Regulator and TSO activity in the area of severe accident management in the light of accident at Fukushima-Daiichi NPP

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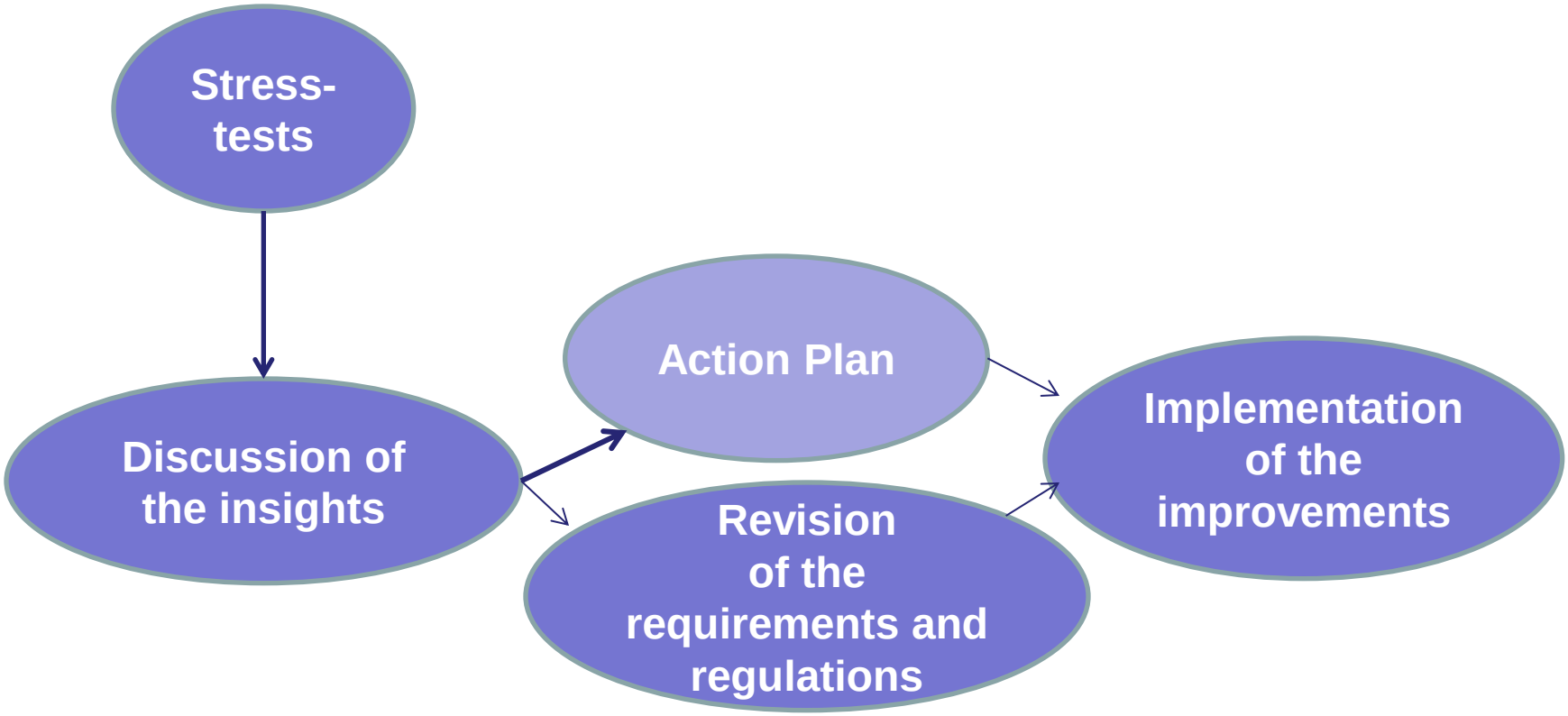
Scientific and Engineering Center for Nuclear and Radiation safety (SEC NRS)
RTN TSO

- **Safety review (licensing procedure)**
- **Supporting investigations**
- **Development of normative documents**

Content:

- Introduction;
- Requirements and regulations;
- Main results of stress-tests and areas for safety improvement;
  - mobile equipment
  - emergency procedures
  - emergency response
- Conclusions

Post-Fukushima activity



Requirements before accident at Fukushima-Daiichi NPP

Main requirements related to severe accident management were implemented after Chernobyl accident (not exhaustive list).

