Stress Test Report

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1 Introduction

Referenced documents should be classified into:

D1 validated in the licensing process → ENSI has delivered its review comments;

D2 not validated in the licensing process but gone through licensee's quality assurance program;

D3 none of the above.

2 Methodology adopted

3 hazard levels:

H1 hazard against which the plant was originally designed,

H2 hazard against which the plant has been requalified, (possibly H2 = H1)

H3 new seismic hazard results according to the studies for the renewed deterministic demonstration of protection against seismic events
new flooding hazard results according to the studies for the renewed deterministic demonstration of protection against flooding events

H2 seismic hazard should correspond to the values currently in the safety analysis report and should be used when DBE is mentioned in the stress test reports. H2 should be used for the discussion of the safety margins beyond the design basis.

H3 seismic hazard should be used in the discussion of adequacy of the design basis.

3 General data about site/plant

3.1 Brief description of the site characteristics

- location (sea, river)
- number of units;
- license holder

3.2 Main characteristics of the unit

- reactor type;
- thermal power;
- date of first criticality;
- existing spent fuel storage (or shared storage).

3.3 Systems for providing or supporting main safety functions

In this chapter, all relevant systems should be identified and described, whether they are classified and accordingly qualified as safety systems, or designed for normal operation and classified to non-nuclear safety category. The systems description should include also fixed hook-up points for transportable external power or water supply systems that are planned to be used as last resort during emergencies.

3.3.1 Reactivity control

Systems that are planned to ensure sub-criticality of the reactor core in all shutdown conditions, and sub-criticality of spent fuel in all potential storage conditions. Report should give a thorough understanding of available means to ensure that there is adequate amount of boron or other respective neutron absorber in the coolant in all circumstances, also including the situations after a severe damage of the reactor or the spent fuel.

3.3.2 Heat transfer from reactor to the ultimate heat sink

a) All existing heat transfer means / chains from the reactor to the primary heat sink (e.g., sea water) and to the secondary heat sinks (e.g., atmosphere or district heating system) in different reactor shutdown conditions: hot shutdown, cooling from hot to cold shutdown, cold shutdown with closed primary circuit, and cold shutdown with open primary circuit.

b) Lay out information on the heat transfer chains: routing of redundant and diverse heat transfer piping and location of the main equipment. Physical protection of equipment from the internal and external threats.

c) Possible time constraints for availability of different heat transfer chains, and possibilities to extend the respective times by external measures (e.g., running out of a water storage and possibilities to refill this storage).

d) AC power sources and batteries that could provide the necessary power to each chain (e.g., for driving of pumps and valves, for controlling the systems operation).

e) Need and method of cooling equipment that belong to a certain heat transfer chain; special emphasis should be given to verifying true diversity of alternative heat transfer chains (e.g., air cooling, cooling with water from separate sources, potential constraints for providing respective coolant).

3.3.3 Heat transfer from spent fuel pools to the ultimate heat sink

a) All existing heat transfer means / chains from the spent fuel pools to the primary heat sink (e.g., sea water) and to the secondary heat sinks (e.g., atmosphere or district heating system).

b) Respective information on lay out, physical protection, time constraints of use, power sources, and cooling of equipment as explained under 3.3.2

3.3.4 Heat transfer from the reactor containment to the ultimate heat sink

a) All existing heat transfer means / chains from the containment to the primary heat sink (e.g., sea water) and to the secondary heat sinks (e.g., atmosphere or district heating system).

b) Respective information on lay out, physical protection, time constraints of use, power sources, and cooling of equipment as explained under 3.3.2.

3.3.5 AC power supply

3.3.5.1 Off-site power supply

a) Information on reliability of off-site power supply: historical data at least from power cuts and their durations during the plant lifetime.

b) Connections of the plant with external power grids: transmission line and potential earth cable routings with their connection points, physical protection, and design against internal and external hazards.

3.3.5.2 Power distribution inside the plant

a) Main cable routings and power distribution switchboards.

b) Lay-out, location, and physical protection against internal and external hazards.

