**MEETING MINUTES**

**Consultancy Meeting - WG1**

**29. – 30. April, 2019, TAVANA, NPPD, Tehran, Iran**

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# Agenda

**Day 1 - 29.4.2019**

1. Purpose of the meeting and main objectives
2. Technical meeting – splitting into groups

WG 1 – Earthquake

* Going through UJV comments and finding the way for completion of chapter 2
* SSCs required for safe shutdown (success path)
* Main operating contingencies (emergency operating procedures….)
* Compliance with licensing basis

WG 1 – Flooding

* Possible ways for water ingress into first safety category buildings
  + Doors and other openings (HVAC)
  + Underground channels
  + Drainage systems

**Day 2 - 29.4.2019**

WG 1 – Flooding – chapters prepared by TAVANA:

* Methodology used to evaluate DBF
* Identification of systems, structures and components (SSC) that are required for achieving and maintaining safe shutdown state and are most endangered when flood is increasing
* Main design and construction provisions to prevent flood impact to the plant
* Main operating provisions to prevent flood impact to the plant
* Situation outside the plant, including preventing or delaying access of personnel and equipment to the site
* Licensee's processes to ensure that plant systems, structures, and components that are needed for achieving and maintaining the safe shutdown state, as well as systems and structures designed for flood protection remain in faultless condition
* Potential deviations from licensing basis and actions to address those deviations

WG 1 – Extreme meteorological events - chapters prepared by TAVANA:

* 4.1. assessment of extreme meteorological events
* 4.1.1. identification, screening and analysis
* 4.1.2. consideration of potential combination of extreme meteorological events
* 4.2. Design basis

WG 1 – missing data for simple analyses

Preparation of Minutes of Meeting

# General Data about the site and nuclear power plant

# Earthquakes

## Design basis

**Prepared by UJV - 2530**

### Earthquake against which the NPP is designed

**Prepared by UJV - 2530**

#### Characteristics of the design basis earthquake

**Prepared by UJV - 2530**

#### Methodology used to evaluate the design basis earthquake

**Prepared by UJV - 2530**

#### Conclusion on the adequacy of the design basis for the earthquake

**Prepared by UJV - 2530**

### Provisions to protect the NPP against the design basis earthquake

**Prepared by TAVANA (UJV – 2501)**

#### Systems, structures and components required for achieving safe shutdown during an earthquake

**Prepared by TAVANA (UJV – 2501)**

* Explain subcategories IIa, IIb, or remove them from the table
* Remove subcategory III
* Describe briefly all operating modes (1 to x) for reactor and spent fuel storage (e.g. mode 1 is nominal power reactor = 100% Nnom)

#### Main operating contingencies in case of damage that could be caused by an earthquake

**Prepared by TAVANA (UJV – 2501)**

* Potential failures of heavy equipment - move to the chapter 2.1.2.3.1
* Damages of transportation or access roads – move to chapter2.1.2.3.3
* Prepare new text providing information on EOPs and BDBA for reactor and spent fuel
* What operation procedures should be prepared for mobile equipment

#### Protection against indirect effects of the earthquake

**Prepared by TAVANA (UJV – 2507 + 2502)**

##### Assessment of potential failures of heavy structures, pressure retaining devices, rotating equipment, or systems containing large amount of liquid that are not designed to withstand DBE and that might threaten heat transfer to ultimate heat sink by mechanical interaction or through internal flood

**Prepared by TAVANA (UJV – 2507)**

* Place here the text from 2.1.2.2
* Make reference to the Russian document “Detailed seismic walkdown of BNPP 1” which is mentioned in Russian stress test report and deals with seismic interactions
* Remove part on fires and explosions

##### Loss of external power supply that could impair the impact of seismically induced internal damage at the plant

**Prepared by UJV - 2502**

##### Situation outside the plant, including preventing or delaying access of personnel and equipment to the site

**Prepared by TAVANA (UJV – 2507)**

* Place here the text from 2.1.2.2
* Provide new text with potential damages on the surrounding plant infrastructure that can block access routes
* Provide small map with alternative access roads to NPP

##### Other indirect effects (e.g. fire or explosion)

**Prepared by TAVANA (UJV – 2507)**

* Describe possible damages on industrial and military facilities near the plant
* Storage technical gases inside NPP, their location and classification according to ATEX standard
* shorten parts describing ignition of cables

### NPP compliance with its current licensing basis

**Prepared by TAVANA (UJV – 2501)**

#### Licensee's processes to ensure that plant systems, structures, and components that are needed for achieving safe shutdown after earthquake, or that might cause indirect effects discussed under 2.1.2.3 remain in faultless condition

