October 14, 1982

Docket No. 50-155
LS05-82-10-039

Mr. David J. VandeWalle
Nuclear Licensing Administrator
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. VandeWalle:

SUBJECT: SEP TOPIC III-4.C, INTERNALLY GENERATED MISSILES - BIG ROCK POINT

Enclosed is the staff's evaluation of SEP Topic III-4.C for the Big Rock Point Plant. This evaluation is based on our review of your topic safety assessment report submitted by letter dated May 4, 1982. The staff has determined that Big Rock Point meets the intent of the acceptance criteria for this topic.

This evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this subject is modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

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10/6/82

*SEE PREVIOUS TISSUE FOR ADDITIONAL CONCURRENCES.

OFFICE	SEPB:DL	SEPB:DL	SEPB:DL	ORB#5:PM	ORB#5:BC	AD:SA:DL	
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Consumers Power Company
1945 West Parnall Road
Jackson, Michigan 49201

Dear Mr. VandeWalle:

SUBJECT: SEP TOPIC III-4.C, INTERNALLY GENERATED MISSILES - BIG ROCK POINT

Enclosed is the staff's draft evaluation of SEP Topic III-4.C for the Big Rock Point Plant. This evaluation is based on our review of your topic safety assessment report submitted by letter dated May 4, 1982. The staff has determined that Big Rock Point meets the intent of the acceptance criteria for this topic.

You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct, or by identifying errors and supplying the corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the Integrated Assessment of your facility.

Your response is requested as soon as possible. If no response is received by the time the next phase of the integrated assessment of your facility begins, we will assume that you have no comments or corrections.

This evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this subject is modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

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ENCLOSURE

SAFETY EVALUATION REPORT
BIG ROCK POINT
SYSTEMATIC EVALUATION PROGRAM
TOPIC: III-4.C INTERNALLY GENERATED MISSILES

I. INTRODUCTION

Missiles which are generated internally to the reactor facility (inside or outside containment), may cause damage to structures, systems and components that are necessary for the safe shutdown of the reactor facility or accident mitigation and to the structures, systems and components whose failure could result in a significant release of radioactivity. The potential sources of such missiles are valve bonnets, and hardware retaining bolts, relief valve parts, instrument wells, pressure containing equipment such as accumulators and high pressure bottles, high speed rotating machinery, and rotating segments (e.g., impellers and fan blades).

Scope of Review

The scope of review is as outlined in the Standard Review Plan (SRP) Section 3.5.1.1, "Internally Generated Missiles (Outside Containment)," and SRP Section 3.5.1.2, "Internally Generated Missiles (Inside Containment)." The review specifically excludes SRP Section 3.6.1, "Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," 3.6.2, "Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," as well as those SRP sections dealing with natural phenomena (including missiles generated by natural phenomena), missiles generated outside the facility, and turbine missiles.

II. REVIEW CRITERIA

The acceptability of the design of protection for facility structures, systems and components from internally generated missiles is based on meeting the following criteria:

1. General Design Criterion 4, "Environmental and Missiles Design Bases," with respect to protecting structures, systems and components against the effects of internally generated missiles to maintain their essential safety functions.

2. Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," as related to the spent fuel pool systems and structures being capable of withstanding the effects of internally generated missiles, and preventing missiles from impacting stored fuel assemblies.

3. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," as related to the ultimate heat sink being capable of withstanding the effects of internally generated missiles.

III. RELATED SAFETY TOPICS AND INTERFACES

Review Areas Outside the Scope of this Topic

As stated previously, this review specifically excludes the following:

1. SRP Sections 3.6.1, "Plant Design for Protection Against Postulated Piping Failure in Fluid Systems Outside Containment" - This matter will be covered under Safety Topic III.5.B, "Pipe Break Outside Containment."

2. SRP Section 3.6.2, "Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping" - This matter will be covered under Safety Topic III-5.A, "Effects of Pipe Break on Structures, Systems and Components Inside Containment."

3. Natural Phenomena - This matter will be covered under Safety Topics III-6, "Seismic Design Considerations" and III-4.A, "Tornado Missiles."

