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Nuclear Regulatory Authority of the Slovak Republic

National Action Plan Review Workshop

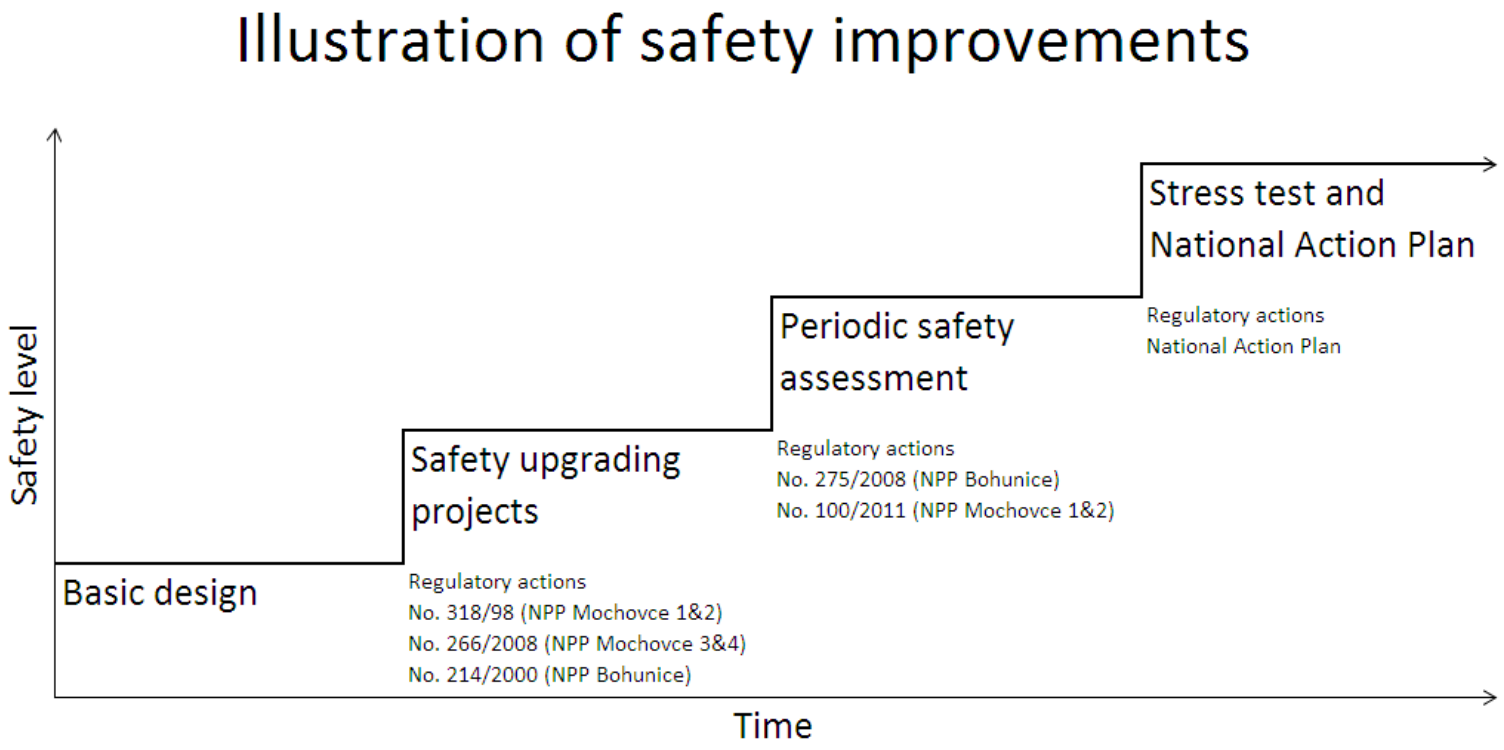
Brussels, April 2015

Nuclear power plants in Slovakia

Safety improvement activities

- Program of modernization and safety improvement of NPP Bohunice 3&4 (2002 - 2008)
- Result of periodic safety review (PSR) of NPP Bohunice 3&4 and Mochovce 1&2 (started 2008 resp. 2011)
- Management of severe accidents at all NPPs (started 2008)
- Fukushima actions already started

