valve Pit
2. Stack
3. Waste Water and Make-Up Systems
4. Drips and Drains Room

C. VBWR Fuel Storage Vault

D. Special Nuclear Material and Byproduct Materials Held
Under License DPR-1 and SNM-130

E. Hot Radioactive Waste

F. Contaminated and Activated Equipment

G. Non-Contaminated Equipment

IV. HAZARDS EVALUATION

A. Contamination and Radiation Hazards

B. Fire Hazard

C. Natural Forces

D. Unlawful Entry

CONTENTS - Page 2

V. PERIODIC INSPECTIONS

VI. RECORDS

APPENDIX I - VBWR Radiation and Contamination Report

FIGURE 1 - 300 Area Plot Plan

VBWR DEACTIVATION - FINAL REPORT

I. INTRODUCTION

In a letter dated January 29, 1964, General Electric presented a preliminary outline of plans concerning the deactivation of the Vallecitos Boiling Water Reactor (VBWR), License No. DPR-1, Docket 50-18.

The purposes of this document are 1) to report in aggregate the changes made to the facility during Phase I and Phase II of the VBWR deactivation, 2) to describe the final shutdown condition of the plant, and 3) to support General Electric's request for license modifications to reflect the deactivation status of the plant. Radiation and contamination survey readings taken at the conclusion of deactivation activities are included in Appendix I of this report and indicate compliance with the applicable sections of 10 CFR Part 20.

The facility deactivation included: 1) retirement of portions of the plant by physical separation of this equipment from the rest of the plant and 2) turn over of portions of the facilities for utilization by ESADA-Vallecitos Experimental Superheat Reactor (EVESR) operations. EVESR operations will be responsible for the security, maintenance and inspection of the retired facilities since the VBWR is located immediately adjacent to EVESR. A plot plan is shown in Figure 1.

Facilities to be retired include:

1. The entire VBWR reactor enclosure and all of its contents;
2. The VBWR 70 foot stack;
3. The main VBWR valve pit between the reactor building and the turbine building;
4. Certain waste water, make up water and air lines outside the reactor enclosure;
5. Certain equipment in the turbine building including the reactor feed pumps and the instrument air compressor;
6. Control room instrumentation associated with the retired VBWR equipment.

Equipment and facilities turned over to EVESR for control and utilization include:

1. The VBWR control room and office building including the change room;
2. The turbine building including the turbine generator and associated equipment;
3. The cooling water tower and associated equipment;
4. All of the VBWR waste water and makeup water system outside of the enclosure;
5. All outside buildings including the former instrument shop, the maintenance shop, the turbine test loop building, the warehouse,

the resin storage shed, the paint shed and the hot storage building. The hot storage building has been decontaminated and is no longer used for hot storage;

6. The drips and drains deionizer room located adjacent to the VBWR waste area.

II. FACILITY CHANGES DURING VBWR DEACTIVATION

A. The following facility changes were made to bring VBWR to a safe standby status. These changes are being filed in aggregate to meet the requirement of paragraph 4B of Amendment 16 to DPR-1. Such changes were outlined in Section II, paragraph 4, of our January 29, 1964 letter.

1. Air Lock Door Alarm: Micro switches were installed on both outer air lock doors which will sound an alarm in the control room when either outer door is open. In addition these doors are locked and the keys controlled by the EVESR shift supervisor.
2. Containment Building Vent: An absolute filter was installed outside of the enclosure to an existing 1-1/2" containment penetration. This will allow the containment building to "breathe".
3. Reactor Vessel: After the water was drained from the vessel to a level under the lowest penetration, a water level indicator was installed. A manometer located outside of the containment

building will allow monitoring the water level without either entering the building or opening the pressure vessel. Periodic readings will be taken. The vessel is vented through an MSA Airline filter mounted on top of one of the control rod nozzles.

4. Main Steam Line: The main steam line from the reactor to the turbine has been cut and capped at both ends.
5. Control Rod Drive System: Control rod drive shafts have been disconnected and stored in the reactor vessel. Scram and operating air systems have been disconnected. DC power has been turned off and locked out. Control rod nozzles have been blind flanged except for a vent connection and a level indicator connection.
6. Liquid Poison System: Poison has been drained from the system and the system is deactivated.
7. Emergency Heat Exchanger (EHX) Deionized Water Supply: A spool piece has been removed from the EHX deionizer discharge to isolate the piping to the emergency heat exchanger. Piping to the exchanger has been drained.
8. Auxiliary Cooling Water System: Piping has been cut at the discharge return to the cooling tower and the ends blind flanged.
9. Air & Water Lines: All lines capable of supplying water or air to the enclosure were separated and capped.
10. Primary System Recirculation: To minimize system corrosion while the primary system was full, piping was installed to permit circulating water from the former ESADE connection on #1

Recirculation Pump discharge to one of the control rod nozzles on the reactor vessel. This piping has not been removed.