4. Turbine Missiles - This matter will be covered under Safety Topic III-4.B, "Turbine Missiles."

Interfaces with Other SEP Safety Topics

Satisfactory resolution of the following safety topics will depend, at least in part, on the satisfactory resolution of this topic:

1. Topic VII-3, "Systems Required for Safe Shutdown"

2. Topic VII-4, "Effects of Failure in Non-Safety Related Systems On Selected Engineered Safety Features"

3. Topic IX-1, "Fuel Storage"

4. Topic IX-3, "Station Service and Cooling Water System"

5. Topic II-3.C, "Safety-Related Water Supply (Ultimate Heat Sink)."

IV. REVIEW GUIDELINES

Systems and components needed to perform safety functions as identified below, are consistent with the guidance provided in SRP Section 3.2.2, "Systems Quality Group Classification." Because the design of Big Rock Point differs from the usual G.E. BWR design (from which SRP Section 3.2.2 is based), the systems listing of necessary plant systems differs from the SRP listing.

1. Systems needed to perform safety functions (safe plant shutdown or accident mitigations)
   a. Main Recirculation Loop
   b. Shutdown Cooling System

c. Emergency Condenser

d. Reactor Cleanup System

e. Liquid Poison System

f. Control Rod Drive System

g. Main Steam System (portion of)

h. Feedwater and Condensate System (portion of)

i. Reactor Depressurization System

j. Core Spray System

k. Post-incident Cooling System (Enclosure Spray)

l. Fire Suppression Water System

m. Reactor Cooling Water System

n. Reactor Protection System

o. Other Passive Systems Relative to Safe Shutdown

2. Systems whose failure may result in release of unacceptable amounts of radioactivity

a. Containment Building

b. Spent Fuel Pool Cooling System

c. Airborne Waste Processing System

d. Liquid Waste Processing System

e. Sampling System

3. Electrical systems which are necessary for shutdown

a. Direct Current Power System

b. Diesel Generator

c. AC Power Supply

d. Cable Spreading Trays

e. Electrical Penetration Room

f. Control Room

V. REVIEW AND EVALUATION

1. Systems Needed to Perform Safety Functions

a. Main Recirculation Loop

The main recirculation loop is comprised of a reactor vessel, steam drum, reactor recirculating pumps, interconnecting piping, valves and safety valves. All components of the main recirculation loop up to the outboard main steam isolating valves are located in the reactor building and are shielded by reinforced concrete.

The reactor vessel is 5-1/4 inch thick with a gasketed removable upper head. The vessel head is secured in position by forty-two 4-3/4 inch diameter studs. It is extremely unlikely that any of these studs would become a missile because of application of controlled stud tension. Also, main steam safety relief valves assure that the system pressure would not exceed design limits.

The core spray piping is connected to the reactor vessel for the removal of core decay heat. Spray lines also extend from the enclosure spray header to the steam drum enclosure area. The core spray piping is a low pressure piping (100 psig), which will not generate missiles, and is protected by concrete shielding. A small portion of this piping which connects to the reactor vessel is subjected to main loop pressure. In the reactor cavity, there is no equipment which could pose a missile threat. A break in main loop piping constitutes a LOCA and the plant is designed to accommodate this event. A branch of the core spray line provides water for enclosure spray. A missile's strike to this branch spray line would not prevent safe shutdown nor damage other safety systems since the line usually does not contain water (discussed in item V.1.j and k).

The steam drum with its piping is mounted inside a 3 to 5 feet thick concrete enclosure. Protection from the internally generated missiles is provided by a thick concrete barrier and the heavy wall thickness of the steam drum. The steam drum studs and manhole cover if ejected would strike the concrete wall. There is no equipment in their direct flight path which could be affected.

The two main circulating pumps are driven by 400 HP, 900 RPM induction motors. The effect of pump failure has been analyzed for overspeed assuming a postulated break in pump discharge. The probability of missiles being generated by the circulating pump is remote due to heavy ductile stainless steel casing and low speed of the pump.

Six top mounted safety relief valves on the steam drum are equipped with rupture discs; their position and orientation are such that any part blown off the relief valves would strike the thick concrete ceiling or side walls and is not likely to damage other NSSS components or piping. Blind flanges and valve bonnets are firmly secured by multiple bolts and are not likely that all of the bolts would fail simultaneously to generate missiles.

The reactor vessel and the steam drum are not susceptible to damage from a missile strike due to heavy wall thickness of the reactor vessel and the steam drum. However, should a missile create a break in the reactor coolant pressure boundary, the emergency core cooling system will keep the core cooled after vessel depressurization.

Based on our evaluation, we conclude that main recirculation system will not generate nor is it susceptible to missiles that will preclude the plant from being safely shutdown.

b. Shutdown Cooling System

The shutdown cooling system removes fission products decay heat during reactor shutdown, refueling or maintenance when the reactor pressure is under 300 psig and temperature is between 350°F and 120°F.

