ATTACHMENT A

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 16

Revise the Technical Specifications as follows:

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TS Tech

14pp.

INSTRUMENTATION

TURBINE OVERSPEED PROTECTION

LIMITING CONDITION FOR OPERATION

3.3.4 At least one Turbine Overspeed Protection System shall be OPERABLE.

APPLICABILITY: MODES 1, 2*, and 3*.

ACTION:

a. With one ~~stop~~ Throttle valve or one governor valve per high pressure turbine steam line inoperable and/or with one reheat stop valve or one reheat intercept valve per low pressure turbine steam line inoperable, restore the inoperable valve(s) to OPERABLE status within 72 hours, or close at least one valve in the affected steam line(s) or isolate the turbine from the steam supply within the next 6 hours.

b. With the above required Turbine Overspeed Protection System otherwise inoperable, within 6 hours isolate the turbine from the steam supply.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.4.1 The provisions of Specification 4.0.4 are not applicable.

4.3.4.2 The above required Turbine Overspeed Protection System shall be demonstrated OPERABLE:

a. At least once per 31 days by cycling each of the following valves through at least one complete cycle from the running position:

1) Four high pressure turbine ~~stop~~ throttle valves,
2) Four high pressure turbine governor valves,
3) Four high pressure turbine reheat stop valves, and
4) Four low pressure turbine reheat intercept valves.

b. At least once per 31 days by direct observation of the movement of each of the above valves through one complete cycle from the running position,

c. At least once per 18 months by performing a CHANNEL CALIBRATION on the Turbine Overspeed Protection Systems, and

d. At least once per 40 months by disassembling at least one of each of the above valves and performing a visual and surface inspection of valve seats, disks, and stems and verifying no unacceptable flaws or excessive corrosion. If unacceptable flaws or excessive corrosion are found, all other valves of that type shall be inspected. unless the nature of the problem can be directly attributed to a service condition specific to that valve

*Specification not applicable with all main steam isolation valves and associated bypass valves in the closed position and all other steam flow paths to the turbine isolated

Proposed Wording

3/4.3.3.8 ACCIDENT MONITORING INSTRUMENTATION

The OPERABILITY of the accident monitoring instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables during and following an accident. This capability is consistent with the recommendations of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Plants to Assess Plant Conditions During and Following an Accident," December 1975 and NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations."

3/4.3.3.9 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures of ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

3/4.3.3.10 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also includes provisions for monitoring (and controlling) the concentrations of potentially explosive gas mixtures in the waste gas holdup system. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

3/4.3.4 TURBINE OVERSPEED PROTECTION

This specification is provided to ensure that the turbine overspeed protection instrumentation and the turbine speed control valves are OPERABLE and will protect the turbine from excessive overspeed. Protection from turbine excessive overspeed is required since excessive overspeed of the turbine could generate potentially damaging missiles which could impact and damage safety related components, equipment or structures.

INFO ONLY

ATTACHMENT B

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 16
Revision of Technical Specification 3.3.4
TURBINE OVERSPEED PROTECTION

A. DESCRIPTION OF AMENDMENT REQUEST

The proposed amendment would revise Turbine Overspeed Protection requirements. Action statements and surveillance requirements related to operability and testing of low pressure turbine reheat stop and interceptor valves would be deleted.

An editorial change is proposed for Action statement a and Surveillance 4.3.4.2.a.1. In both statements, "stop valve" would be revised to read "throttle valve."

Surveillance requirement 4.3.4.2.d would be clarified by adding the following wording to the end of the last sentence: " . . . unless the nature of the problem can be directly attributed to a service condition specific to that valve."

B. BACKGROUND

Operating experience and the performance of Technical Specification surveillances have disclosed no significant problems relating to the proper operation of the overspeed protection system. However, turbine control valve testing results in thermal and pressure transients. Testing has been found to cause turbine component damage, and could result in the generation of turbine missiles. In addition, a destructive turbine overspeed condition could arise independently of whether reheat stop and intercept valves are closed or not.

Maintenance History

A review of the computerized maintenance history for Unit 1 did not reveal a single case of valve stem sticking. Unit 2 is credited with a similar (although shorter) turbine control valve maintenance history.