3.3.5.3 Main ordinary on-site source for back-up power supply

a) On-site sources that serve as first back-up if offsite power is lost.

b) Redundancy, separation of redundant sources by structures or distance, and their physical protection against internal and external hazards.

c) Time constraints for availability of these sources and external measures to extend the time of use (e.g., fuel tank capacity).

3.3.5.4 Diverse permanently installed on-site sources for back-up power supply

a) All diverse sources that can be used for the same tasks as the main back-up sources, or for more limited dedicated purposes (e.g., for decay heat removal from reactor when the primary system is intact, for operation of systems that protect containment integrity after core meltdown).

b) Respective information on location, physical protection and time constraints as explained under 3.3.5.3.

3.3.5.5 Other power sources that are planned and kept in preparedness for use as last resort means to prevent a serious accident damaging reactor or spent fuel

a) Potential dedicated connections to neighbouring units or to nearby other power plants.

b) Possibilities to hook-up transportable power sources to supply certain safety systems.

c) Information on each power source: power capacity, voltage level and other relevant constraints.

d) Preparedness to take the source in use: need for special personnel, procedures and training, connection time, contract arrangements if not in ownership of the Licensee, vulnerability of source and its connection to external hazards and weather conditions.

3.3.6 Batteries for DC power supply

a) Description of separate battery banks that could be used to supply safety relevant consumers: capacity and time to exhaust batteries in different operational situations.

b) Consumers served by each battery bank: driving of valve motors, control systems, measuring devices, etc.

c) Physical location and separation of battery banks and their protection from internal and external hazards.

d) Alternative possibilities for recharging each battery bank.

3.4 Significant differences between units

This chapter is relevant only for sites with multiple NPP units of similar type.
In case some site has units of completely different design (e.g., PWR's and BWR's or plants of different generation), design information of each unit is presented separately.

3.5 Scope and main results of the plant specific Probabilistic Safety Assessment

The presentation of the scope and main results of the plant specific PSA should include:

- description of the scope of the PSA (for reactor, spent fuel storage) concerning
    - initiating events
    - level of PSA
    - operational mode
- presentation of the main results according to
    - ENSI-A05/d, Page 37, Table 1
    - General statement concerning LERF (SLERF) with respect to the IAEA recommendations
- When possible, for the H2 seismic hazard as well as for the H3 seismic hazard

4 Earthquake assessment

4.1 Design basis

H2 unless otherwise indicated

4.1.1 Earthquake against which the plant is designed

a) Level of the design basis earthquake (DBE) expressed in terms of peak ground acceleration (PGA) and reasons for the choice. Also indicate the DBE taken into account in the original licensing basis if different;

b) Methodology to evaluate the DBE (return period, past events considered and reasons for choice, margins added…), validity of data in time;

c) Conclusion on the adequacy of the design basis. H2/H3

Switzerland has state-of-the-art studies of the seismic hazards for the NPP sites (PEGASOS project).
The PEGASOS results show that the hazards have been underestimated in the past.
An update of PEGASOS is under way (PEGASOS refinement project, PRP).
(PEGASOS results were applied in the Swiss seismic PSAs)
The Swiss regulator has required the deterministic demonstration of protection against earthquakes with the new hazards by March 31st, 2012.

4.1.2 Provisions to protect the plant against the DBE

a) Identification of the key structures, systems and components (SSCs) which are needed for achieving safe shutdown state and are supposed to remain available after the earthquake;

Safe shutdown state = to be defined in the intermediate report (plant specific)

b) Main operating provisions (including emergency operating procedure, mobile equipment…) to prevent reactor core or spent fuel damage after the earthquake;

Core damage = same definition as in PSA

c) Discussion of the indirect effects of the earthquake that need to be taken into account, including:

1. Failure of SSCs that are not designed to withstand the DBE and that, in loosing their integrity could cause a consequential damage of SSCs that need to remain available (e.g. leaks or ruptures of non seismic pipework on the site or in the buildings as sources of flooding and their potential consequences);
2. Loss of external power supply;
3. Situation outside the plant, including preventing or delaying access of personnel and equipment to the site.

