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**ANNEX II**

**Instrument for Nuclear Safety Cooperation**

**AAP 2016**

**IRAN**

**TERMS OF REFERENCE**

Version 1.01

15 September 2016

**Project INSC IRN3.01/16 Lot 1**

**EuropeAid/138091/DH/SER/IR**

**Enhancing the capabilities of the   
Iranian Nuclear Regulatory Authority (INRA)**

**Project total budget: €2.800.000**

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# BACKGROUND INFORMATION

## Partner Country

The Islamic Republic of Iran.

## Contracting Authority

The European Union (EU), represented by the European Commission (EC).

## Country Background

The Partner country of this Action is Iran.

On 14 July 2015, the E3/EU+3 (China, EU, France, Germany, Russia, UK and USA, with the High Representative of the Union for Foreign Affairs and Security Policy) and Iran reached an agreement on a Joint Comprehensive Plan of Action (JCPoA), the full implementation of which will ensure the exclusively peaceful nature of Iran's nuclear programme.

The JCPoA includes the necessary verification to ensure the exclusive civil nature of the Iranian nuclear programme as well as specified areas for civil-nuclear cooperation. In particular, Annex III of the documents provides a detailed description of the future cooperation in civil nuclear cooperation which largely is covered by activities funded by the EU under the Instrument for Nuclear Safety Cooperation.

The EU has a special responsibility as the leader of the negotiations that have produced the JCPoA. Annex III of the JCPoA provides for cooperation in the field of nuclear safety which covers, *inter-alia*:

* Support to the regulatory authority;
* Creation of a Nuclear Safety Centre;
* Training and tutoring activities;
* Emergency Preparedness and Response and Severe Accident management capability;
* Nuclear safety assessment (including stress tests) and studies;
* Safe management of nuclear and radioactive wastes.

The EU has considerable experience in the implementation of nuclear safety projects supporting regulatory authorities in third countries as a result of the previous TACIS (Technical Assistance to the Commonwealth of Independent States) and Poland and Hungary: Assistance for Restructuring their Economies (PHARE) programmes and now under the INSC (i.e., Armenia, Brazil, China, Russia, Turkey, Ukraine and several other countries such as Jordan, Morocco and Vietnam) and is able to ensure effective cooperation with the Iranian Nuclear Regulatory Authority (INRA).

## Current situation in the sector

*Nuclear power programme*

Iran has one nuclear power plant in operation at Bushehr on the Persian Gulf. It comprises one unit, the Bushehr Nuclear Power Plant BNPP-1, the main components of which are based on the VVER[[1]](#footnote-1)-1000 V-320 design. The plant was constructed in 1994 by the nuclear power equipment and service export company Atomstroyexport of Russia and has the model designation V-446. It deviates considerably from the standard V-320 design due to the requirement to take over and make maximum possible use of the Unit 1 structures and the equipment already existing at Bushehr. These structures and equipment remained after two partly constructed Siemens KWU 1300 MW PWRs were abandoned in 1979 following the Islamic revolution. Unit 1 was already substantially completed (around 85%) at the time, while Unit 2 was approximately half complete. The completion of Unit 1 by Atomstroyexport in 2006 presented significant challenges related to the need to adapt the main VVER components to the retained Siemens KWU parts and equipment as well as the need to verify and in some cases upgrade the abandoned Siemens components, many of them having little or no technical documentation.

The plant has a higher seismic rating than the standard VVER V-320 design due to the high seismicity of the region.

Despite problems and delays during commissioning, mainly caused by the failure of one of the main circulation pumps from the original German supply, the unit entered commercial operation in September 2013. Initially the plant was operated mainly by Russian personnel. Following training of Iranian operational staff in Russia, the operation was taken over by Iranian operators under the supervision of Russian experts until the end of 2015.



The plant is owned and operated by the Bushehr Nuclear Power Plant (BNPP) Operation Company, a subsidiary of the Nuclear Power Production & Development Company of Iran (NPPD), which was established in 2004, from the former Nuclear Power Plant Division of the Atomic Energy Organisation of Iran (AEOI). NPPD remains a subsidiary of AEOI in charge of the nuclear power plant development in Iran.

Following the Fukushima accident, the vendor country (Russian Federation) has performed in 2012 a post-Fukushima safety re-evaluation for BNPP-1. The resulting 'stress test report' was indicated to be performed in compliance with the ENSREG stress test specification, but was not yet submitted to any regulatory review in Iran. Subsequently, the vendor country recommended NPPD ordering a specific set of mobile equipment for BNPP-1, which will be supplied to BNPP-1 relatively soon. NPPD has started a design project for the corresponding implementation measures.

Plans to construct a second unit at Bushehr have been under discussion with Russian Federation and a contract has been signed in 2015. The reactor will be a VVER-1000 V-392 and will not need to be adapted to the abandoned structures of the original Siemens KWU Unit 2. These structures will be removed and the plant will be constructed from scratch as a standard V-392.

Iran plans for further expansion of nuclear power capacity include Bushehr phase II, for which a contract has been signed with Nizhny-Novgorad Atomenergoproekt – Atomstroyexport (NIAEP-ASE) for the construction of two further VVER-1000 units. Further plans include two more VVER-1000 at Bushehr, four at another site not yet specified and two Chinese units at a site on the Makran coast on the Gulf of Oman. There are also plans for the construction of an indigenous design of LWR of 360 MWe capacity at Darkhovin, on the Karun River, close to the border with Iraq, on the site where the construction of two French 910 MWe PWRs had been abandoned after the revolution in 1979.