Three occasions of throttle valve sticking did occur during the initial startup at Unit 2. In each case the valve was opened after having been closed and the sticking occurred during reclosure. The valves closed satisfactorily after allowing a soak period of 15 to 30 minutes. There have been no sticking problems encountered when testing the valves and no incidents of valve sticking have occurred while the units were carrying load.

Testing Causes Turbine Component Damage

Turbine component damage has been linked to control valve testing. Control valve testing causes unusual steam flow distribution patterns, steam pressure changes, and load disturbances that result in component damage.

Specific component damage and causal factors are described in two Nuclear Engineering Department Reports entitled: "Reported Turbine Component Damage at BVPS Unit 1 Related to Conduct of Operational Surveillance Test 1.26.1 [Turbine Control Valve Test],"(1) and "Beaver Valley Power Station No. 1 and 2 Moisture Separator-Reheater Report."(2) The reports are included in this submittal as Attachments E and F. A summary of the report findings and related operational experience follows.

Each valve test (throttle, governor, reheat stop, and interceptor) was reviewed separately to determine how steam flows are redistributed, what pressure drop and velocity changes are occurring, and what forces are resulting. Historically, the equipment damage has been disguised because it is the cumulative effect of repeated testing and not the result of a single test. The effects of reheat stop valve and interceptor valve testing are described below.

Reheat stop and interceptor valve testing results in high flow rates through cross-under piping, moisture separator-reheaters, and cross-over piping. The high steam flow rates and resulting pressure drops have resulted in erosion of the piping and damage to moisture separator-reheater (MSR) internals.

A study of Unit 1 turbine cycle erosion was completed in January of 1987. The study concluded that the 36 inch cross-under piping will not last 40 years, and that sections of the pipe such as elbows and tees will require replacement at 30 years of operating life. The study also concluded that any increase in the testing of reheat-stop valves from the present frequency would reduce the operating life of the 36 inch cross-under and 42 inch cross-over piping.

The following description of Unit 1 MSR damage was extracted from Attachment E:

> During the Unit 1 sixth refueling outage, two types of damage were discovered in the MSRs. The first type of damage was the failure of the reheat steam inlet hemi-head partition plate. The hemi-head partition plate isolates the top half of the U-tube bundle from the bottom half. Integrity of the hemi-head partition plate is necessary to ensure proper reheat steam flow.

The second type of damage was the failure of shell side closure plates. The integrity of the closure plates is required to direct turbine cycle steam through the chevron type moisture separating sections of the MSR without leaking around the reheater.

The failure of the hemi-head partition plate was due to an increase in the tube side (partition plate) pressure drop. Partition plate pressure drop increases as steam velocity through the U-tubes of the reheater increases.

Steam flow through the first pass tubes increases as (1) first pass tubes are plugged, (2) with the addition of the vent condenser modification or (3) during reheat stop and interceptor valve testing.

During reheat stop and interceptor valve testing, the cycle steam flow to one MSR is shut off and diverted mostly to the opposite side MSR. This results in significantly higher shell side (cycle steam) flow rates and corresponding pressure drops. These pressure drops overstress the shell side closure plates.

Simultaneously, the heat transfer across the three active tube bundles is increased due to higher shell side flow and this causes additional reheat steam to be cooled in the tubes. Increased cooling in the tubes results in larger tube side pressure drops.

The increased pressure difference across the partition plates plus the added pressure imbalance during valve testing are the prime causes of the partition plate failures. The cumulative effects from reheat stop and interceptor valve testing are considered the primary cause of the shell side closure plate damage.

A shell side closure plate failure created fragments that were carried into the cross-over pipe and through the reheat stop and interceptor valves. Some fragments came to rest in the turning vanes at the inlet to the low pressure turbine. Fortunately, the fragments did not appear to have damaged any low pressure turbine blades.

The Unit 1 MSR hemi-head partition plates were replaced with a thicker plate and reinforced with two ribs on the top side. Additional plates were installed to reinforce the top closure plates in the center two compartments of each MSR.

Unit 2 cross-under and cross-over piping and MSRs are susceptible to the same type of damage experienced at Unit 1 based on the similarity in design of the two units.