The shutdown cooling system is isolated during normal operation by double block valves at both ends. The major components are two heat exchangers, two pumps, interconnecting piping and valves. This system is located inside a ? feet thick concrete enclosure and protected against missiles from other equipments. It is not likely to produce damaging missiles because it is a low pressure system, which operates during plant shutdown. However, loss of this system will not result in inability of safe shutdown, as normal shutdown via main feedwater system is available.

c. Emergency Condenser

The emergency condenser is a backup heat sink for the reactor after scram when the main condenser is not available. It is located at elevation 667'3" in the containment and consists of two redundant cooling coils in a shell which contains water. Steam passes through two 6 inch coils, dissipates its heat energy to the water and the condensate returns to the steam drum through two 4 inch lines. The shell side receives make-up water from the demineralizer system or the fire suppression system and is vented to the atmosphere outside the containment.

Potential missile sources to the emergency condenser are the isolating valves of the reactor depressurization system (RDS) and the liquid poison system. Failure of these valves is not likely to result in any significant damage to the emergency condenser because of the relative small size of the valves and of the condenser being outside the flight path of the postulated missiles. The chances of these valves becoming missiles are remote due to long operating history and valve design. Alternate shutdown via main condenser or RDS and core spray systems can be accomplished if main condenser is not available.

Based on our evaluation, we conclude that emergency condenser will not generate missiles that would preclude the plant from being safely shutdown.

d. Reactor Cleanup System

The reactor cleanup system controls and maintains reactor coolant system purity and consists of four regenerative heat exchangers, one non-regenerative heat exchanger, one demineralizer and one cleanup pump. The regenerative and non-regenerative heat exchangers, cleanup pump and demineralizer are located in the reactor building in separate enclosures. The components in a given enclosure are protected against internally generated missiles from sources outside of the enclosure. The cleanup pump is the only significant postulated missile generator. Even if a missile is generated causing failure in the cleanup system boundary, the system could be isolated and the plant could be safely shutdown. Further, a failure in the cleanup system will not endanger other systems needed for shutdown.

e. Liquid Poison System

The liquid poison system is a backup to the control rod drive system for bringing the reactor to subcritical condition. It consists of a poison tank, nitrogen bottles gas supply and connecting piping and valves.

The poison tank, which contains neutron absorber solution, is located at elevation 640'0" in the reactor building. Pressurization is provided by a bank of nitrogen bottles securely held in position at elevation 600'6". The relief valves on the pressurized bottles are pointed toward the ceiling and there is no safety related equipment in their projected flight path. As this system is a backup to the control rod system, its failure due to any postulated internally generated missiles will not comprise safe plant shutdown.

f. Control Rod Drive System

The control rod hydraulic system provides pressurized water for insertion and withdrawal of the reactor control rods. It also provides makeup water to the reactor from the condensate storage tank and the main condenser hot well at 50 gpm.

The control rod drives, supply pumps, accumulators, dump tanks and associated accessories are located in missile-protected compartments and are separated from other safety related equipment.

The CRD valves are very small and are not capable of damaging safe shutdown equipment should they fail. Also, a CRD support structure is located below the CRDs and is provided to hold the CRDs in place in case the thimble weld fails. The support structure prevents the CRDs from becoming missiles and damaging other safety related equipment.

If the control rod hydraulic system is damaged by an internally generated missile, the liquid poison control system, which serves as a backup reactor shutdown system, is capable of making and holding the reactor subcritical. Due to the physical arrangement of these two systems, an internal missile could not disable both these systems.

g. Main Steam System (portion of)

The main steam system consists of a steam drum (discussed with the main recirculation loop), a 12 inch main steam line to the turbine and another 12 inch main steam line to the reactor depressurization system (discussed in item V.1.i). The main steam line is of heavy-walled construction and is well supported and protected from postulated internally generated missiles from other sources by its physical location.

The main steam line is equipped with a main steam isolation valve (MSIV) located in the steam pipe tunnel inside containment, a turbine bypass valve and a stop valve located in the steam tunnel outside containment. Based on design features, restraints and orientation, these valves are not likely to generate internal missiles that could prevent safe plant shutdown. In any event, if missile damage were to occur upstream of the MSIV, the consequences of the resulting accident are enveloped by the design basis accident analysis for this plant. Should damage occur to the main steam line downstream of the MSIV, valve closure would terminate the accident.