Safety improvement activities



The 2013 workshop main findings

- The correspondence between measures planned pre-Fukushima and post-Fukushima does not become entirely clear from the NAcP; however, some explanations have been provided at the Workshop.
- It is a complex task to integrate these two. It should also be appreciated that a number of safety improvements was initiated long before the Fukushima accident, and the Stress Tests only confirmed that the right decisions had been taken.
- Good practices could be identified in the NAcP, in particular:

- use of Periodic Safety Reviews to identify improvement measures,
- implementation of in vessel retention strategy is an important activity,
- application of a return frequency of 10-4/year for extreme weather events.

WENRA reference levels

- Full harmonisation of national regulations with 2008 Reference Levels achieved
- EU regulators made a commitment to harmonise their regulatory framework with 2014 RL by 2017
- A revised/new Atomic Act is under preparation to implement Directive 2014/87/EURATOM and WENRA 2014 RL
- New Atomic Act is expected to be in force by the end of 2016

Implementing schedule NAcP

The measures, from which several have been already implemented, are divided into the following groups:

- Short-term – to be finished by 2013
- Medium-term – to be finished by 2015
- Additional measures, which may result from analyses defined by medium-term measures, will be implemented after 2015

Some measures has been implemented immediately after the Fukushima accident in compliance with WANO SOER 2011 - 2, 3, 4.

Some of the measures related to SAM approved in the past have been rescheduled/accelerated in comparison with the original schedule.

At present the analyses are completed and the results are analyzed. A time schedule of potential actions will be proposed by the operator and agreed with the regulator.

Example of the structure of the updated NAcP (in progress)

ID	Source	Recommendation	Fulfilment of recommendation	EBO3&4	EMO1&2	MO34
41.	ENSREG Compilation of recommendations 3.3.5	SAMG verification	To analyse the SAM project from the viewpoint of severe accident management at multi units (all) at the same site (fuel situated in the reactor core and in the spent fuel pool); to modify the SAM project, if needed, so that sufficient measures can be implemented. To prepare a plan of implementation of additional measures for extension of the SAM project to improve the severe accident manageability at its simultaneous occurrence in all units at the same site. Status: The analysis of severe accident management at all units on the site (including reactors at full power, reactors in shutdown and spent fuel pool) has been prepared (Report No. CVV 12/2014-01 "Management of Severe Accidents on All Units on Site"). The licensee performed a self-assessment on the implementation of severe accident management /9/ and /10/ as well and the plan of implementation of additional measures is an integral part of respective documents. *Comm.: The analyses has been completed and at present evaluated by the licensee. The plan of implementation of measures is dependent on the evaluation of the analyses results. dependent on the evaluation of the analyses results.	Analysis and plan of implementation of additional measures by 31/12/2014 *Completed	Analysis and plan of implementation of additional measures by 31/12/2014 *Completed	Analysis and plan of implementation of additional measures by 31/12/2014

Example of the structure of the updated NAcP (before deadline)

ID	Source	Recommendation	Fulfilment of recommendation	EBO3&4	EMO1&2	MO34
33.	ENSREG Compilation of recommendations 3.2.16	Equipment inspection and training programmes	To prepare operating regulations and to implement training programmes for operators of diversity mobile devices. Status: New procedures for activities developed and implemented: 3,4-LPS-001/O60: Activities after Earthquake 3,4-LPS-001/O63: Unit Cool down after MDBE, 3-3,4LPS-001/O64: Activities of OP at Flooding of structures 3,4-LPS-001/O65: Strong wind in SE-EBO locality 3,4-LPS-001/O66: Loss of service water supply in PS Pecenady 0HP/3001 Loss of external power supply, 0HP/3002 Loss of raw water supply, 0HP/3003 Back-up water make-up 0HP/3004 Transport of employees for non-standard and calamity situations, 0HP/3005 External and internal floods, 1TP/6009 Cool down after seismic event 0HP3006:Measures against extreme climatic conditions The procedures are exercised and operators are trained in compliance with the emergency drill plan (e.g. emergency drill in October 2014 at EBO). Training programmes for the diverse mobile devices were prepared implemented and through exercises tested at EBO and EMO.	31/12/2015 Completed	31/12/2015 Completed	Before put of the respective unit into operation