The erosion of cross-under and cross-over piping, and the MSR damage discussed above provide strong evidence of the damaging system transients associated with reheat stop and interceptor valve testing.

<u>Low Pressure Turbine Valve Testing
Could Result In Turbine Missiles</u>

Testing of the reheat stop and interceptor valves could damage the MSR internals and cause parts of the MSR to break away. The fragments could enter the turbine and cause turbine blade damage or cause missiles to leave the turbine and damage safety related equipment.

The turbine overspeed protection specification is provided to ensure that the turbine is protected from excessive overspeed. Protection from excessive overspeed is required since excessive overspeed of the turbine could generate potentially damaging missiles that could impact and damage safety related components, equipment, or structures. Thus reheat stop and interceptor valve testing could generate missiles and result in damage to the very equipment that it was intended to protect.

<u>Destructive Turbine Overspeed Could Arise
Independent Of Whether Reheat Stop And
Interceptor Valves Are Closed Or Not</u>

The NRC approved Westinghouse topical report entitled "Analysis of the Probability of a Nuclear Turbine Reaching Destructive Overspeed,"[3] states the following:

> "The specifications of the reheat stop valves and interceptor valves are irrelevant to the present study, as the destructive overspeed condition arises independent of whether these valves are closed or not."
>
> and
>
> "Since the destructive overspeed condition can occur only if the main steam inlet is not closed, one needs to consider only the governor valves and throttle valves, and that is why the reheat stop valves and interceptor valves do not appear in the fault tree diagram."

Therefore, operability of the reheat stop and interceptor valves is not critical to preventing a destructive turbine overspeed event. It is the high pressure turbine governor and throttle valves that are critical to stopping steam flow to the turbine and thereby preventing a destructive overspeed condition.

Inspection And Testing Of Low Pressure
Turbine Control Valves

The reheat stop and interceptor control valves will continue to be inspected periodically in accordance with the vendor's recommendations, as stated in Unit 2 Updated Safety Analysis Report Section 10.2.3.5. Proper operation of these valves will continue to be verified during startup through Operating Manual Chapter 52, Procedure 4A, "Increasing Power From 5% Reactor Power & Turbine On Turning Gear To Full Load Operation." This procedure requires that an operator be stationed in the vicinity of the governor, interceptor, and reheat stop valves to observe that the valves close freely (no hesitation) when the turbine is tripped as part of the procedure.

C. JUSTIFICATION

Elimination of Operability and Testing Requirements
For The Reheat Stop And Interceptor Valves

The following paragraphs summarize the background information provided above and is offered as justification for eliminating reheat stop and interceptor valve testing.

Operating experience and the performance of Technical Specification surveillances have disclosed no significant problems relating to the proper operation of the overspeed protection system. No incidents of valve stem sticking have occurred while the Units were carrying load.

Testing has been found to cause turbine component damage. In particular, erosion of piping and damage to moisture separator-reheater internals.

Low pressure turbine control valve testing could result in the generation of turbine missiles. Fragments from damaged MSR internals have been found in the turning vanes at the inlet to the low pressure turbine. If fragments were to enter the turbine, the possibility of missile generation is increased.

In addition, a destructive turbine overspeed condition could arise independently of whether reheat stop and intercept valves are closed or not. Thus, it is the high pressure turbine control valves that are critical to stopping steam flow to the turbine and thereby preventing a destructive overspeed condition.

The reheat stop and interceptor valves will continue to be inspected in accordance with the vendor's recommendations. Proper operation of the valves will be verified during each plant startup.

<u>Change "stop valve"
To Read "throttle valve"</u>

In Action a and Surveillance 4.3.4.2.a.1, "stop valve" would be revised to read "throttle valve." This change would make the wording consistent with the terminology used in the manufacturers literature and plant documents.

<u>Clarification of Requirement to Inspect
All Valves When A Problem Is Found</u>

Surveillance requirement 4.3.4.2.d would be clarified to require, if unacceptable flaws or excessive corrosion are found, an inspection of all other valves of that type <u>unless the nature of the problem can be directly attributed to a service condition specific to that valve</u>. This clarification is intended to eliminate unnecessary inspections.