4.1.3 Plant compliance with its current licensing basis

a) Licensee's general process to ensure compliance (e.g. , periodic maintenance, inspections, testing);

b) Licensee' process to ensure that off-site mobile equipment/supplies considered in emergency procedures are available and remain fit for duty;

c) Any known deviation, and consequences of these deviations in terms of safety; planning of remediation actions;

d) Specific compliance check already initiated by the licensee following Fukushima NPP accident.

4.2 Evaluation of the margins

H2 unless otherwise indicated

4.2.1 Range of earthquake severity above which loss of fundamental safety functions or severe damage to the fuel (core or fuel storage) becomes unavoidable

4.2.1.1 Reactor

Based on available information (which could include seismic PSA, seismic margin assessment or other seismic engineering studies to support engineering judgement)

Indicate which are the weak points and specify any cliff edge effects according to earthquake severity.

Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions…).

The methodology to evaluate the seismic margins of the plant with respect to seismic events is performed by using for all relevant structures, systems and components (SSC) the seismic fragilities of the seismic PSA as they exist today. The fragility for each SSC includes a median capacity, which represents the acceleration at which there is a 50% probability for failure. In addition the fragility includes a HCLPF capacity (high confidence of low probability of failure), at which there is a 95% confidence that failure is lower than 5%. For accelerations lower than the HCLPF value, seismic failure of the relevant SSC can be realistically excluded.

To determine the plant median capacity and the plant HCLPF value, the different safety trains of the plant are considered. From each safety train, the structure, system or component with the lowest capacity determines the capacity of the train. Among the different safety trains, the one with the highest capacity determines the plant capacity. This evaluation is done for the median capacity as well as for the HCLPF capacity.

4.2.1.2 Spent fuel pool

The methodology to evaluate the seismic margins is performed analog to chapter 4.2.1.1.

4.2.2 Range of earthquake severity the plant can withstand without losing confinement integrity

Based on available information (which could include seismic PSA, seismic margin assessment or other seismic engineering studies to support engineering judgement)

a) Description of the safety factors considered for the design of safety-relevant components and structures

b) Evaluation of the range of earthquake severity (in terms of peak ground acceleration, PGA) that the safety-relevant components and structures can withstand, according to deterministic approaches

c) Evaluation of the range of earthquake severity (in terms of peak ground acceleration, PGA) that the safety-relevant components and structures can withstand, according to the fragility analysis

4.2.3 Earthquake exceeding DBE and consequent flooding exceeding DBF

a) Indicate whether, taking into account plant location and plant design, such situation can be physically possible. To this aim, identify in particular if severe damages to structures that are outside or inside the plant (such as dams, dikes, plant buildings and structures) could have an impact of plant safety.

b) Indicate which are the weak points and failure modes leading to unsafe plant conditions and specify any cliff edge effects. Identify which buildings and equipment will be impacted.

c) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions…).

5 Flooding assessment

5.1 Design basis

H2 unless otherwise indicated

5.1.1 Flooding against which the plant is designed

a) Level of the design basis flood (DBF) and reasons for choice. Also indicate the DBF taken into account in the original licensing basis if different;

b) Methodology to evaluate the DBF (return period, past events considered and reasons for choice, margins added…). Sources of flooding (tsunami, tidal, storm surge, breaking of dam…), validity of data in time;

c) Conclusion on the adequacy of the design basis. H3

5.1.2 Provisions to protect the plant against the DBF

a) Identification of the key SSCs which are needed for achieving safe shutdown state and are supposed to remain available after the flooding, including:

   1. Provisions to maintain the water intake function;
   2. Provisions to maintain emergency electrical power supply;

b) Identification of the main design provisions to protect the site against flooding (platform level, dike…) and the associated surveillance programme if any;

c) Main operating provisions (including emergency operating procedure, mobile equipment, flood monitoring, alerting systems…) to warn of, then to mitigate the effects of the flooding, and the associated surveillance programme if any;

d) Discussion of other effects linked to the flooding itself or to the phenomena that originated the flooding (such as very bad weather conditions) that need to be taken into account, including:

   1. Loss of external power supply;
   2. Situation outside the plant, including preventing or delaying access of personnel and equipment to the site.