**Prepared by TAVANA (UJV – 2501)**

* Remove existing text
* Prepare brief description of procedures used for SSCs maintenance, testing, periodic inspections…. Using the quality assurance documents and provide references

#### Licensee's processes to ensure that mobile equipment and supplies that are planned to be available after an earthquake are in continuous preparedness to be used

**Prepared by TAVANA (UJV – 2501)**

* Remove existing text
* Prepare brief description of procedures used for mobile equipment and supplies, maintenance, testing, periodic inspections…. Using the quality assurance documents and provide references

#### Potential deviations from licensing basis and actions to address those deviations

**Prepared by TAVANA (UJV – 2501)**

* Describe implementation of post-Fukushima measures and improvements based on Russian stress test report, executed or under preparation

## Evaluation of safety margins

**Prepared by UJV - 2530**

### Range of earthquake leading to severe fuel damage

**Prepared by UJV - 2530**

### Range of earthquake leading to loss of containment integrity

**Prepared by UJV - 2530**

### Earthquake exceeding design basis earthquake for the NPP and consequent flooding exceeding design basis flood

**Prepared by TAVANA (UJV – 2530)**

It is required to describe potential flooding that can be caused by earthquakes, please remove text on flooding due to precipitation which is described in chapter 3. Add paragraph on geographical location of the plant, near rivers, any facilities around that have potential to generate consequent flooding. Internal flooding due to earthquakes should be mentioned. Confirm also that no cliff edge effects were identified in relation to potential flooding caused by an earthquake.

### Measures envisaged increasing robustness of the NPP against earthquakes

**Prepared by UJV – 2501**

Please prepare answer to the following questions by e-mail

1. What do you mean under BNPP seismic upgrading – any post-Fukushima measures ??
2. Do earthquake operating regulation documents exist at NPP?
3. Guideline instructions for use of mobile and alternative equipment/supplies/means
4. Working of emergency response units in case of unavailability of Emergency control center – what is currently existing
5. Seismic resistance (seismic category) and location of the BNPP Fire brigade building
6. Alternative means of communications during and after a seismic event
7. Analysis regarding threat to shelters on a seismic event
8. Sufficient amount of staff after a seismic event
9. Existence of documentation, information and equipment about access to buildings and availability of machinery after a seismic event
10. Basic information on ZK.9 building, structural drawings and description of system/equipment, function, connection to BNPP

# Flooding

## Design basis

### Flooding against which the NPP is designed

**Prepared by UJV - 2530**

#### Characteristics of the design basis flood

**Prepared by TAVANA (UJV – 2530)**

Information given in the first draft is sufficient.

#### Methodology used to evaluate the design basis flood

**Prepared by TAVANA (UJV – 2530)**

* Explanation why only floods from the sea and floods due to extreme precipitation are considered as sources for design basis flood (DBF).

##### DBF due to extreme precipitation

* Information about the sources of meteorological data (name of meteorological stations)
* Only information connected to flooding
* Information about meteorological data set used for determination of extreme precipitation (period of time). The most important information is the max 24-hour precipitation which should be given for every year since the monitoring started
* Information about methodology (e.g. Gumbel distribution) which was used for determination of extreme precipitation and information about return period
* Information about the geographical and geomorphological site data is sufficient
* Information about determination of surface run-off is sufficient
* Information about determination of the height of water on the site during DBF should be completed by the thickness of the layer: 91,4 mm (1/100), 161 mm (1/10000) and 356 mm (˂1/10000)
* Information regarding the uncertainty analysis in identification of DBF: Shower run-off factors for the area are within 0,4…0,8 – some presumption were taken regarding this value but we do not know how exactly these coefficients were used
* Information regarding the added safety margins in identification of DBF – PMP was considered in some cases – for example ZB or ZX entrances are higher than 356 mm

##### DBF due to high sea water level

* The DB height of the water level is 5,2 m above MSL – it should be clearly stated what phenomena were considered while evaluating this value (storm surge and seiche, wind waves, tsunami, wave run-up, high tide, climate change etc.)
* Information regarding the analysis of historical flooding data should be added
* Storm surge – only methodology for extreme wind speed determination is given, but methodology for determination of extreme waves driven by this wind is missing and should be added
* Tsunami – there is only result of the investigation, but not the methodology – it should be taken from the Oceanographical investigations, 1997 or in SER Busher 2
* Seiche – there should be a statement, that surge and seiche were investigated together and thus should be described together – similar information is also in SER for Busher 2
* Tide – it is not clear what tide elevation was used in DBF determination (is it + 1,33m?), information about wind waves should be removed
* Climate change – it must be clearly stated whether the rise of sea water level due to climate change was considered or not
* Information about the geographical, geomorphological site data, bathymetry data is sufficient
* Determination of the height of sea water level at the site during DBF combining all the phenomena contributing to this hazard – only the methodology for determination of high sea water level with the return period once in 10 000 should be described
* Information regarding the uncertainty analysis in identification of DBF – try to find sth even in Oceanographical investigations, 1997, if nothing is found, the statement “no uncertainty analysis were performed”
* Information regarding the added safety margins in identification of DBF – try to find some conservatism – use the Oceanographical investigations, 1997
* Information regarding the validity of flooding data in time used in identification of DBF – information is sufficient