D. SAFETY ANALYSIS

The turbine overspeed protection specification is provided to ensure that the turbine is protected from destructive overspeed. Protection from excessive overspeed is required since excessive overspeed of the turbine could generate potentially damaging missiles that could impact and damage safety related components, equipment, or structures.

As stated in the BACKGROUND discussion above, operating experience and Technical Specification surveillances have disclosed no significant problems relating to the proper operation of the turbine overspeed protection system.

Operability requirements for the high pressure turbine throttle and governor valves ensure that these valves will be available to stop the steam supply to the turbine when necessary and thereby protect the turbine from reaching destructive overspeed. Periodic cycling of these valves (as required by Technical Specification surveillance 4.3.4.2) verifies their operability.

With the proposed change, sufficient surveillance requirements will continue to exist to ensure operability of the high pressure turbine throttle and governor valves. Therefore, this change will not affect the capability to stop the steam supply to the turbine for overspeed protection and will not reduce the safety of the plant.

Conversely, continued testing of the reheat stop and interceptor valves will reduce the safety of the plant. Continued testing of the reheat stop and interceptor valves will result in transients and damage to turbine components.

E. NO SIGNIFICANT HAZARDS EVALUATION

The no significant hazards considerations involved with the proposed amendment have been evaluated, focusing on the three standards set forth in 10 CFR 50.92(c) as quoted below:

> The commission may determine, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards consideration, if operation of the facility according to the proposed amendment would not:
>
> (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
>
> (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or
>
> (3) Involve a significant reduction in a margin of safety.

The following evaluation is provided for the no significant hazards consideration standards.

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

   The previously evaluated accident of interest is a destructive turbine overspeed event. Operability requirements for the high pressure turbine throttle and governor valves ensure that these valves will be available to stop the steam supply to the turbine when necessary and thereby protect the turbine from reaching destructive overspeed. Periodic cycling of these valves (as required by Technical Specification surveillance 4.3.4.2) verifies their operability.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

The high pressure turbine control valves will continue to provide turbine overspeed protection in the same manner. Turbine overspeed protection prevents the turbine from reaching a destructive overspeed, and producing missiles that could damage safety related systems structures or components.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the change involve a significant reduction in a margin of safety?

Sufficient surveillance requirements will continue to exist to ensure the operability of the turbine throttle and governor valves. This change will not affect the capability of these valves to stop steam flow to the high pressure turbine and prevent a turbine overspeed event.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the considerations expressed above, it is concluded that the activities associated with this license amendment request satisfies the no significant hazards consideration standards of 10 CFR 50.92(c). Accordingly, a no significant hazards consideration finding is justified.

G. ENVIRONMENTAL EVALUATION

The proposed changes have been evaluated and it has been determined that the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed changes is not required.

H. UPDATED FINAL SAFETY ANALYSIS REPORT CHANGES

Changes to the Unit 2 UFSAR are provided in Attachment D. UFSAR Section 10.2 will be revised after the Technical Specification changes discussed in this submittal are approved.

Background Information

Two electronic turbine overspeed trips were originally provided. The first trip circuit includes a speed pickup at the turbine stub shaft and provides a signal to the emergency trip cabinet at 111.5 percent turbine overspeed. This trip circuit does not have provisions for on-line testing without tripping the turbine.

The second trip circuit includes a speed pickup at the turning gear and provides a signal to the overspeed trip chassis within the emergency trip cabinet. This trip circuit would initiate a turbine trip at 111 percent turbine overspeed and provides for on-line testing without tripping the turbine. However, the trip circuit was found to be unreliable due to an undetermined source of "noise" that interferes with the signal going to the overspeed trip chassis. This trip was initially disabled and later removed by DCP 1152.[4]

UFSAR Change Description

Page 10.2-5 will be revised to delete reference to complete on-line testability since the 111 percent trip has been removed.

Page 10.2-7 will be revised to describe the 111.5 percent turbine overspeed trip instead of the removed 111 percent trip.

Page 10.2-8 will be revised to indicate that high pressure turbine valves are exercised according to Technical Specifications. Reference to the testing of reheat stop and interceptor valves will be deleted. The sentence that describes testing of mechanical and backup turbine overspeed trips also will be revised. Reference to the removed backup turbine overspeed trip will be deleted. This sentence also will be revised to indicate that a mechanical overspeed trip test is performed during start-up.