5.1.3 Plant compliance with its current licensing basis

a) Licensee's general process to ensure compliance (e.g. , periodic maintenance, inspections, testing);

b) Licensee' process to ensure that off-site mobile equipment/supplies considered in emergency procedures are available and remain fit for duty;

c) Any known deviation, and consequences of these deviations in terms of safety; planning of remediation actions;

d) Specific compliance check already initiated by the licensee following Fukushima NPP accident.

5.2 Evaluation of the margins

H3

5.2.1 Level of flooding that the plant can withstand without severe fuel damage

Based on available information (including engineering studies to support engineering judgement)

core or fuel storage.

Safety margins should always be quantified via flood heights and if possible via the corresponding flow rates.

a) Evaluation of the safety margins

1. Describe up to which level buildings containing safety relevant equipment are able to withstand flooding (considering all relevant operational states as well as reactor and the spent fuel pool).
2. State up to which level a river flow with an exceedance frequency of 10^{-4} per year (according to the H3 hazard) will flood the site and compare this level with the original design.
3. State if the plant is designed against flooding caused by degradation or failure of a hydro-engineering facility. If so, state the expected resulting flood level and compare to the original design.

b) Identification of weak points

Evaluate weak points considering:

1. Which buildings will be flooded first
2. Which safety relevant equipments will be flooded first
3. Cliff edge effects:
   - State whether a substantial increase in river flow as compared to the flow with initiating event frequency of $\geq 10^{-4}$ per year will exceed the design limit of the plant
   - State whether a complete failure or multiple failures of hydro-engineering facilities (dams/weirs/barrages) will lead to severe fuel damage.
   - State whether a complete jam of the river by log / debris or a complete jam[1] followed by the instantaneous failure of the jam will lead to severe fuel damage.
   - Indicate if a single failure of a component (independent of the external flood) leads to a loss of a fundamental safety functions. No passive component with proven high quality has to be assumed as a single failure.

c) Provisions

Using the results under point b) indicate if any provisions (modifications of hardware, modification of procedures, organisational provisions) have been or can be envisaged to increase the robustness of the plant Consider in particular the time between warning and flooding as well as possibly identified cliff edge effects which might be prevented.

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1 An acceptable criterion for excluding with certainty debris flow blockages is described in „Technischer Bericht zur Gefahrenkarte Hochwasser, Aare Villigen – Klingnau“ of the Departement Bau, Verkehr und Umwelt of canton Aargau (December 2010) http://www.ag.ch/raumentwicklung/de/pub/themen/gefahrenkarte/originaldokumente.php/rails/dropdown/template/11_gefahrenkarte_hochwasser/show/213.

6 Extreme weather conditions

6.1 Design basis

6.1.1 Reassessment of weather conditions used as design basis

a) Verification of weather conditions that were used as design basis for various plant systems, structures and components: maximum temperature, minimum temperature, various type of storms, heavy rainfall, high winds, etc.

b) Postulation of proper specifications for extreme weather conditions if not included in the original design basis (see Guideline ENSI-A05).

c) Assessment of the expected frequency of the originally postulated or the redefined design basis conditions.

d) Consideration of potential combination of weather conditions.

6.2 Evaluation of safety margins

6.2.1 Estimation of safety margin against extreme weather conditions

a) Analysis of potential impact of different extreme weather conditions to the reliable operation of the safety systems, which are essential for heat transfer from the reactor and the spent fuel to ultimate heat sink.

b) Estimation of difference between the design basis conditions and the cliff edge type limits, i.e. limits that would seriously challenge the reliability of heat transfer.