Based on our evaluation, we conclude that the main steam system will not generate missiles that will preclude the plant from being safely shutdown or be susceptible to missiles from other sources.

h. Feedwater and Condensate System (portion of)

The Condensate System consists of two condensate pumps which take suction from the condenser hot well and pump the condensate through the air ejector, gland seal condenser, and low and intermediate pressure heaters to the suction of two reactor feedwater pumps. The feedwater pumps pump the feedwater through a common regulating valve located in the turbine building, a high pressure feedwater heater located in the steam pipe tunnel (outside the containment) and then through a check valve to the steam drum located in the containment.

There is no safety related equipment located near the feedwater pumps and the regulating valve.

Should the feedwater system be disabled by an internal missile, then the loss of feedwater could be mitigated by depressurization of the vessel through the feedwater rupture and use of the core spray system (discussed in item V.1.j) to obtain safe shutdown.

i. Reactor Depressurization System

The reactor depressurization system (RDS) automatically depressurizes the reactor to allow core cooling via the low-pressure core spray system when the main condenser or the emergency condenser is not available. The RDS consists of four parallel blowdown paths through 10-inch, pilot-operated isolation valves connected to the 12-inch main steam header. These valves are located in the reactor building and are oriented upward toward the steel spherical shell.

The ejection of missiles from the valves is considered very low due to their design and long operating history. RDS valve stems or bonnets, if ejected, would strike the containment spherical shell. There is no equipment in the direct flight path of these valves. However, after striking the containment spherical shell, these valve missiles could fall on the NSSS panels located on the floor at elevation 616'0". Assuming damaging to NSSS , nels (safety related panel C-30 Steam Drum wall instrumentation and non-safety related panels C-20 and MCC-2D 480 volt system), the following systems would be available for safe plant shutdown:

Emergency Condenser

CRD System

RDS

Fire Suppression Water System

Core and Enclosure Spray System.

An analysis of RDS valve stem failure by the licensee indicated that the postulated missile would not penetrate the steel spherical shell.

Based on our evaluation we conclude that the RDS system will not generate missiles that will preclude the plant from being safely shutdown.

j. Core Spray System

The core spray system is designed to remove core decay heat and minimize release of fission products into the containment atmosphere. A 6-inch header for the core spray ring, and a 4-inch header for the core spray nozzle, supply low pressure water from the underground fire suppression water loop for injection into the core (discussed with main recirculation loop, item V.1.a).

Two redundant core spray pumps take suction from the containment sump, beneath the reactor vessel and deliver water to the core spray lines through a heat exchanger for long-term cooling in the recirculation mode. In this mode, water supply from the fire suppression system is shut off by manual valves.

The core spray pumps, heat exchangers and associated accessories are located in a separate concrete room outside the containment. Piping runs are primarily underground and are isolated from potential missile sources. The system is not likely to generate internally generated missiles because it is not a high energy system, does not normally operate and is well isolated. The use of redundant subsystems ensures that no missile is likely to cause loss of core spray function.

k. <u>Post-incident Cooling System (Enclosure Spray)</u>

This system consists of two post-incident spray sets in the upper part of the steel spherical shell. Operation of only one spray set is sufficient to provide required temperature and pressure suppression following a LOCA. Spray lines also extend from the spray headers to the steam drum enclosure (cavity) such that spray sets will simultaneously spray inside and outside cavity (discussed with main recirculation loop, item V.1.a).

Water is initially supplied automatically from the fire suppression system. Later the water is supplied by the core spray recirculation system. The post-incident cooling sets are not under pressure during normal plant operation and they are isolated from other high energy postulated missile generating sources.

In our judgment, the post-incident cooling system with its redundant features and separation, is capable of performing its function in the event of postulated internally generated missiles.

1. Fire Suppression Water System

This system provides backup cooling water to the emergency condenser, the reactor cooling water heat exchangers and the main condenser hot well. It also supplies water for the primary core spray, redundant core spray, enclosure sprays for steel spherical shell and for fire protection.

The main components of the system are two redundant fire pumps, one electric and the other diesel driven, one accumulator with jockey pump. These components are located in the screenhouse. These pumps take suction from the condenser circulating water intake structure and offshore intake line and discharge into the fire suppression water system piping. The fire suppression water system piping enters the containment through the turbine building steam pipe tunnel and as a backup, through the core spray pump and heat exchanger room.