11. Reactor Sump Pump on Clean-Up System: While the primary system was full, the discharge of the reactor sump pump was routed to the suction of the reactor clean-up system to minimize the inventory of waste water.
12. Relief Valve Quench Lines: The main steam relief valve quench lines were cut off and removed from the spent fuel pit in the reactor enclosure to lower the radiation level in the pit.
13. Rupture Disc on Vessel: Overpressure protection for the reactor vessel was provided while the primary system was full, by installing a 3" diameter 200# rupture disc assembly on an existing riser. This was done to avoid inadvertent overpressurization of the system with the feedpumps. The rupture disc was not removed after the primary system was drained.
14. ESADE: All ESADE equipment and loop piping have been removed from the VBWR basement and shipped for disposal as radioactive waste. ESADE piping connections have been removed from the vessel. Electrical wiring was removed back to the cubicle in the turbine building. Instrument panels and gage boards were removed from the enclosure. The control console and instrument panels were removed from the control room.

15. Turbine Test Loop: The loop piping was removed and disposed of as radioactive waste. The line was cut and capped off at main steam line. The turbine test building was decontaminated.
16. Turbine Building and Cooling Tower: Control of the turbine building and cooling water tower has been turned over to EVESR and the PG&E staff. The turbine will be used to receive steam from EVESR as noted in Change No. 8 to the EVESR Technical Specifications. All piping connecting VBWR and the turbine has been removed or capped. Certain equipment such as the feedwater pumps and the instrument air compressor has been deactivated by locking out valves and breakers.
17. VBWR Control Room: The control room has been made part of the EVESR control room by removing the separating wall to facilitate the operation of the turbine-generator controls, instruments and auxiliaries. All VBWR instrumentation has been deactivated by removing power to the instruments and shutting off control air.
18. Stack Cap: A 1/4" aluminum plate was installed on top of the VBWR 70 foot stack to contain any contamination inside the stack.

B. The following items are not considered changes but are actions taken to place the facility in a deactivated condition. In general, systems were deactivated by draining, closing valves, pulling breakers and closing switches, etc. In addition, valves and breakers were locked out and tagged to assure complete separation and deactivation of retired systems. Keys will be controlled by EVESR Operations.

Deactivated systems not mentioned elsewhere in this report were:

1. Steam generator and condensate back-up pump;
2. Enclosure air washer;
3. Ventilation blowers;
4. Reactor feed pumps;
5. System motor operated valves;
6. Instrument air compressor in Turbine Building.

III. FACILITY DEACTIVATION DESCRIPTION

Descriptions of the various retired areas are given below. Those areas which were not retired are also described.

A. Reactor Enclosure: The reactor building has been cleaned and surveyed. The entire enclosure is considered a "Restricted Area" and the outer doors of the east and west airlocks are secured with a chain and lock. The key is controlled by the

EVESR shift supervisor to prevent access to unauthorized personnel. An alarm will sound in the control room when either outer door is opened. All enclosure building isolation valves have been closed and their manual back-ups have been closed and locked. The ventilation system, all utilities, and electrical power (other than that which will be occasionally needed for illumination) to the enclosure have been secured.

1. Main Floor: Cleanup of gross contamination was accomplished and the interior of the enclosure dome and walls painted. This area remains a low level contaminated zone and radiation levels are in the range of a "Radiation Area".
2. Spent Fuel Pit: The pit has been drained, the fuel racks removed, and a cover has been installed over the top.
3. Reactor Vessel: All refueling ports have been bolted in place and the missile shield is closed and bolted. The vessel has been drained to a point below the lowest penetration to assure there will be no water leakage.
4. Enclosure Basement: This area remains a "contaminated zone" and a "High Radiation Area". A concrete floor plug covers the west ladder well and a metal cover is locked in place over the east ladder well to prevent unauthorized entry. Resins and filter cartridges have been removed from the cleanup system deionizers and filters to lower radiation levels in that area of the basement. Radiation levels are indicated in Appendix I.

5. Primary Piping System: The piping has all been drained to assure there will be no water leakage. All drain vent valves were closed.

B. External Areas

All open external areas are clean of smearable contamination.