#### Conclusion on the adequacy of protection against external flooding

**Prepared by UJV - 2530**

### Provisions to protect the NPP against the design basis flooding

**Prepared by UJV - 2530**

#### Identification of systems, structures and components (SSC) that are required for achieving and maintaining safe shutdown state and are most endangered when flood is increasing

**Prepared by TAVANA (UJV – 2501)**

* Try to prepared the text together with the Earthquake group – the procedure should be very similar (the same system should be used for safe shut down)

#### Main design and construction provisions to prevent flood impact to the plant

**Prepared by TAVANA (UJV – 2530)**

* The elevation, door watertightness, protection against underground water and the final collectors of drainage system are described. Information about additional means of protection against flood such as bank protection, ditches, dikes, mobile barriers etc. should be added if relevant.
* Newly added chapter 3.1.2.2.4 Protection against extreme precipitation should be removed – it is about determination of surface run-off but not about protection against flood

#### Main operating provisions to prevent flood impact to the plant

**Prepared by TAVANA (UJV – 2530)**

* It is necessary to check whether there are any emergency operating procedures (EOPs) to achieve safe shutdown state and to prevent reactor core damage in all operating modes following a flooding event. If there are none, it should be stated and the current text can be used as explanation why there are no EOPs
* It is necessary to check whether there are any emergency EOPs to provide for fundamental safety functions and to prevent fuel damage in the spent fuel storage following a flooding event. If there are none, it should be stated and the current text can be used as explanation why there are no EOS
* Not only the actions of the systems but also procedures for personnel what to do in case of flood
* The new text should be removed together with the table – updated table will be used by UJV in chapter 3.2

#### Situation outside the plant, including preventing or delaying access of personnel and equipment to the site

**Prepared by TAVANA (UJV – 2530)**

* Try to prepared the text together with the Earthquake group
* There should be a description what is the procedure in case both roads are temporarily blocked by floods, what negative impact to the power plant it can have in case of emergency and what are the alternative means
* Information about flooding induced damage to access roads to the site (what height of sea water level is needed for access roads blockage by water, how long does it take to renew the access roads in case of DBF etc.)
* Information of flooding induced damage to external power supply to the site (what height of sea water level is needed for damage of external power supply) – try to find a map with elevation and with the power line on it and try to compare it with DBF
* Information of flooding induced damage to supporting systems outside of the plant site (where relevant e.g., fresh water supply, backup power supply) – for sure the fire brigade station
* Information on other effects linked to the flooding itself or to the phenomena that originated the flooding (such as very bad weather conditions) taken into account in the analyses
* Information on flooding induced damage to neighbouring municipalities.

### NPP compliance with its current licensing basis

**Prepared by TAVANA (UJV – 2501)**

#### Licensee's processes to ensure that plant systems, structures, and components that are needed for achieving and maintaining the safe shutdown state, as well as systems and structures designed for flood protection remain in faultless condition

**Prepared by TAVANA (UJV – 2501)**

* The text should be completed by main requirements/procedures stated in quality assurance document which describes main procedures in important SSC inspection, maintenance, periodical testing etc. for SSC – work together with Earthquake group. Only information about SSC dedicated to flood protection should be described differently.

#### Licensee's processes to ensure that mobile equipment and supplies that are planned for use in connection with flooding are in continuous preparedness to be used

**Prepared by TAVANA (UJV – 2501)**

* The text should be completed by main requirements/procedures stated in quality assurance document which describes main procedures in important mobile equipment and supplies inspection, maintenance, periodical testing etc. for mobile equipment and supplies – work together with Earthquake group. Only information about SSC dedicated to flood protection should be described differently.