Page 10.2-13 will be revised to indicate that functional testing of the high pressure turbine steam inlet valves will be performed according to Technical Specifications. Reference to the testing of reheat stop and interceptor valves will be deleted.

Table 10.2-1, Item 7, "Turbine overspeed trip (111 percent of rated speed)," will be revised to read: "Turbine overspeed trip (111.5 percent of rated speed)."

I. REFERENCES

1. S.T. Deahna, and F.A. Beldecos, "Reported Turbine Component Damage at BVPS Unit 1 Related to Conduct of Operational Surveillance Test 1.26.1 [Turbine Control Valve Test]," August 26,1988. This report is included as Attachment E to the submittal.

2. S.T. Deahna, "Beaver Valley Power Station No. 1 and 2 Moisture Separator-Reheater Report," August 23,1988. This report is included as Attachment F to the submittal.

3. Westinghouse Topical Report, "Analysis of the Probability of a Nuclear Turbine Reaching Destructive Overspeed," WSTG-3-NP-A, Pages 3 and 7, July 1987. This report is included as Attachment G to the submittal.

4. Design Change Package (DCP) 1152, "Turbine Trip System Modification." A summary of the safety evaluation for this DCP was submitted to the NRC in accordance with 10 CFR 50.59 as part of the 1989 Report of Facility Changes, Tests and Experiments, pages 75 and 76, (May 23, 1990).

ATTACHMENT C

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 2A-16

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INSTRUMENTATION

TURBINE OVERSPEED PROTECTION

LIMITING CONDITION FOR OPERATION

3.3.4 At least one Turbine Overspeed Protection System shall be OPERABLE.

APPLICABILITY: MODES 1, 2*, and 3*.

ACTION:

a. With one throttle valve or one governor valve per steam line inoperable, restore the inoperable valve(s) to OPERABLE status within 72 hours, or close at least one valve in the affected steam line(s) or isolate the turbine from the steam supply within the next 6 hours.

b. With the above required Turbine Overspeed Protection System otherwise inoperable, within 6 hours isolate the turbine from the steam supply.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.4.1 The provisions of Specification 4.0.4 are not applicable.

4.3.4.2 The above required Turbine Overspeed Protection System shall be demonstrated OPERABLE:

a. At least once per 31 days by cycling each of the following valves through at least one complete cycle from the running position:

1) Four high pressure turbine throttle valves,
2) Four high pressure turbine governor valves.

b. At least once per 31 days by direct observation of the movement of each of the above valves through one complete cycle from the running position,

c. At least once per 18 months by performing a CHANNEL CALIBRATION on the Turbine Overspeed Protection Systems, and

d. At least once per 40 months by disassembling at least one of each of the above valves and performing a visual and surface inspection of valve seats, disks, and stems and verifying no unacceptable flaws or excessive corrosion. If unacceptable flaws or excessive corrosion are found, all other valves of that type shall be inspected unless the nature of the problem can be directly attributed to a service condition specific to that valve.

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*Specification not applicable with all main steam isolation valves and associated bypass valves in the closed position and all other steam flow paths to the turbine isolated.

ATTACHMENT D

UPDATED FINAL SAFETY ANALYSIS REPORT

SECTION 10.2 CHANGES

The control of the reactor and TG is accomplished from the main control room, which contains all instrumentation and control equipment required. The control system allows BVPS-2 to accept step load increases of 10 percent and ramp load increases of 5 percent/min over a load range of 15 to 100 percent power. Below 70 percent full power, the unit can accept a turbine trip without initiating a reactor trip. Turbine bypass and atmospheric steam dump capacity permits 85 to 100 percent external load rejection without a turbine or reactor trip. The control of the reactor with turbine is covered more fully in Section 7.7. The turbine bypass system's capability is covered more fully in Section 10.4.4.

The Westinghouse analog EHC system and electro-mechanical trip system include three separate speed sensors, mounted on the turbine stub shaft located in the turbine front pedestal as follows:

1. Mechanical overspeed trip weight (spring-loaded),
2. Electro-magnetic pickup for main speed governing channel, and
3. Electro-magnetic pickup for overspeed protection control channel. (This pickup uses the same toothed wheel as item 2.)