- List of BDBA scenario, including SA, should be developed and confirmed in SAR; Correspondent BDBA analyses should be presented in SAR.
- Licensee should develop and implement guideline on BDBA management based on BDBA analyses;
- Any available technical means could be used for SAM even out of their design assignment;
- In case of probability of a big radioactive release higher then 10^{-7} special technical means dedicated for SAM should be foreseen in the design;
- Guideline on BDBA management is included in the list of licensing documents;
- Deflagration should be excluded for DBA; detonation should be prevented for BDBA;

SAM was a subject for licensing before accident at Fukushima-Daiichi NPP

Compliance with existed requirements

- Guidelines for BDBA management was developed and implemented at all operated NPP, however; mostly it covered operator actions at prevention stage; mitigation actions were presented as general recommendations;
- Special technical means for BDBA management was implemented for the old generation power units;
- Hydrogen recombines were implementing at the power units beginning from 2009;
- Pilot version of guideline for BDBA management (mitigation stage) was developed and licensed (with license conditions) in 2010 for Balakovo-4 power unit.

Main Insights of Stress-tests in SAM Area

- On site power sources of AC don't cover the power needs in case of long lasting station blackout;
- I&C system are not qualified for SA conditions and should be upgraded; scope and ranges of the measured parameters should be expanded;
- Reliability of the equipment dedicated for SAM does not confirmed for SA conditions at some power units;
- Operated power units are not equipped with the reliable system to provide controlled and filtered release from the containment in case of need;
- Insufficient scope of the safety analyses to develop guidelines for BDBA management (for mitigation stage).

Action Plan

Action Plan was developed by operation organization was based on stress-test insights and included short-term actions (until 2013), medium-term and long-term actions (until 2016);

Responsibility of Regulatory body (RTN) to provide the supervision over the plan implementation;

Supervision is provided within licensing procedure through review of safety justifications related to implementation of the new technical means at the power units, new emergency procedures, additional safety analyses and also through the target inspections.

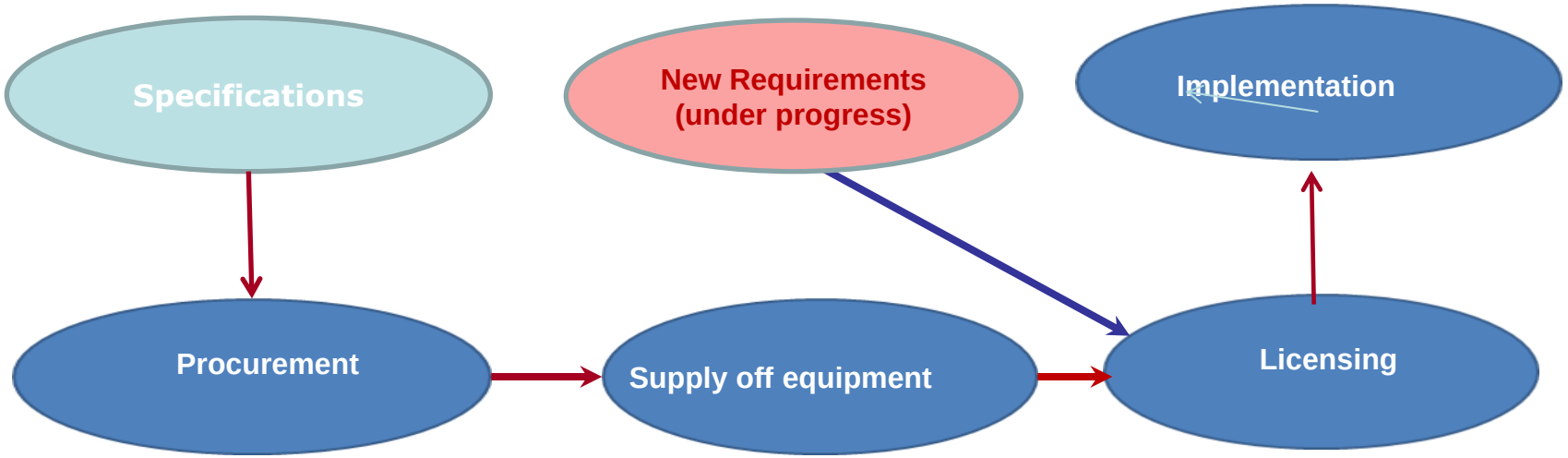
Main Findings Concerning Requirements and Regulation in the Area of SAM