6.2.2 Potential need to increase robustness of the plant against extreme weather conditions

Consideration of measures, which could be envisaged to increase plant robustness against extreme weather conditions and would enhance plant safety.

7 Loss of electrical power

Electrical AC power sources are:

- off-site power sources (electrical grid);
- plant generator;
- ordinary back-up generators (diesel generator, gas turbine...);
- in some cases other diverse back-up sources.

Sequential loss of these sources has to be considered (see 7.1 and 7.2 below).

All offsite electric power supply to the site is lost. The offsite power should be assumed to be lost for several days. The site is isolated from delivery of heavy material for 72 hours by road, rail or waterways. Portable light equipment can arrive to the site from other locations after the first 24 hours.

The external storage facility in Reitnau can be discussed for its operability within the first 24 hours (D1 or D2).

7.1 Loss of off-site power (LOOP)

a) Describe how this situation is taken into account in the design and describe which internal backup power sources are designed to cope with this situation.

LOOP = loss of external grid.

All available means including island mode, hydropower, Notstromdiesel, Notstanddiesel, Batterien should be addressed to describe the available level of redundancy

b) Indicate for how long the on-site power sources can operate without any external support.

c) Specify which provisions are needed to prolong the time of on-site power supply (refueling of diesel generators...).

d) Indicate any envisaged provisions to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions...).

For clarity, systems such as steam driven pumps, systems with stored energy in gas tanks etc. are considered to function as long as they are not dependent of the electric power sources assumed to be lost and if they are designed to withstand the initiating event (e.g. earthquake)

7.2 Loss of off-site power and of on-site backup power sources (SBO-Categories)

7.2.1 LOOP + Loss of the ordinary back-up source (SBO)

LOOP AND Loss of island mode AND Loss of Hydropower AND Loss of Notstromdiesel

a) Provide information on the battery capacity and duration.

b) Provide information on design provisions for these situations.

c) Indicate for how long the site can withstand a SBO without any external support before severe damage to the fuel becomes unavoidable.

d) Specify which (external) actions are foreseen to prevent fuel degradation:

   1. Equipment already present on site, e.g. equipment from another reactor;

2. Equipment available off-site, assuming that all reactors on the same site are equally damaged;
3. Near-by power stations (e.g. hydropower, gas turbine) that can be aligned to provide power via a dedicated direct connection;
4. Time necessary to have each of the above systems operating;
5. Availability of competent human resources to make the exceptional connections;
6. Identification of cliff edge effects and when they occur.

e) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions...)

7.2.2 LOOP + Loss of the ordinary back-up sources + loss of any other diverse back- up sources (Total-SBO)

LOOP AND Loss of island mode AND Loss of Hydropower AND Loss of Notstromdiesel AND Loss of Notstanddiesel

a) Provide information on the battery capacity and duration.

b) Provide information on design provisions for these situations.

c) Indicate for how long the site can withstand a SBO without any external support before severe damage to the fuel becomes unavoidable.

d) Specify which (external) actions are foreseen to prevent fuel degradation:

1. Equipment already present on site, e.g. equipment from another reactor;
2. Equipment available off-site, assuming that all reactors on the same site are equally damaged;
3. Near-by power stations (e.g. hydropower, gas turbine) that can be aligned to provide power via a dedicated direct connection;
4. Time necessary to have each of the above systems operating;
5. Availability of competent human resources to make the exceptional connections;
6. Identification of cliff edge effects and when they occur.

e) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions...)

8 Loss of ultimate heat sink

The ultimate heat sink (UHS) is a medium to which the residual heat from the reactor is transferred. In some cases, the plant has the primary UHS, such as the sea or a river, which is supplemented by an alternate UHS, for example a lake, a water table or the atmosphere. Sequential loss of these sinks has to be considered (see c) below).

The connection with the primary ultimate heat sink for all safety and non safety functions is lost. The site is isolated from delivery of heavy material for 72 hours by road, rail or waterways. Portable light equipment can arrive to the site from other locations after the first 24 hours.