#### Potential deviations from licensing basis and actions to address those deviations

**Prepared by TAVANA (UJV – 2501)**

* Describe implementation of post-Fukushima measures and improvements based on Russian stress test report, executed or under preparation.
* Text will be contains two part:
  + First part – realization measures on the BNPP (2 mobile DGs, Fire tracks, mobile pumps……
  + Second part – planning measures on the BNPP (water channel……)

## Evaluation of safety margins

**Prepared by UJV - 2530**

### Estimation of safety margin against flooding

**Prepared by UJV – 2530**

* Table of openings was prepared during the meeting



* Information about sewer connection between inside and outside of the buildings will be sent as soon as possible after it will be received from Busher NPP
* Information about the façade penetrations for HVAC inlet/outlet up to the +10 m above MSL (approximately 2,7 m above terrain of the main buildings) should be given by TAVANA as background information – TAVANA will visit Busher site next week and after this will send the information to UJV.

### Measures envisaged increasing robustness of the NPP against flooding

**Prepared by UJV – 2530**

# Extreme meteorological events and other natural hazards relevant for the site

## Assessment of extreme meteorological events

**Prepared by TAVANA (UJV – 2530)**

### Identification, screening and analysis of extreme meteorological events

**Prepared by TAVANA (UJV – 2530)**

* List of credible meteorological evens
* Rules for screening according to TECDOC and WENRA, screened out events that may not have safety consequences
* General info on site meteorological conditions
* Impact of extreme conditions at the site (which SSCs should be protected against extreme meteo hazards, mention specific Russian classification of buildings)
* Move info about derivation of design basis to chapter 4.2 !!! (statistics for parameters at 100 and 10 000 years)
* Meteostations and collection of data (location of stations, map ? , measured data for period…., what is measured)

### Consideration of potential combination of extreme meteorological events

**Prepared by TAVANA (UJV – 2530)**

* Use table of combinations from Russian report
* Prepare comment according to rules from TECDOC 1834 and WENRA.
* Recommendation for better justification of combinations in next updating of FSAR

## Design basis

**Prepared by TAVANA (UJV – 2530)**

* Statistics used for determination of design basis, tables with results for individual phenomena.
* Statistics of extremes is based on set of year maxima, provide info for what period year maxima are available for each phenomenon
* Monitoring and alerting system, if available at the plant
* If there is warning from meteostation that some extreme event can be expected, what are actions at the plant. Are there rules and guides with instructions for preparation of preventive measures ?

## Evaluation of safety margins

**Prepared by UJV - 2507**

### Estimation of safety margin against extreme meteorological conditions

**Prepared by UJV - 2507**

### Measures envisaged to increase robustness of the NPP against extreme weather conditions

**Prepared by UJV - 2507**

**Additional requirements for information**

* Provide please basic information on Fuel tanks for auxiliary boilers. Drawings of the tanks, foundation, seismic capacity.
* Please provide the orientation layout of the electrical equipment inside ZE building (Building of Electric Devices) Equipment layout for each floor level.
* In the chapter 2.1 related to seismic design basis we are using some information and figures from the report on seismic hazard for new units (Bushehr 2). Provide please full name of this document for references.
* Provide please basic information on ZK.9 Building. Layout drawings, typical cross sections, structural system drawings, architectural design rains, elevation above sea level, information on equipment inside including diesels.
* Reinforcement drawings are still missing or estimation of real seismic capacity of underground cable channels ZW 95/96. Please provide reinforcement drawings for typical cross section of the channel.
* Building 1ZK.1 (or 1ZK.2) – UJV prepared finite element model of ZK.1 building for simple analysis in order to evaluate real seismic capacity and estimation of margins. FEM has been prepared using the drawings found in FSAR. TAVANA provided some reinforcement drawings in February, but probably due to complicated history of construction, the reinforcement drawings are not compatible with geometry of the structure in FSAR drawings. Please try to find reinforcement drawings for 3 to 5 typical structural elements compatible with FSAR layout drawings. (structural members ensuring stability of the building against horizontal seismic forces, such as main shear walls, columns, main frames, main floor beams, …)
* Information about sewer connection between inside and outside of the buildings
* Information about the façade penetrations for HVAC inlet/outlet up to the +10 m above MSL (approximately 2,7 m above terrain of the main buildings)
* Comprehensive Seismological studies of BNPP site, OCE Consultants, 2015
* Heidarzadeh m. et al.,Evaluation the Tsunami Hazard in the Persian Gulf and its Possible Effects on Coastal Regions, ICOPMAS 2010

**Time for completion of draft of chapters assigned to TAVANA and providing the additional documents and information**

**Due to short time available for preparation of SAST final draft, it is ultimately necessary to send the updated chapters 2, 3 and 4 to UJV until May 12 !!!**

**The same deadline is valid for additional documents and information.**