Monitoring of implementation

- Annual inspection plans (2012. 2013, 2014, 2015) of UJD were approved which contains inspection activities to monitor the progress of implementation of safety measures related to the Action Plan
- If any deficiency found during an inspection ÚJD SR can impose measures to remove the deficiencies including binding deadlines for their fulfillment or sanctions.

Q & A for 2015

The Slovakia received **89** questions.

The questions focused mainly on:

- Responses to external/natural hazards
- Hydrogen management
- Filtered Venting
- In Vessel Retention strategy
- Status of implementation of SAM project

Written Answers to Questions are available.

Q & A for 2015 - Responses to external/natural hazards

***Q:** Design requirements of mDG buildings, can they survive severe external hazards with low return frequencies? (42; 53; 65; 81)*

A: Specification for mDG0,4kV shelters requires qualification for extreme external events with low return frequencies 10-4.

Q & A for 2015 - Responses to external/natural hazards

- **Q: 1) Relevant combinations of hazards would be considered? (25)**

- **A: *1. Yes, permanent load due the structure self weight and relevant combination of accidental load due to wind load, snow cover and temperature were considered (UNI ENV 1991-1). An evaluation of the Safety Margin for the extreme weather conditions, has been performed considering separately the extreme snow load and the extreme wind load.***

Q & A for 2015 - Responses to external/natural hazards

- **Q: Results of assessment of impacts of extreme meteorological events on safety and reliability of civil structures? Are there any improvement measures envisaged? (4; 12; 64; 80)**
- **A: *Immediate/short term measures were already implemented in 2011 at both NPP sites (reported during 2013 workshop) It is planned to implement additional barriers against water intrusion from outside, reinforcement of structures of roofs of buildings against wind and snow loads.***

Q & A for 2015 - Responses to external/natural hazards

- **Q: Impact of extreme external temperatures in selected NPP rooms after loss of cooling? Needs/measures to improve equipment cooling robustness? (56; 70; 86)**

- ***A: Analysis of temperature changes in the rooms of Main Reactor building, under conditions of SBO were performed . Measures limiting heat flux (e.g. load shedding, it means operational procedures disconnecting some not necessary I&C part, etc) will be applied. The SAM DG6kV or mDG0,4kV can be used for restoration of cooling capacity during SBO.***

Q & A for 2015 - Seismic upgrading

- **Q: What are the plans for Seismic assessments?(1; 3; 62; 79)**
  A:Seismic parameters sites were examined in detail by an IAEA mission (EBO November 1998, EMO in 1999-2003).
  In the frame of surveillance of seismic activity monitoring is carried out in line with the recommendations of the IAEA safety guide 50-SG-S1 (Rev. 1).Seismic parameters are considered as valid for the site EBO and EMO also at present. PSR does not include a full re-assessment of seismic hazard.
- **Q: Results of seismic margins analyzes? (5; 61; 78)**
  A: ***Seismic margin of civil structures of Main Reactor Building are from 20% to 30%. Seismic evaluation for additional seismically qualified equipment was performed and the appropriate measures were implemented by the end of 2008.***

Q & A for 2015 - Seismic upgrading

Q: Planned seismic reinforcement for units? (49; 60; 61; 77)

A:The priority 1 buildings with the devices important for long-term removal of residual heat after seismic events deadline is 2015 :

Building of Plant Fire Brigade,

Connection points for Mobile high pressure source of SG feedwater,

Super emergency feed water pipes,

Buildings with connection points for external source of SG feed water

Other SSC will be seismically reinforced by 2018.