The external storage facility in Reitnau can be discussed for its operability within the first 24 hours (D1 or D2).

a) Provide a description of design provisions to prevent the loss of the UHS (e.g. various water intakes for primary UHS at different locations, use of alternative UHS, ...)

8.1 Loss of primary ultimate heat sink (UHS)

i.e. access to water from the river or the sea

a) Indicate for how long the site can withstand the situation without any external support before severe damage to the fuel becomes unavoidable

b) Provide information on design provisions for these situations.

c) Specify which external actions are foreseen to prevent fuel degradation:

   1. Equipment already present on site, e.g. equipment from another reactor;
   2. Equipment available off-site, assuming that all reactors on the same site are equally damaged;
   3. Time necessary to have these systems operating;
   4. Availability of competent human resources;
   5. Identification of cliff edge effects and when they occur.

d) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions...).

8.2 Loss of primary ultimate heat sink (UHS) and the alternate UHS

a) Indicate for how long the site can withstand the situation without any external support before severe damage to the fuel becomes unavoidable

b) Provide information on design provisions for these situations.

c) Specify which external actions are foreseen to prevent fuel degradation:

   1. Equipment already present on site, e.g. equipment from another reactor;
   2. Equipment available off-site, assuming that all reactors on the same site are equally damaged;
   3. Time necessary to have these systems operating;
   4. Availability of competent human resources;
   5. Identification of cliff edge effects and when they occur.

d) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions...).

8.3 Loss of primary UHS with SBO / Total-SBO

a) Indicate for how long the site can withstand the situation without any external support before severe damage to the fuel becomes unavoidable

b) Specify which external actions are foreseen to prevent fuel degradation:

1. Equipment already present on site, e.g. equipment from another reactor;
2. Equipment available off-site, assuming that all reactors on the same site are equally damaged;
3. Time necessary to have these systems operating;
4. Availability of competent human resources;
5. Identification of cliff edge effects and when they occur.

c) Indicate if any provisions can be envisaged to prevent these cliff edge effects or to increase robustness of the plant (modifications of hardware, modification of procedures, organisational provisions…).

9 Severe accident management

This chapter deals mostly with mitigation issues. Even if the probability of the event is very low, the means to protect containment from loads that could threaten its integrity should be assessed. Severe accident management, as forming the last line of defense-in-depth for the operator, should be consistent with the measures used for preventing the core damage and with the overall safety approach of the plant

The envisaged accident management measures shall be evaluated considering what the situation could be on a site:

- Extensive destruction of infrastructure around the plant including the communication facilities (making technical and personnel support from outside more difficult);
- Impairment of work performance (including impact on the accessibility and habitability of the main and secondary control rooms, and the plant emergency/crisis centre) due to high local dose rates, radioactive contamination and destruction of some facilities on site;
- Feasibility and effectiveness of accident management measures under the conditions of external hazards (earthquakes, floods);
- Unavailability of power supply;
- Potential failure of instrumentation;
- Potential effects from the other neighbouring plants at site.

9.1 Accident management generic issues

As an overview here and, when applicable, specifically under 9.2 to 9.5 the following aspects have to be described and assessed:

a) Organisation of the licensee to manage the situation, including:
   1. Staffing, resources and shift management
   2. Use of off-site technical support for accident and protection management (and contingencies if this becomes unavailable)
   3. Procedures, training and exercises

b) Possibility to use existing equipment

c) Provisions to use mobile devices (availability of such devices, time to bring them on site and put them in operation, accessibility to site)

d) Provisions for and management of supplies (fuel for diesel generators, water…)

e) Management of radioactive releases, provisions to limit them

f) Management of workers' doses, provisions to limit them

g) Communication and information systems (internal, external)

h) Long-term post-accident activities

i) Conditions that would prevent staff from working in the main or secondary control room as well as in the plant emergency/crisis centre and what measures could avoid such conditions to occur.