Main requirements relating to SAM are correct, however more detailed requirements are necessary concerning the following:

1. Special technical means dedicated for SAM
   (mobile and installed equipment, I&C)
2. Emergency procedures and guidelines
   (Minimal requirements to the structure and content, harmonization of the existed emergency procedures and instructions)
3. Safety analyses
   Specification of the requirements concerning the scope of BDBA
4. Emergency preparedness
   Specification of the requirements concerning the criteria of actions in the frame of emergency plan;

Special Technical Means Dedicated for SAM (mobile equipment)

Implementation of the mobile equipment at all operated power units is a short term action according to Action Plan (2012-2013) developed by Operation organization. It is multistage process and developing in parallel with development of the new detail requirements and recommendations.



New requirements related to mobile equipment (1) (under progress)

Additional requirements related to special technical means (including mobile) will be included in OPB-88/97(principal requirements) and in NP-006-98 (requirements on the content of SAR); the following aspects will be considered:

— **Classification (OPB-88/97):**
technical means dedicated for BDBA management – **safety class 3**
the following aspects should be taken into account in appointing safety class:
safety function to be supported;
mission time.

— **Specifications of the mobile equipment (NP-006-98):**

characteristics of the mobile equipment (capacity, head, mass flow) must be sufficient to ensure the basic safety functions;
mission time
copy time

New requirements related to mobile equipment (2) (under progress)

— Storage, maintenance, testing, documenting

- to provide readiness of the mobile equipment, when needed responsibilities and routines to manage the mobile equipment should be developed by licensee;
- mobile equipment, dedicated to BDBA management should be protected from in-site and off site impacts;
- availability of the mobile equipment must be ensured considering site specific emergency conditions (seismic, temperatures,
- deployment time should be defined and confirmed basing on the results of emergency exercise.

New requirements related to mobile equipment (2) (under progress)

— Multi-units aspects

Basic provisions dedicated for SAM (mobile DG, mobile pumps) providing/supporting basic safety functions do not sheared between units at the same site. Each power unit on a site is provided with a complete set of such equipment.

However the possibility to shear the resources should be foreseen in the procedures and should be based at the adequate analyses to prevent the situation, when shearing of the resources will resulted on the aggravation of the general situation;

Majority of the requirements related to mobile equipment are general
Design-specific requirements should be developed by Licensee.

Recommendations Related to Emergency Procedures (1)

General requirements were defined before (1988) Accident at Fukushima-Daiichi NPP :

- Licensee should provide development and implementation the guideline for BDBA management;
- It should be based on the results of the BDBA analyses, presented in SAR and should cover as mitigation and prevention stages of BDBA management.

Due to very general requirements the existing guidelines for BDBA management have a different levels of details of emergency procedures for different power units; It was identified before 2011; needs for more detail regulations on the emergency procedures in the light of lessons learned from FUKUSHIMA accident, became even more essential.

Development a special regulations containing recommendations for structure and content of the guidelines for BDBA management was initiated by RTN to provide minimum necessary level of detail, and to take into account the lessons learned from the Fukushima accident.