Q & A for 2015 - Seismic upgrading

Q: Can the mDG shelters survive earthquake? (42; 53; 65; 81; 85)

A: Specification for mDG0,4kV shelters requires qualification for the beyond design seismicity with low return frequencies 10-4.

Mobile units will be classified according to NS-G-1.6 in seismic class 1.

Q & A for 2015 - Hydrogen management

- **Q*:* Presence of hydrogen in unexpected places? Installation of additional PARs or other measures? (15; 3; 62; 79 72; 88)**
- ***A: There are some progress reports available. However, taking into account project schedules, currently there are no outputs available in the meaning of outcomes. The purpose of this analytical project is to extend current knowledge about hydrogen migration outside containment. At this time, it is preliminary neither to specify potential mitigation measures nor to provide the extent.***

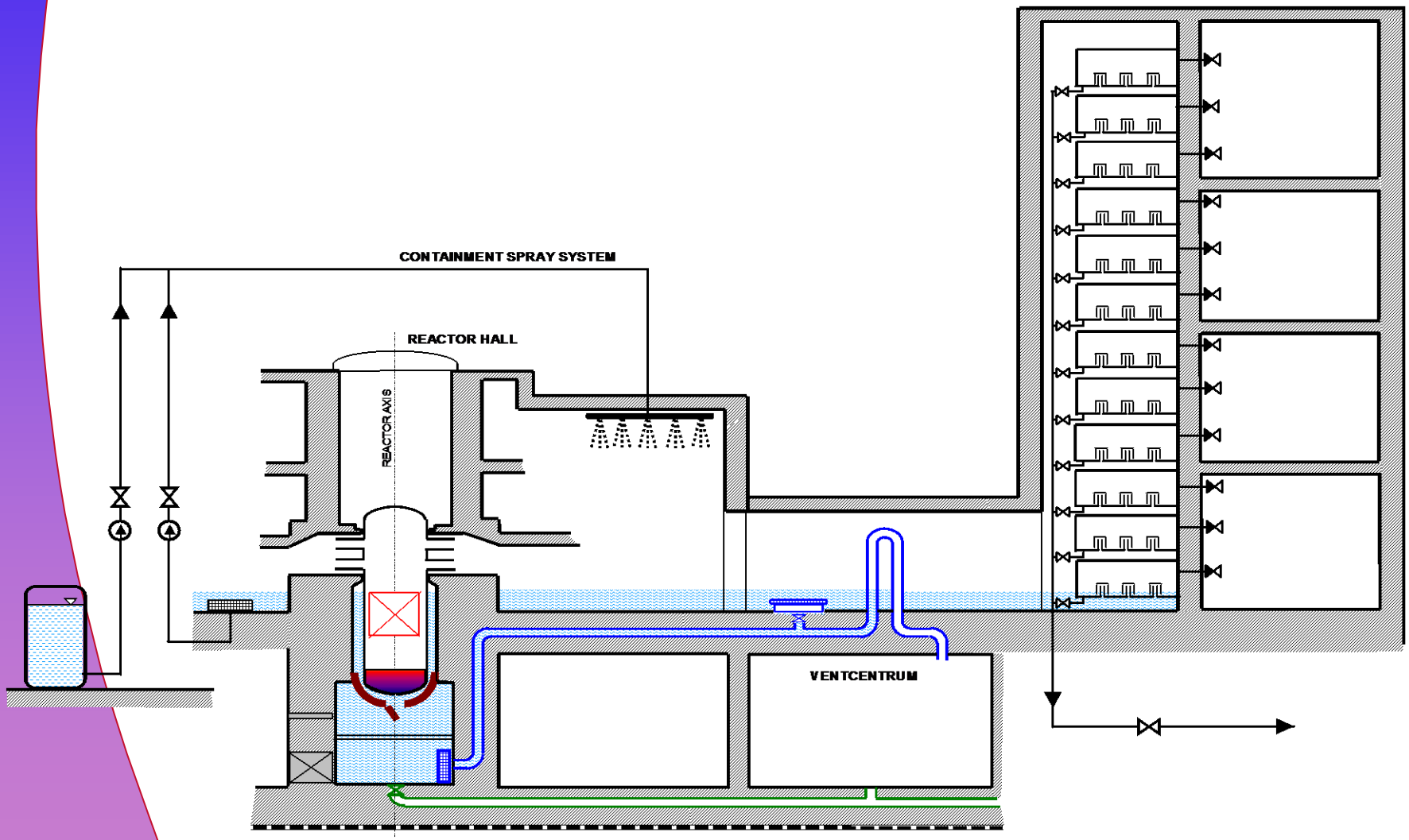
Q & A for 2015 - Filtered Venting

- **Q: Are there any alternative solutions analyzed in case the filtered venting would be found as unfeasible mean for containment long term heat removal?**

  Is there a tendency in favor or against the implementation of a filtered venting system? (26; 68; 84)

- **A:** ***Based on the analyses conducted under PHARE framework with Westinghouse as well as based on additional analytical studies developed during SAM project implementation, is that filtered venting should not be used as a mean for containment long term heat removal. The reassessment of the outputs of PHARE project is ongoing to support previous conclusions taking into account detailed design of implemented HW modifications.***

IVR strategy - „SIPHON“ AND REACTOR CAVITY FLOODING



Q & A for 2015 - In Vessel Retention strategy

Q: Consequences of IVR failure and the preservation of containment integrity in case of a severe accident (10; 19; 73; 89)