A description of the status of equipment outside of the enclosure is given below.

1. Enclosure/Turbine Building Valve Pit: The valve pit is a "Contaminated Zone". Access to the valve pit is prevented by a heavy metal cover and an appropriate radiation sign. As shown in Appendix I smearable contamination on the lines and valves does not exceed 200 c/m.
2. Stack: The stack shows a background reading of about 4.5 mr/hr on the inner surface in the area of the RAMS chamber and the inner surfaces contain smearable contamination. All lines to and from the stack have been secured except the stack drain to the waste area sump. A metal cap has been secured over the top of the stack to contain contamination remaining in the stack. The stack is marked with an appropriate radiation sign. The stack particulate and radiation monitors were taken out of service.

3. Waste Water & Make-Up Systems: The VBWR waste area sump tank #3, and waste water storage tanks 4, 5, 6, and 7 are being used and maintained by the EVESR Operation. The demineralized storage tank #1 and the condensate storage tank #2 will also be maintained by EVESR. System piping from the VBWR enclosure building has been deactivated by draining lines, closing, locking and tagging valves and by installing blind flanges where needed to assure isolation. All normal supply lines to the enclosure have been separated and capped.
 4. Drips and Drains Deionizer Room: This open outside room located west of the waste sump area has been cleaned to remove all smearable contamination. Resins and filter cartridges have been removed from the units. This area is a radiation zone and is under the control of EVESR and not considered part of the retired area.
- C. VBWR Fuel Storage Vault: All fuel has been removed from the vault and sent to other licensees for storage and ultimate reprocessing. The vault criticality system has been deactivated.
- D. Special Nuclear Material and Byproducts Materials Held Under License DPR-1 and SNM-130
- Irradiated fuel elements including driver fuel, Dresden type fuel, HPD fuel, and fuel cycle elements stored in the Fuel Storage

Building have been segregated by programs and prepared for shipment to Savannah River Laboratory under License SNM-130 for reprocessing. Irradiated plate fuel elements were transferred to ICCP in Idaho for reprocessing. Non-irradiated fuel was transferred to other licensees for storage or reprocessing. Some special byproducts material was disposed of as radioactive waste by standard VBWR procedures.

- E. Hot Radioactive Waste: Low level radioactive waste such as the ESADE loop, turbine test loop, in-core sampler piping and components were packaged and disposed through standard waste disposal procedures. High level radioactive waste such as control rods, all channels, startup sources, and fuel element hardware were shipped off-site in casks for burial.
- F. Contaminated and Activated Equipment: Some radioactive equipment and materials considered an integral part of the plant have been packaged and stored on the reactor enclosure mezzanine or in storage areas under the control of the EVESR Operation. Equipment such as pumps and instruments useful to other Vallecitos operating facilities has been transferred to these facilities.
- G. Noncontaminated Equipment: Spare parts, tools, and conventional facility equipment has been transferred to operating facilities. EVESR Operations will have control of any such future transfers of equipment.

IV. HAZARDS EVALUATION

With the exception of the stack and the main valve pit, all of the retired facilities are within the containment enclosure. Based on the radiation survey results, the principle of "Restricted Areas" will be applied to the retired VBWR facilities. The enclosure building will be locked and only authorized personnel allowed to enter. The EVESR Operation located adjacent to the retired VBWR will provide trained personnel in the unlikely event an emergency arises at the retired facility.

A. Contamination and Radiation Hazards: Uncontrolled escape of contamination or radioactivity is not credible because of safeguards and precautions initiated in retiring the facility. There is no smearable contamination in outside areas. Radiation and contamination levels in the enclosure have been reduced through decay, decontamination and removal of radioactive materials.

As required by 10 CFR Part 20, Section 20.204, restricted areas will be posted as "Radioactive Materials Areas and/or Radiation Areas". Periodic inspections will be made of the retired areas at which time a complete radiation and contamination survey will be taken. All retired areas will remain locked, properly posted and restricted. Because access to all high radiation areas is restricted by lock or barricade and, since an alarm will sound in the EVESR control room when either outer door of the containment building is opened, the requirements of 10CFR 20.203(c)(2) are deemed to be met.

