Title :	**Reconstruction of Steam Generators Super Emergency Feadwater Supply System (SHNČ) and Steam Dump Stations to the Atmosphere System (PSA)**
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Abstract :	*Steam Generators Super Emergency Feadwater Supply System (SHNČ) and Steam Dump Stations to the Atmosphere System (PSA) are two systems which cooperate to remove residual heat from reactor core after seismic event.* *SHNÈ assure feeding of the secondary site of steam generator (Feed) where after heat removal from primary loops, is relieted to the atmosphere by PSA (Bleed) in form of steam.*

1. Purpose and System Criteria

The residual heat removal via secondary side can be considered as first step inside of the safety concept of PWR's. So a strong function of secondary feed and bleed can play an important role for prevention and mitigation of severe accidents.
As part of the gradual safety upgrading of Bohunice V 1 the safety function "secondary feed and bleed" is improved based on the UJD SR decision 1/94 by
- upgrading of the super emergency feedwater system (SHN - superhavarijne napajanie -) and
- installation of new steam dump stations to atmosphere (PSA - prepúštacia stanica do atmosféry -) for each main steam line.

This upgrading supplement the existing safety systems and not replace any of it. The defence in depth concept is extended by this upgrading.

The system has to meet the following criteria:

- the system is consists of two **independent subsystems** with physical, electrical and fire separation

- **unlimited time period** (using external sources for water make-up after 72 hours)

-functional performance of the system is demonstrated **under extreme external temperatures** (severe frost, high temperatures)

-the system is **operable during and following seismic event**

2. Status after the reconstruction

2.1 Steam Generators Super Emergency Feadwater Supply System (SHNČ) - Secondary Feed

The configuration of the systems for secondary feed is given in Fig. 1.

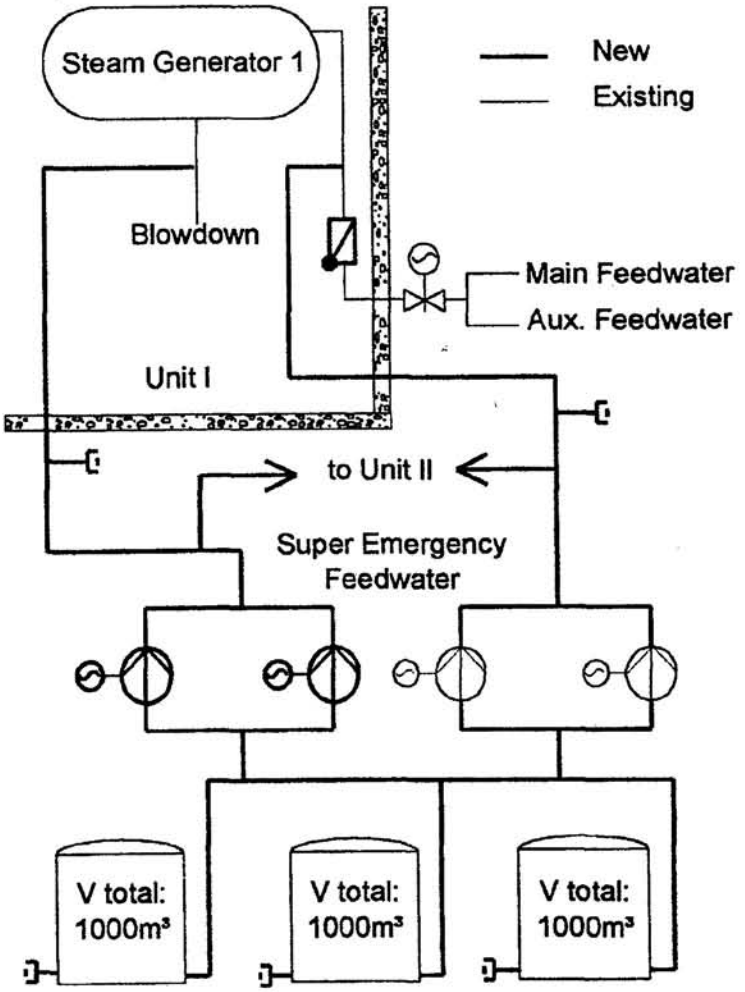

Fig.1 : Configuration of Systems for Secondary Feed

The super emergency feedwater system assures feeding of the steam generators to remove core decay heat and subsequent plant cooldown in the event of unavailability of the main and auxiliary feedwater systems. It is a common system for both units I and II.

The existing system is extended from two pumps to four pumps which can be shared between the two units. All system parts are rearranged to form two independent subsystems with a sufficient degree of physical, electrical and fire separation and resistance to flooding and earthquake. The pipes are led exclusively through seismically resistant rooms, protected against the consequences of high energy pipe breaks inside the turbine hall. The two subsystems is routed separately one to the feedwater lines the other to the blowdown lines of each steam generator in both units.

Each subsystem contains two pumps, one electrical assigned to unit I, the other one to unit II. Even after a failure of one subsystem one pump of each unit remains available.