10.2.2.1.2 Turbine Trip System

The electro-hydraulic emergency trip system consists of an emergency trip block, three test blocks mounted on the governor pedestal, a cabinet containing all the electrical and electronic hardware, a remote trip test panel, and main control board-mounted trip pushbuttons for manual tripping. The emergency trip system offers a redundant overspeed protection (Section 10.2.2.1.3) via electro-hydraulic and mechanically-actuated systems, an auto stop trip (AST) system which monitors various TG parameters, an overspeed protection controller (OPC) which monitors turbine speed and load, and a mechanical overspeed trip weight. The system also offers ~~complete on-line testability,~~ provisions for detection and diagnosis of failed devices, and provisions for inservice maintenance and inspection. |

Under normal conditions, the AST solenoid valves and the interface diaphram valve are closed, blocking the path to drain off the auto-stop emergency trip header fluid. The pressure in the trip header line keeps the dump valves associated with each steam valve closed. Upon collapse of this pressure, the dump valve will unseat, causing the throttle valves, governor valves, intercept valves, and reheat stop valves to close in approximately 150 milliseconds.

The AST solenoid valves are separated into two channels, with two valves per channel, which are kept energized from separate relay trains in the emergency trip system cabinet. If a trip contingency pressure on the diaphram of the interface diaphram valve. This drains the AST header pressure and closes all the throttle, governor, reheat stop and intercept valves.

The electro-hydraulic overspeed trip utilizes a speed pickup mounted ~~adjacent to a gear at the turning gear~~ at the turbine stub shaft. When the speed sensor indicates ~~111~~ 111.5 percent of rated speed, the relay logic in the electro-hydraulic control cabinet and emergency trip cabinet will be such that all four AST solenoid valves will open and trip the turbine.

The throttle and governor valves and the stop and intercept valves are arranged in a redundant fashion such that failure of one valve will not cause or prevent a turbine trip.

The extraction steam lines to the first through fifth point heaters contain nonreturn valves which are used to protect the turbine from a reverse flow. Each nonreturn valve is a swing check valve with a side-closing, spring-loaded cylinder. During normal operation, air pressure compresses this spring so the disc can swing freely. Upon receipt of a low AST header pressure signal or if the AST fluid-operated air pilot valve is vented (turbine tripped), the cylinder air pressure is released and the spring provides a rapid and positive closure of the check valve to prevent the fluid inventory in the down-stream heater from flashing and entering the turbine and providing energy to accelerate the turbine. The sixth point heaters have no nonreturn valves because there is a low inventory of fluid in these heaters so that overspeeding the turbine due to flashing in the heater is prevented.

A rupture of a hydraulic line will cause a turbine trip. A single failure of any component will not lead to destructive overspeed. A multiple failure, including combinations of undetected electronic faults, mechanically stuck valves, and hydraulic fluid contamination, at the instant of load loss would be required to reach destructive overspeed. The probability of such joint occurrences is extremely low due to the high design reliability of components and frequent inservice testing.

The effects of turbine missiles on safety-related systems or components is not required to be analyzed because the probability of generating a turbine missile is acceptably low, as described in Section [illegible].3.

10.2.2.2 Turbine Gland Sealing System

The TG is sealed using labyrinth type shaft seals. The seal system is supplied with steam at 150 psig from the auxiliary steam system or 125 psig steam from the main steam system. Auxiliary steam is used during start-up and when main steam becomes available, the auxiliary steam supply is isolated.

The steam to the high pressure glands is maintained at 5 psig. Steam to the low pressure glands is maintained at 1 psig. Any excess steam is bypassed to the condenser through a spillover valve. The turbine gland sealing system is described more fully in Section 10.4.3.

10.2.2.3 Inspection and Testing Requirements

high pressure turbine throttle and governor valves
The ~~main turbine stop and control valves and the combined intercept and intermediate stop valves~~ are exercised ~~monthly~~ in accordance with ~~Westinghouse recommendations~~ to detect possible valve stem sticking. The valves are closed and then reopened during this procedure. Mechanical ~~and backup~~ overspeed trip tests are performed ~~periodically while carrying load, without tripping the unit, by using special test provisions~~.
Technical Specifications
during startup

10.2.2.4 Generator

The generator is sized to accept the output of the turbine. The generator is equipped with an excitation system, hydrogen control system (HCS), and a seal oil system. The generator terminals are connected to the main step up transformer and unit station service transformers through the isolated phase generator leads.