The contamination and/or radiation areas are:

1. Reactor Enclosure
Main Floor
Spent Fuel Pit
Enclosure Basement
2. General
VBWR Stack
Main Valve Pit

- B. Fire Hazard: Non-combustible materials were used in the construction of the VBWR. Fire hazards have been reduced by removing combustible and flammable materials from the retired areas where practical. Electrical circuits have been de-energized. Fire extinguishers located outside of the enclosure will be maintained as in normal plant operation. Around-the-clock fire protection is available from the trained shift fire protection squads made up of EVESR Operations personnel.
- C. Natural Forces: The reactor enclosure has been designed to withstand forces and storms of the magnitude appropriate to this area.
- D. Unlawful Entry: It is unlikely that attempted trespass or unlawful entry could be accomplished without detection. There is a perimeter fence along the side of the Laboratory adjacent to the road with guards provided to prevent unlawful entry. A chain link fence surrounds the entire reactor area. EVESR Operations personnel will be in the adjacent area at all times and are responsible for the security of the retired areas. Routine patrols are also made by the guards.

V. PERIODIC INSPECTIONS

The retired VBWR facilities will be inspected periodically by personnel experienced in the detection of hazards, both nuclear and non-nuclear. Personnel from the General Electric Irradiation Processing Operation will comprise the inspection team. They will be assisted by Radiation Monitors and Mechanical Technicians. Prior to the inspection, air samples and a general survey will be taken in the enclosure to ascertain the safety equipment and procedures necessary to conduct the inspection. A complete survey similar to the one given in Appendix I of this report will be made. The condition, security and integrity of the retired facility will be checked during the inspection. All enclosure penetrations will be checked to assure complete enclosure isolation. The integrity of the reactor vessel and process system will be verified. The air filter which allows the system to breathe will be inspected and changed if necessary. Security of all locks, doors, and covers restricting access to the retired areas will be checked. The condition of all radiation signs and labels will be checked and replacements made if necessary.

VI. RECORDS

Records required by License No. DPR-1 will be retained for a period of two years after which further retention or disposal will be made at the option of the General Electric Company.

APPENDIX I

December 15, 1964

VBWR RADIATION AND CONTAMINATION REPORT

LOCATIONS	RADIATION LEVELS*		CONTAMINATION LEVELS*	
	Total mrems/hr	Gamma mr/hr	Surface (smears) Beta - Gamma c/m/100 cm ²	Airborne Beta - Gamma μc/cc
I. Reactor Enclosure				
A. Main Floor-General-Field	1	1	3,000 c/m	.7 x 10 ⁻¹⁰
1. Top of Reactor Missile Shield-Field	1	1	2,000 c/m	1.2 x 10 ⁻¹⁰
2. Top of Spent Fuel Pit Cover-Surface	7	7	700 c/m	NA
3. Spent Fuel Pit (3' down)- Field	15	15	50,000 c/m	1.0 x 10 ⁻¹⁰
B. Reactor Basement				
1. Upper Levels-Field	40	40	--	NA
2. Lower Levels-Field	200	200	8,000 c/m	.54 x 10 ⁻¹⁰
3. West Ladder Bottom-Field	110	110	8,000 c/m	NA
4. East Ladder Bottom-Field	70	70	4,000 c/m	4.64 x 10 ⁻¹⁰
5. Between Recirc. Pumps- Field	250	250	20,000 c/m	2.1 x 10 ⁻¹⁰
6. RCP #1 - Surface	330	250	30,000 c/m	NA
7. RCP #2 - Surface	1240	240	400 mrem/hr	NA
8. Downcomers-Surface	410	410	18,000 c/m	NA
9. Behind Reactor Shield Wall- Field	200	200	45,000 c/m	NA

LOCATIONS	RADIATION LEVELS*		CONTAMINATION LEVELS*	
	Total mrems/hr	Gamma mr/hr	Surface (smears) Beta - Gamma ₂ c/m/100 cm	Airborne Beta - Gamma μc/cc
10. Cleanup System-Field	70	70	NA	3.3×10^{-10}
11. Cleanup Filter-Surface	600	600	12,000 c/m	1.1×10^{-10}
12. Cleanup Deionizer-Surface	2000	2000	35,000 c/m	NA
13. Emergency Heat Exchanger-Surface	35	35	20,000 c/m	NA
14. Main Steam Line-Surface	40	40	4,000 c/m	NA
15. Reactor Head Area-Field	50	50	NA	1.2×10^{-10}
16. Reactor Head-Contact	42	42	3,000 c/m	NA
II. Enclosure Stack - Outside-Surface	1	1	< 100 c/m	NA
III. Main Valve Pit - Field	1	1	< 100 c/m	$.22 \times 10^{-10}$
Valve Pit Lines & Valve - Surface	6	6	200 c/m	NA

* Peak values for areas tabulated.