Each demineralized water tank has a secured water content of 620 m3, at a total volume of 1000 m3. This secured water inventory guarantee residual heat removal for at least 72 hours after plant shutdown. To guarantee the exclusively usage of this secured content by the super emergency feedwater pumps, all nozzles of operational pipes at the tanks are connected higher than this volume. This assures that even in the event of a leakage in operational pipes the secured water content will not be touched. At each tank is a connection for refilling of the water storage from external sources.

For beyond design basis accidents connections for a water supply from backup sources to each super emergency feedwater discharge line is provided.
An additional check valve in each main feedwater line had been installed inside of the hermetic zone. This reduces possible steam generator dryout due to leakages in the feedwater pipes outside of the hermetic zone.

2.2 Steam Dump Stations to the Atmosphere System (PSA) - Secondary Bleed

The configuration of the systems for secondary bleed is given in Fig. 2.

The new main steam dump station (PSA) provides a controlled steam relief to atmosphere in cases of unavailability

- of the turbine bypass station PSK and the steam relief control valves to atmosphere connected with the main steam header or
- after actuation (closure) of the main steam line isolation valves.

One main steam dump station is installed in each main steam line outside of the hermetic zone upstream of the main steam isolation valve. Each station consists of one steam dump isolation valve and, downstream, one steam dump control valve. The stations are designed to withstand seismic loads, fluiddinamic loads induced by pipe breaks, loads during operation with two phase flow and elevated ambient conditions like temperature and humidity.

The main steam dump isolation valves is automatically open at main steam pressure higher than 5.3 MPa (gauge). At 5.3 MPa in 2 of 6 steam generators reactor trip is initiated. Additionally these valves can be opened and closed by manual commands.

The main steam dump control valves are operated by an automatic pressure controller. The controller is released at a main steam pressure higher than 5.3 MPa with a setpoint of 5.0 MPa (gauge).

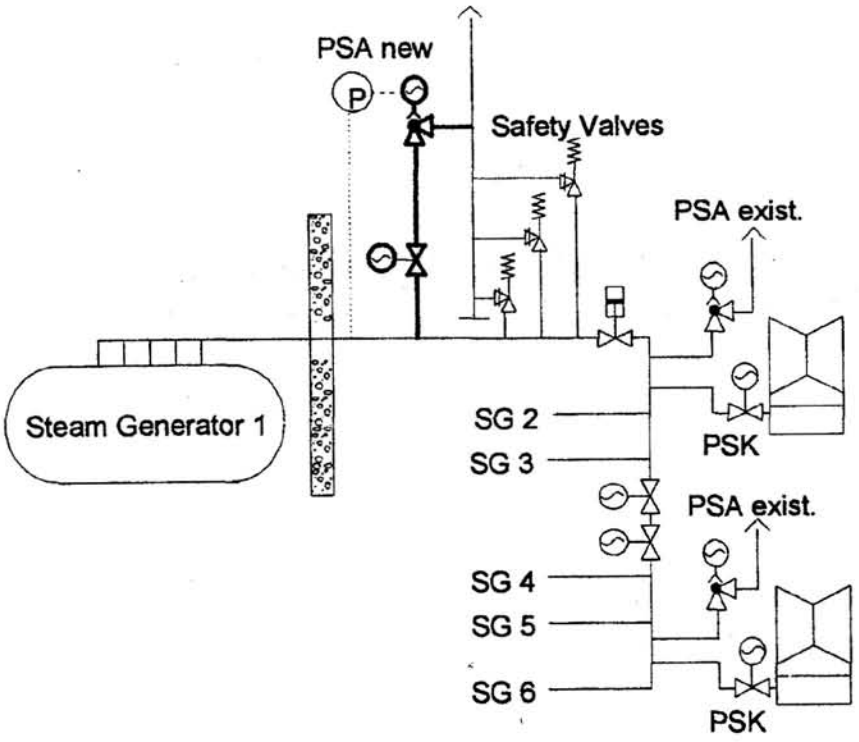

Fig. 2: Configuration of the Systems for Secondary Bleed

The automatic pressure control can be switched into enable the steam generator pressure to be reduced for plant cooldown under manual control.
The pressure signals necessary to control the main steam dump valves are derived from the RPS pressure instrumentation in the associated steam lines.
The setpoint for the new steam dump control valves was fixed at 5.0 MPa between the setpoint of the existing steam relief valves (PSA) and the response pressure of the first main steam safety valve of 5.45 MPa.

2.3 Electrical Power Supply and Control Concept

All electrical consumers of the super emergency feedwater system and the valves of the steam dump stations are connected to the seismically qualified emergency power diesel supply of the associated unit and train.

Additionally a third electrical grid connection from the hydro electric power plant of Madunice had been installed during the reconstruction activities, which can be connected whithin approx. 30 min. The electrical capacity of Madunice is sufficient for supplying all required safety related consumers including super emergency feedwater system and the new steam dump stations.

The feeding valves of the super emergency feedwater system and the steam dump valves assigned to one steam generator are supplied from the same electrical train.

The super emergency feedwater system and the main steam dump valves can be commanded either from the main control room or from the emergency control room.

At normal plant operation the commands are given in the main control room. During accident conditions with unavailability of the main control room it is possible to switch over the command to the emergency control room. This switch over can be done manually; the switch is located in the emergency control room.