A: ***The In-Vessel Retention capability is based on providing the sufficient coolant volume for flooding of the reactor cavity and to remove the heat produced in the corium and to ensure the localization and stabilization of corium inside the RPV.***

Significant experiments were performed on CERES facility in Hungary. SAMGs consider the injection of coolant into the reactor cavity as one of top priority actions. During SAM project implementation the SAMGs have been updated and additional HW measures have been implemented into the NPP designs to implement the IVR strategy to a high degree of confidence during SA (Redundancy –SFC 2x100%).

Q & A for 2015 - In Vessel Retention strategy

On top of this, additional contingency measures are included in SAMG strategies to maintain flooded cavity configuration even in the case of containment bypass scenarios.

The flooded cavity configuration is considered essential to provide for mitigation of IVR failure minimizing the risk of reactor cavity door/ basement concrete penetration due to core melt/debris attack or the containment overpressurization due to MCCI.

Additional analyses have been performed to support this hypothesis in the frame of current PSA L2 update after SAM project implementation.

Q & A for 2015 - In Vessel Retention strategy

Q: Why did you decide to replace the seals at the reactor pressure vessel cavity lids and doors? (44)

A: Additional HW modifications performed include:

- installation of valves to the ventilation system of reactor cavity to allow for water intake to the cavity

- installation of fine mesh sieve to clean the water

- sealing of all cavity penetrations to the surrounding compartments and upgrade of sealing of cavity door

- reactor neutron and thermal shielding modification to allow for water inflow to the reactor pressure vessel external surface itself

- modification of reactor thermal shielding in the area of RPV nozzles to allow the steam release to the containment.