Recommendations Related to Emergency Procedures (2)

Main aspects will be covered by regulations:

- procedures for plant shutdown states (pilot versions are under review);
- multi-unit events;
- long-duration events;
- accidents in spent fuel pools;
- use off the mobile equipment;
- serious infrastructure damage;
- widespread contamination of the environment.

Both prevention and mitigation domains will be covered by the recommendations;

Recommendations Related to Emergency Procedures (3)

–multi-unit aspects;

Guidance on SAM should cover the following aspect related to multi-unit accident:

possible impact of the one unit on the adjacent ones;

shear of equipment;

staff coordination;

definition of the responsibility.

– Extension the scope of BDBA analyses

•Scope of the BDBA analyses performed to confirm the efficiency of SAM was enlarged

Scenarios should be covered:

• long lasting blackout;

• accidents in the spent fuel pool (coordination in time with accident escalation in the reactor);

•consideration of the mobile equipment

•Shutdown conditions.

Emergency preparedness (revision of the requirements)

Requirements related to emergency preparedness and emergency response are presented in two documents:

NP-015-2012

- contains main requirements concerning the content of the emergency plan;
- last revision of the document coincided with Fukushima accident (2011-2012);
- base requirements were not changed; responsibilities for all participants of the emergency plan were specified in more detail

NP-005-98

- contains criteria for notification of the emergency conditions, notification procedure, procedure for providing NPP support in case of accident);
- it is under revision at the moment;

It is planned (under discussion):

- implementation of the additional criteria for notification of alert condition at NPP;
- definition the frequency of the emergency exercises and drills.

Emergency preparedness

Main objectives of Regulator in case of accident :

- to asses the emergency preparedness of Operator;
- to provide the independent assessment of accident progression;
- to inform the government about the status of the emergency unit.

In 2013 Emergency Center of RTN was upgraded to provide the adequate conditions according to defined objectives (reliable transmission of data defined the status of all operated power units, reliable (redundant) communication lines with all participants of emergency response (NPP, crisis center of REA, TSOs and their technical support centers);

The adequate functionality of RTN crisis center was tested during last emergency exercise at NOVOVORONEZH-5 power unit in November 2013. This emergency exercise was coincided with IAEA post-mission.