This is a low-pressure system which uses low speed pumps and, as such, is not likely to generate internal missiles. There is no high energy or high pressure equipment nearby which can render this equipment inoperable. Service water and circulating water pumps are 15 to 30 feet away. These low-speed low-pressure pumps are not likely to generate internal missiles which can damage redundant fire water pumps. In the highly unlikely event of damage to the fire suppression system, the reactor can be safely shutdown using the main condenser, or emergency condenser and service water systems.

Based on the system design, redundancy and layout, we conclude that the fire suppression system does not pose a missile hazard to safe plant shutdown.

m. Reactor Cooling Water System

The reactor cooling water system (RCWS) provides cooling water to the reactor shield cooling panels and other potentially radioactive cooling systems. The RCWS consists of a closed loop and is located inside containment. It is composed of a 53,000-gallon concrete tank, two pumps, two heat exchangers, piping and valves.

The RCWS is a low energy system which uses low speed pumps for water recirculation. The system is protected from postulated internally generated missiles by virtue of its separation from other systems, location of its components, and does not pose a missile hazard to safe shutdown systems. In addition, this system is not needed for safe shutdown.

n. Reactor Protection System

The reactor protection system (RPS) initiates control rod insertion for reactor shutdown and also initiates other secondary protection functions. The system consists of two RPS safety channels, each of which has its own power supply, its own sensors for monitoring the parameters of concern, and logic circuitry. Each reactor protection channel is powered by a separate motor generator set. Loss of one of the two motor generator sets would result in actuation of only one RPS channel and an RPS actuation would not result. By manual actuation of the power controller in the control room, an alternative power supply can be switched to either of the two protection buses.

From our evaluation of the reactor protection system, we conclude that failures in the RPS will not generate missiles, and there is no other equipment nearby which could pose a missile threat to the RPS.

o. Other Systems That Are Passive Relative to Safe Shutdown

The following systems were listed by the licensee:

(1) Service Water System

(2) Demineralized Makeup Water System

(3) Instrument and Service Air System

(4) Ventilation System

The licensee stated that these systems are either well isolated by barriers or are low energy or normally not operating and, therefore, not capable of generating missiles. For the purpose of completeness, we have listed these systems which were identified by the licensee as systems needed to perform safety functions. We have reviewed the above systems and conclude that these systems either: do not pose a missile hazard to safe shutdown systems, are well isolated by plant structures, or are not needed for safe shutdown.

2. Systems Whose Failure May Result in Release of Unacceptable Amounts of Radioactivity

a. Containment Building

The containment is a steel spherical shell 130 feet in diameter and 0.875 inch thick. It is a massive structure and is not considered to generate postulated missiles. The only system which is housed inside of containment and which has sufficient energy to create missiles is the main recirculation loop. Rupture of the main recirculation loop is considered unlikely (discussed in item V.1.a). No other components in the containment are expected to have sufficient energy to penetrate the steel spherical shell. The structural integrity of the containment was evaluated per SEP Topic XV-15, "Inadvertent Opening of BWR Safety/Relief Valve," and found to be in compliance with 10 CFR 50.

Based on our evaluation we conclude that failure of the containment building due to internally generated missiles is unlikely.

b. Spent Fuel Pool Cooling System

The spent fuel pool cooling system removes residual heat from the spent fuel stored in the pool. It consists of two pumps, two heat exchangers, a bypass filter, a surge tank, piping, valves and instrumentation. All equipment is located inside containment. Heat from the spent fuel pool is transferred by the heat exchangers to the reactor cooling water system. The spent fuel pool cooling system is a low pressure system; therefore, it is not postulated to generate missiles. Further, the pumps and heat exchangers are protected against missiles from other sources due to their compartmentalization.

Should the equipment become inoperable due to missile damage, there is sufficient time to effect repairs or arrange for alternate cooling such as fire hoses. Thus, we conclude that failure of this system will not result in adverse radiological consequences.

c. Airborne Waste Processing System

This system provides controlled release and dispersion of radioactive waste gases from the main condenser air ejectors, the turbine gland seal exhauster and the mechanical vacuum pump via holdup piping and then through the stack to the atmosphere. All process gases before release are diluted by two full capacity stack exhaust fans.

The system is a low pressure system and can be isolated as necessary to control releases. The components of the system are behind shielded walls and are protected from internally generated missiles from other components. The potential for internally generated missiles from the system itself is very small. Radioactive gas release rate is continuously monitored; and, in the event of excessive release, the system can be isolated.