Q & A for 2015 - Status of implementation of SAM project

SAM Project implementation		Status as of 4/2015
Title of subproject SAM	Bohunice 3/4	Mochovce 1/2
Reactor Cavity Flooding	2010/2010	2011/2012
PC Depressurization	2011/2012	2015/2015
Containment Hydrogen Management	2011/2012	2013/2013
Containment Vacuum Breaker	2011/2012	2015/2015
Alternative Coolant System	2013/2013	2015/2015
Alternative Power Supply System	2013/2013	2015/2015
I & C – PAMS, Control	2013/2013	2015/2015
Containment Long Term Heat Removal	2013/2013	2015/2015

Fully Implemented

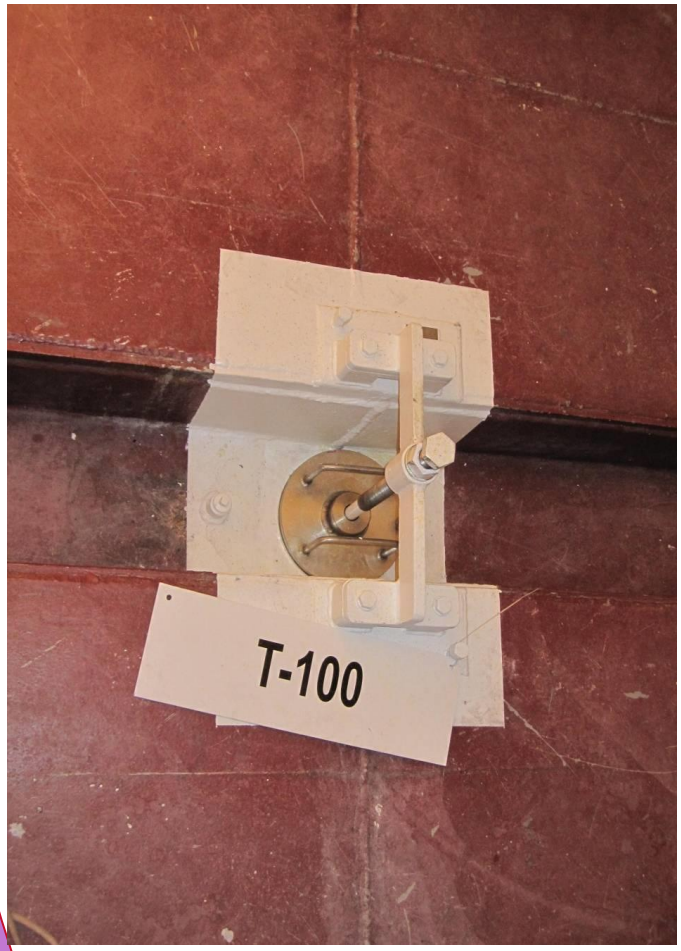
Partly Implemented

Examples of measures implemented

„SIPHON“ of REACTOR CAVITY FLOODING and fine mesh sieve

Bottom part of reactor shielding with floaters for outside cooling of RPV

Plugging of reactor cavity drainage system and modified door sealing



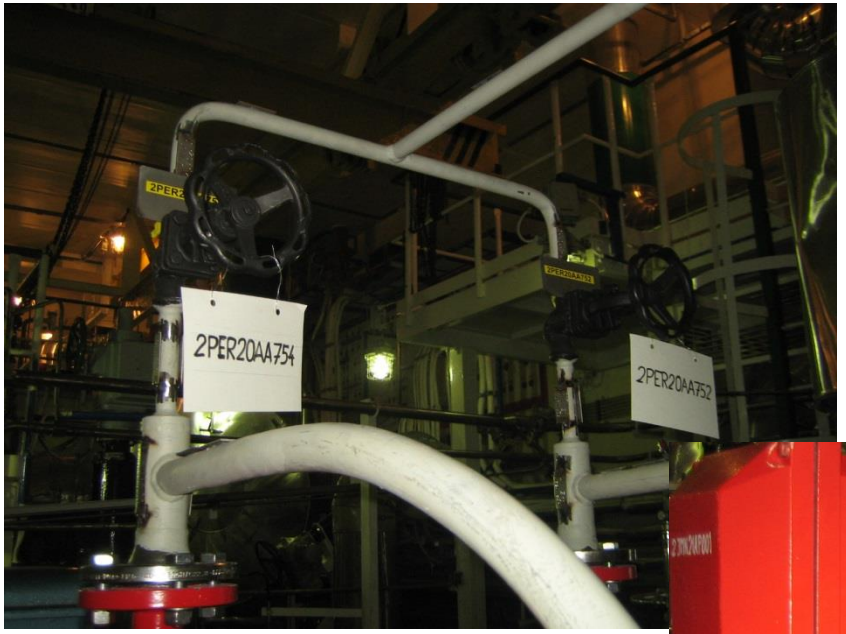
Primary Circuit Depressurization

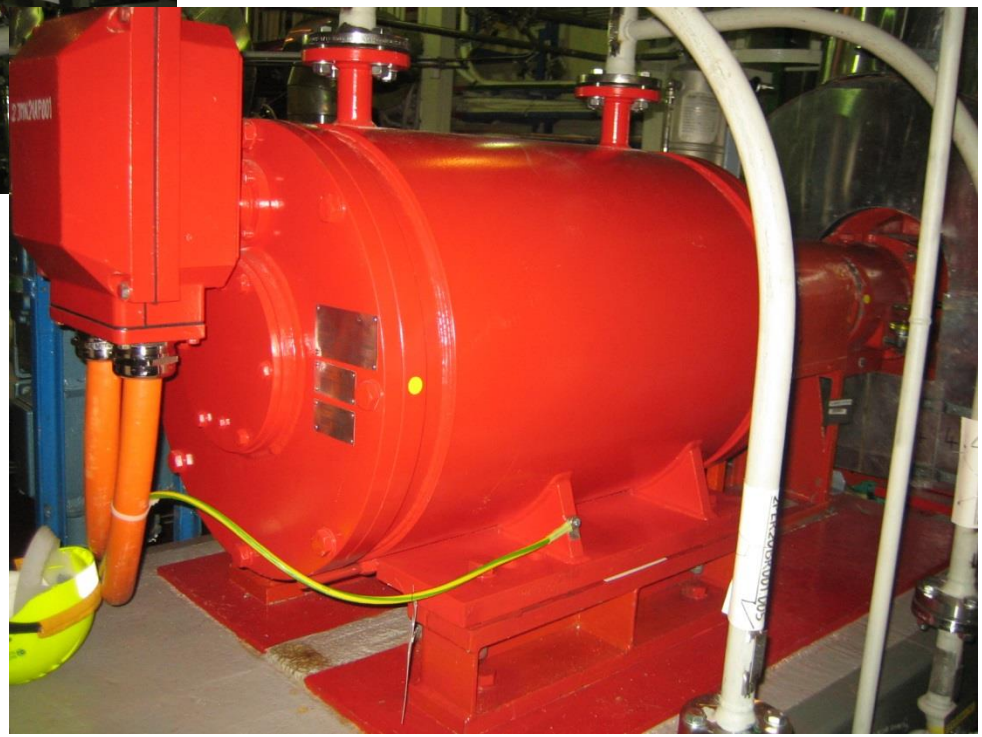
Installation of passive autocatalytic hydrogen recombiners