9.2 Accident management measures for the loss of the core cooling function

a) Describe the accident management measures currently in place at the various stages of a scenario of loss of the core cooling function:

1. Before occurrence of fuel damage in the reactor pressure vessel
   - Last resorts to prevent fuel damage
   - Elimination of possibility for fuel damage in high pressure scenarios
2. After occurrence of fuel damage in the reactor pressure vessel
3. After failure of the reactor pressure vessel

b) Describe the criteria for the transition from the preventive EOP to SAMG for accidents initiated during power and shutdown operation

c) Summarize the emergency exercises carried out on severe accident management

d) Identify any cliff edge effect and evaluate the time before it

e) Assess the adequacy of the existing management measures, including the procedural guidance to cope with a severe accident, and evaluate the potential for additional measures. In particular, the licensee is asked to consider:

1. The suitability and availability of the required instrumentation
2. The habitability and accessibility of the vital areas of the plant (the control room, emergency response facilities, local control and sampling points, repair possibilities)
3. Potential H2 accumulations in other buildings than containment

9.3 Accident management measures and plant design features for protecting containment integrity

a) Describe the accident management measures and plant design features for protecting integrity of the containment function after occurrence of fuel damage

1. Prevention of H2 deflagration or H2 detonation (inerting, recombiners, ~~or~~ igniters, etc.), also taking into account venting processes;
2. Prevention of over-pressurization of the containment;
3. If for the protection of the containment a release to the environment is needed, it should be assessed, whether this release needs to be filtered. In this case, availability of the means for estimation of the amount of radioactive material released into the environment should also be described;
4. Prevention of re-criticality
5. Prevention of basemat melt through
6. Need for and supply of electrical AC and DC power and compressed air to equipment used for protecting containment integrity

b) Identify any cliff edge effect and evaluate the time before it

c) Assess the adequacy of the existing management measures, including the procedural guidance to cope with a severe accident, and evaluate the potential for additional measures. In particular, the licensee is asked to consider:

1. The suitability and availability of the required instrumentation
2. The habitability and accessibility of the vital areas of the plant (the control room, emergency response facilities, local control and sampling points, repair possibilities)
3. Potential H2 accumulations in other buildings than containment

9.4 Accident management measures to mitigate the consequences of the loss of containment integrity

a) Describe the accident management measures currently in place to mitigate the consequences of loss of containment integrity.

b) Identify any cliff edge effect and evaluate the time before it

c) Assess the adequacy of the existing management measures, including the procedural guidance to cope with a severe accident, and evaluate the potential for additional measures. In particular, the licensee is asked to consider:

1. The suitability and availability of the required instrumentation
2. The habitability and accessibility of the vital areas of the plant (the control room, emergency response facilities, local control and sampling points, repair possibilities)
3. Potential H2 accumulations in other buildings than containment

9.5 Accident management measures for the loss of the cooling function in the fuel storage

a) Describe the accident management measures currently in place at the various stages of a scenario of loss of cooling function in the fuel storage (the following indications relate to a fuel pool):

1. Before/after losing adequate shielding against radiation;
2. Before/after occurrence of uncover of the top of fuel in the fuel pool
3. Before/after occurrence of fuel degradation (fast cladding oxidation with hydrogen production) in the fuel pool.

b) Describe the criteria for the transition from the preventive EOP to SAMG for accidents initiated during power and shutdown operation if the accident does not coincide with damage of fuel in the reactor pressure vessel

c) Summarize the emergency exercises carried out on severe accident management

d) Identify any cliff edge effect and evaluate the time before it

e) Assess the adequacy of the existing management measures, including the procedural guidance to cope with a severe accident, and evaluate the potential for additional measures. In particular, the licensee is asked to consider:

1. The suitability and availability of the required instrumentation
2. The habitability and accessibility of the vital areas of the plant (the control room, emergency response facilities, local control and sampling points, repair possibilities)
3. Potential H2 accumulations in other buildings than containment