We conclude that failure in the airborne waste processing system due to a postulated internally generated missile strike will not result in significant radiological consequences.

d. Liquid Waste Processing System

The liquid radwaste system collects, treats, stores, and disposes of all the radioactive liquid waste.

The liquid waste system is a low energy system and is not capable of genrating a missile. Further, it is enclosed by concrete walls. Therefore, it is not a target for other missile sources. However, should this system be impaired by a missile, then any leakage would be retained in the building long enough to allow for cleanup and repair. We conclude that failure of this system will not result in significant radiological consequences.

e. Sampling System

The sampling system consists of a detector for monitoring the plant stack and also utilizes grab samples for monitoring the cleanup demineralizer. An isokinetic probe, permanently fixed in the stack, collects stack gas samples that are withdrawn with a gas pump through flow metering and regulating equipment. The sample is passed through a replaceable filter, which is checked for particulate contamination and then through the continuous monitoring gamma spectrometer.

Grab samples are collected from the water leaving the cleanup demineralizer (reactor cleanup system) and analyzed in the chemistry lab.

The likelihood of missiles causing damage to the sampling system is considered very remote. Further, a missile strike to this system would not result in unacceptable radiological consequences.

3. Electrical Systems Which are Necessary for Shutdown

a. Direct Current Power System

The direct current power system has one 125 Vdc power supply, four uninterruptible power supplies for RDS valves and a battery and charger for each emergency diesel generator and fire water diesel engine.

The dc power system is equipped with a 125 volt, 60 cell battery; two battery chargers; associated control panels and a dc control center located in the station power room. It provides power for normal switchgear control, turbine control, annunciators and various emergency functions. This system can be considered vulnerable to postulated internally generated missiles resulting from motor-generator set flywheel failure. However, failure of the motor generator is extremely unlikely as no mechanism has been identified that could lead to overspeed of the subject motor-generators. Failure at the rated speed due to material deficiency is also unlikely due to long operating history.

In the event of 125 Vdc system failure, the plant can be safely shutdown using alternate ac power or RDS and diesel fire water pump. A separate independent 125 volt battery supply for the operation of the emergency condenser is being provided as part of the modification to meet the fire protection requirements.

b. Diesel Generator

An emergency diesel generator is located in a separate compartment in the screenhouse. A redundant mobile diesel generator is also installed near the well water pump house which can be made operational within 24 hours.

Due to separation and compartmentalization, the diesel generator is not considered to be likely source or target of postulated internally generated missiles. In the event of damage, the safe shutdown of the plant would not be affected due to redundant systems available for shutdown.

c. AC Power Supply

AC power is obtained (either from the main generator or from the transmission system) through a 750 KVA station service transformer connected to a 2,400 volt switchgear bus located in the station power room. AC power is also available through another transformer connected to 2,400 V bus and 46 KV auxiliary offsite supply. 480 V supply is obtained through two stepdown transformers. The reactor instrumentation and protection circuits are fed from three 120 V ac buses. Two of these buses are supplied from different 480 volt systems through separate motor generator sets. The third bus is supplied from the 125 volt dc system through a static inverter. The station power room also houses switchgear for the reactor recirculation and reactor feed pumps, motor control center and control panels.

The postulated missile sources in the switchgear room are the flywheels of the motor-generator sets, the failure of which is discussed under dc power supply system (discussed in item V.3.a). Even if the motor generator set flywheel should fail and somehow strike the 1A, 2A, 2B panels, the plant can be safely shutdown using the emergency condenser and the fire water suppression system.

d. Cable Spreading Trays

The overhead cable spreading trays are also located in the station power room. Cables are routed through these trays to the control room. The postulated missile source in the vicinity is the motor set flywheel whose failure is highly unlikely and which cannot render all safe shutdown systems inoperable. Further, the plant can be safely shutdown using the emergency condenser and the fire water suppression system.

e. Electrical Penetration Room

The electrical penetration room is located adjacent to the station power room. It does not contain any rotating equipment or pressurized sources other than an isolated nitrogen bottle. Failure of the nitrogen bottle relief valve/regulator is not likely to create a damaging missile because of the bottle's location and separation from other safety-related equipment.

f. Control Room

The control room is located in the northwest corner on the third floor of the service building. There are no credible missile sources within the control room or in its immediate vicinity which could damage the control room.

VI. CONCLUSIONS

Based on our review of the systems and components needed to perform safety functions, we conclude that the design of protection from internally generated missiles meets the intent of the criteria listed in Section II, REVIEW CRITERIA.