Alternative Power supply system

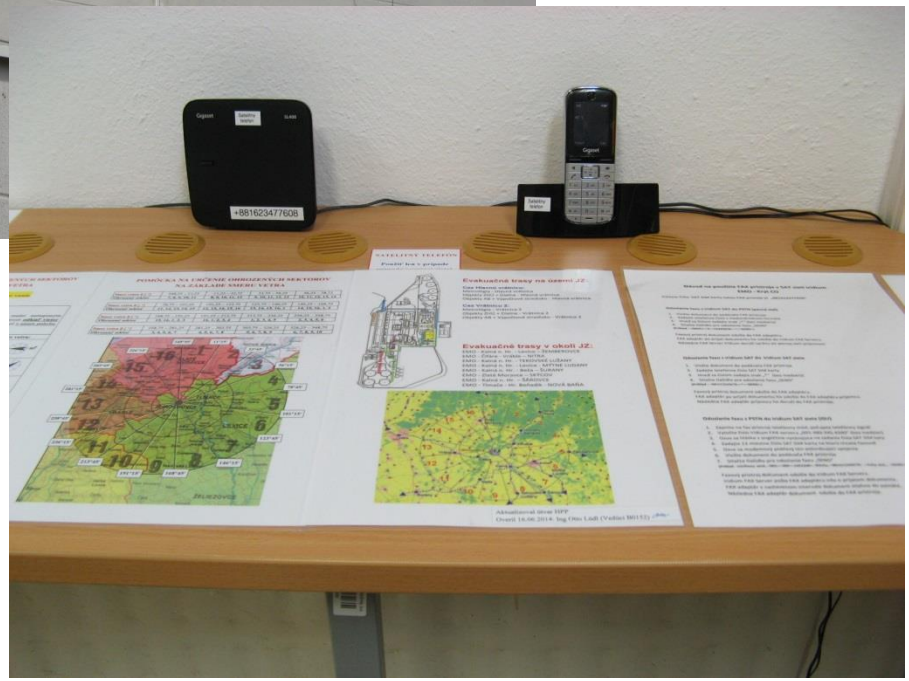
INFORMATION SOURCES I&C - PAMS AND CONTROL

Long term heat removal

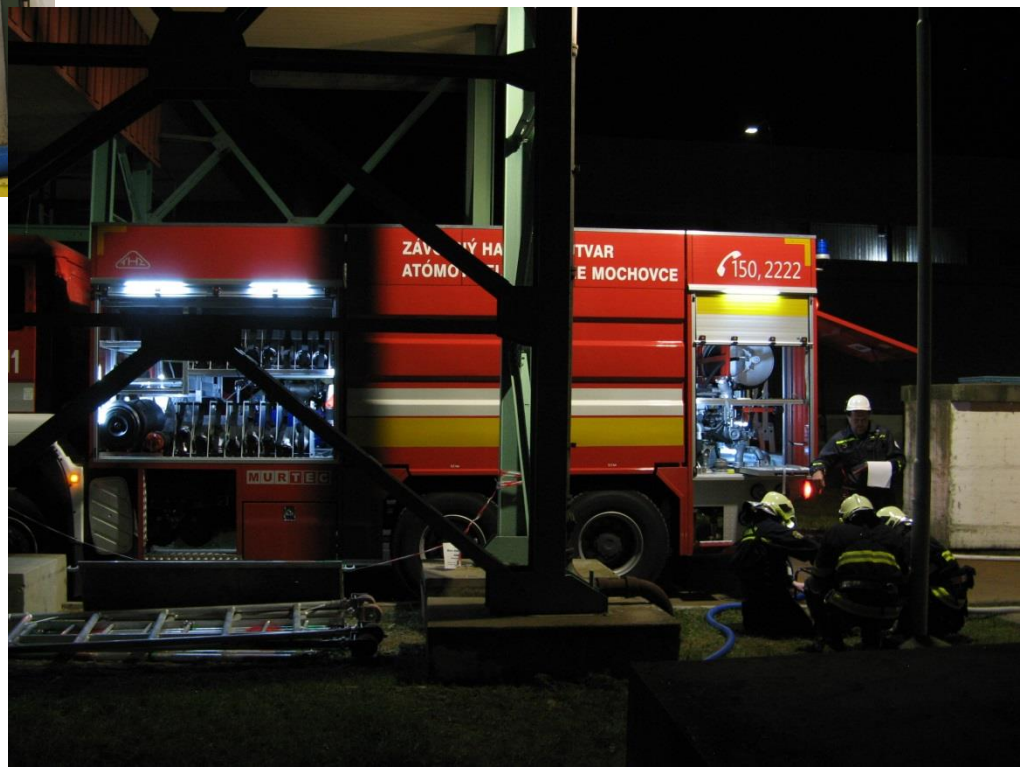




Satellite connection



SG Feeding with the use of Fire Truck – day & night exercise



Thank you for your attention