RTN Crisis center

Regime of daily activity

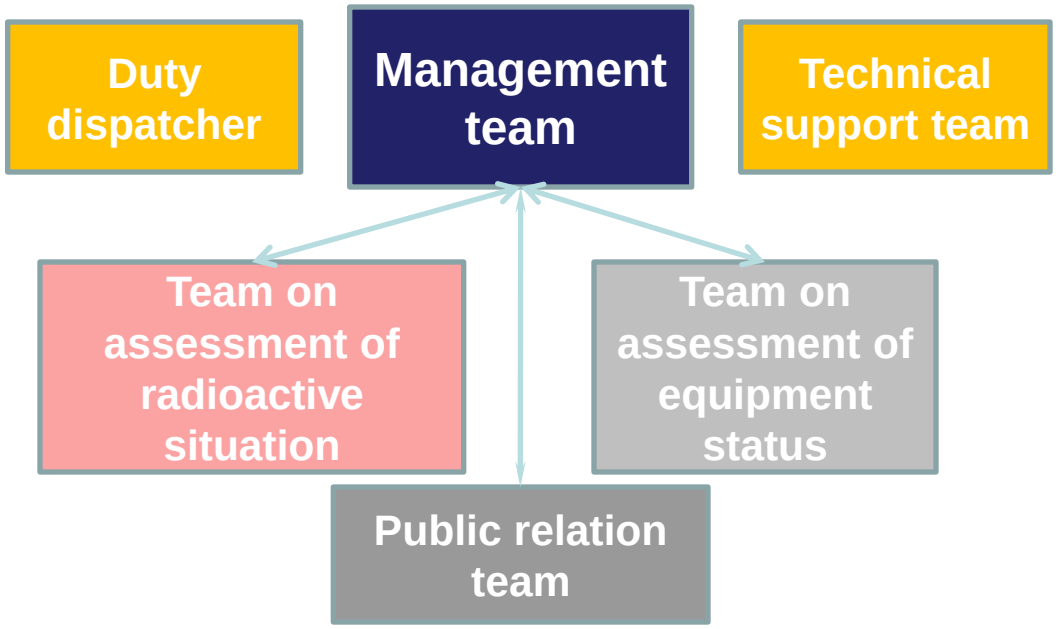
Duty dispatcher

Technical support team

Post-exercise activity:

Analysis and assessment of timeliness and correctness actions on AM and ER based on appointed procedure

Regime of emergency response



Main Conclusions

1. Reassessment of NPP safety in the light of FUKUSHIMA accident revealed the deficiencies and provided the basis for safety improvements in SAM area;

2. Principal requirements related to SAM developed before Fukushima accident are adequate however development of more detail requirements and regulations is actual and under progress concerning: emergency procedures, I&C for SAM, technical means dedicated for SAM, emergency preparedness.

3. SAM is important subject of the licensing including such aspects as procedures, implementation of the technical means, accident analyses, emergency preparedness.

Appendix: Questions and answers (1)

What types of regulatory controls are necessary for severe accident management provisions (i.e. licensed verses voluntary initiatives)? What types of challenges do these choices create (training needs, equipment qualification, inspection requirements, etc.);

In RF SAM provision is under licensing control since the end of the 90th years; more detailed requirements and regulations concerning the provisions are under development (qualification of the equipment dedicated for SAM, it does not interfere with voluntary initiatives of operating organization, however it should be agreed with regulator. It implies the additional activity as for licensee and for regulator.

Appendix: Questions and answers (2)

Should severe accident management provisions (i.e. using mobile equipment verses hardening on site equipment) be performance based or prescribed by regulation?

In RF using of the mobile equipment is not prescribed; according to the requirements Operator could use all suitable provisions for SAM; however the efficiency of chosen way of AM should be confirmed (by the analyses, exercises).

Appendix: Questions and answers (3)

What is the proper level of independent oversight of the technical basis for both mission times and the determination of minimum equipment performance needs?

General approach of RF regulator - to define the general safety goals, more then specify the way how to achieve it; mission time and the minimum equipment performance needs are responsibility of operating organization; regulator requires to confirm the adequacy of the specified characteristics.

Appendix: Questions and answers (3)

What is the proper level of independent oversight of the technical basis for both mission times and the determination of minimum equipment performance needs?

General approach of RF regulator - to define the general safety goals, but not specify the way how to achieve it. The general requirement if need are accomplished by the regulations. But again, being enough free in a choice of a way of achievement of safety goal, licensee should confirm the compliance with installed general requirements.

Appendix: Questions and answers (4)

What type of sensor are adequate to cover the range of conditions that may be encountered and to measure parameters needed for accident management (Mobile sensor deployment)?

There are no special requirements for the type of sensors. it is responsibility of licensee to chose the sensors and to confirm their reliability under the accident conditions.

Appendix: Questions and answers (5)

Should regulators require parallel preplanning of pre-established emergency plan to help organization respond effectively with adaptable strategy to limit scope and duration should the current response fail.

There are no requirements to provide parallel preplanning of pre-established emergency plan. Some elements of parallel preplanning are could be indicated in emergency plan and in procedures.

Appendix: Questions and answers (6)

Special consideration for multi-unit sites (sharing resources)?

Special consideration of multi-unit sites will be done in the new requirements and regulations, specially concerning resources needed for emergency plan. Basic provisions dedicated for SAM are provided for each power unit. It does not exclude possibility to share the recourses at multi-unit site in case of need.

Thank you for your attention!

Picture: SEC NRS office in Moscow