The air-cooled generator excitation system controls the voltage of the generator. The HCS includes pressure regulators, condition monitor for detection of thermally produced particulate, purity monitor for recording changes in gas density, temperature pressure transmitters, liquid detector, and water-cooled gas coolers. A circuit to supply and control the CO_2 is used during filling and purging operations to avoid explosive gas mixtures. A hydrogen seal oil system (Figure 10.2-9) prevents hydrogen leakage or air inleakage through the generator shaft seals. This system includes pumps, controls, and a storage tank, and degasifies the oil before it is returned to the shaft seals.

10.2.2.5 Generator Hydrogen

The HCS is used to cool both the rotor and stator. The rating of the generator is a function of the hydrogen pressure which is normally 75 psig. The system includes pressure regulators for control of the hydrogen gas, and a circuit for supplying and controlling the carbon dioxide used in purging the generator during filling and degassing operations. To prevent hydrogen leakage through the generator shaft seals, a hydrogen seal oil system is provided. This system, which includes pumps, controls, and a storage tank, deaerates the oil before it is sent to the shaft seals. The hydrogen control system appears on Figure 10.2-10.

Hydrogen is manually fed to the generator to maintain design pressure. A normally closed automatic shutoff valve, provided at the bulk storage facility, is operable from the local hydrogen control panel. The bulk storage facility also supplies hydrogen to the

The ISI program for throttle, governor, reheat stop and interceptor valves is in accordance with vendor recommendation of 15, 27, and 39 months after initial start-up of a turbine. In this program, some valves are inspected 12 to 15 months after start-up, others 24 to 27 months, and the remainder 36 to 39 months so that all valves are inspected at least once in the 39 months of operation following initial start-up. Throttle and reheat stop valves are inspected twice in this period. After this initial inspection program is completed, valves will be inspected periodically in accordance with Westinghouse recommendations.

The functional test of the turbine steam inlet valves will be performed ~~monthly~~ in accordance with Technical Specifications. This test can be made while the unit is carrying load. The purpose of the test is to ensure proper operation of the throttle, and governor~~, reheat stop, and interceptor~~ valves. The operation of these valves will be observed during the test by an operator stationed at the valves. Movements of the valves should be smooth and free. Jerky or intermittent motion may indicate a buildup of deposits on shafts.

10.2.3.6 High Temperature Properties

The operating temperatures of the high pressure rotors in turbines operating with light-water-reactors are below the creep rupture range. Creep rupture is, therefore, not considered to be a factor in assuring rotor integrity over the lifetime of the turbines.

10.2.4 Safety Evaluation

Beaver Valley Power Station - Unit 2 is a pressurized water reactor. As such, during normal operation the concentration of radioactive contaminants is minimal and no shielding is required for the TG, thus permitting unlimited access. There is no QA Category I equipment in the turbine building, thus, rupturing of the connection joints between the low pressure casing and the condenser will not adversely affect any QA Category I equipment.

The turbine stop and control valves and reheat stop and intercept valves are arranged such that failure of any one valve will not cause an overspeed event.

10.2.5 References for Section 10.2

Westinghouse Electric Corporation 1971. Scientific Paper. 71-1E7-MSLRF-P1. MSTG-1P.

TABLE 10.2-1

TURBINE TRIP SIGNALS

1. Low turbine bearing oil pressure,
2. Low vacuum in either condenser,
3. Low electro-hydraulic fluid pressure,
4. Loss of 110 V dc electrical power to EHC system,
5. Excessive wear (axial movement) of the turbine thrust bearings in either direction,
6. Electrical protection trip (generator),
7. Turbine overspeed trip (~~111~~ 111.5 percent of rated speed),
8. Turbine anti-motoring (generator is in motoring mode, turbine is anti-motoring), or
9. External trips:
   a. Reactor trip,
   b. Feedwater isolation, or
   c. Manual trip.