Iran has also developed indigenous capacity for the fabrication of nuclear fuel for the Tehran Research Reactor and the IR-40 reactor located at the Arak site. This would also allow the provision of fuel for the planned power reactor at Darkhovin and potentially for the Bushehr Nuclear Power Plant, although a significant amount of development would be needed to allow indigenous production of VVER fuel elements.

*Nuclear regulation*

The legislative and statutory framework for regulating nuclear facilities and activities in Iran is provided primarily by the Atomic Energy Organization of Iran (AEOI) Act (1974) and the Radiation Protection (RP) Act (1989). These Acts are supplemented by related lower tier legislation to provide for the control of nuclear, radiation, waste and transport safety.

Iran has yet to accede to a number of important International Conventions in the area of nuclear safety, in particular those concerned with Nuclear Safety, the Safe Management of Waste and Spent Nuclear Fuel and Civil Liability for Nuclear Damage. These Conventions are currently under consideration by the Government of Iran.

The Atomic Energy Organization of Iran Act of 1974 establishes the Atomic Energy Organization of Iran and its field of activities. These activities include the use of nuclear energy and ionising radiation in industry, agriculture and service industries, establishing nuclear power plants and related fuel cycle and desalination facilities, establishing the required scientific and technical infrastructure for these activities, and coordinating and supervising all nuclear energy related matters in Iran.

AEOI is defined as the competent regulatory authority by both the AEOI and RP Acts. AEOI delegates its responsibilities for regulatory functions to the Iran Nuclear Regulatory Authority (INRA), which is a part of AEOI and is authorised by AEOI to:

* develop and issue regulations and guides for nuclear and radiation safety
* perform safety assessments
* issue (as well as suspend/revoke) licences related to the siting, design, construction, commissioning, operation and decommissioning of nuclear and radiation facilities
* undertake inspection, supervision and enforcement activities.

INRA is also responsible for regulation in the area of nuclear safeguards and security. INRA comprises four departments for discharging its regulatory functions:

* National Nuclear Safety Directorate (NNSD)
* National Radiation Protection Directorate (NRPD)
* National Nuclear Safeguards Directorate (NNSG)
* Development of Standards and Regulations Directorate

INRA has developed and implemented a management system for its activities on the basis of ISO and IAEA standards.

The safety of nuclear facilities, including the Bushehr Nuclear Power Plant (BNPP-1) as well as a number of research reactors in Iran, is regulated and supervised by NNSD, which is responsible for developing the related policies, safety principles and criteria, regulations and regulatory guides that are applied as a basis for its regulatory actions.

With regard to the completion of BNPP-1, a licensing procedure was developed by NNSD for the reconstruction, commissioning, operation and decommissioning of the plant. The procedure took due account of INRA requirements and internationally accepted recommendations such as those issued by the IAEA, as well as the safety standards applicable in the vendor country (Russian Federation). Specific features of the design and operating characteristics and unusual or novel design measures of the BNPP-1 have also been considered. The compliance of the plant with the applicable safety requirements, on the basis of the safety documentation submitted by the operating organisation (NPPD), was supervised by NNSD. VO "safety", a Technical Support Organisation (TSO) to the Russian Federation regulatory body, Rostechnadzor, was contracted to provide technical support to NNSD for the BNPP-1 licensing and supervisory activities.

Due to the sanction regime, the INRA lacks international exchange and networking that will strengthen its position in particular by capacity building and peer review.

## Related programmes and other donor activities

A close working relationship will be maintained between the Commission and the future EU Delegation in Iran.

The Commission will coordinate its activities with the other international donors through the Joint Commission established under the JCPoA and possibly the IAEA Technical Cooperation Department.

For a coordinated and efficient implementation of the post-Fukushima nuclear safety stress test activities in Iran, the EC has adopted the so-called '2+2' approach for INSC project IRN3.01/16:

* In Lot 1 of the project, a Contractor will support INRA, the Iranian Nuclear Regulatory Authority, – among other topics – in performing the review of the operator's self-assessment report and in establishing the Iranian National Stress Test Report.
* In Lot 2 of the project, another Contractor will support NPPD, the operator of BNPP-1, – among other topics – in performing the stress test self-assessment.

Therefore, some meetings at the interface of these two lots will be common to Lot 1 and Lot 2.

Furthermore, the multi-country INSC Training & Tutoring projects (MC3.01/13, MC3.01/14, MC3.01/16 and future successors) will be used to offer still additional training and tutoring opportunities to INRA staff from a catalogue of available topics.

# OBJECTIVE, PURPOSE & EXPECTED RESULTS

## Overall objective

The objective of this project is to enhance the capabilities of INRA and Iran more generally, mainly by sharing the experience of EU regulatory authorities and to contribute to international nuclear safety.

## Purpose

The purposes of this project are as follows:

* Support in the design of the Nuclear Safety Centre that will be established in the framework of the implementation of the Joint Comprehensive Plan of Action;
* Cooperate with the Iranian Nuclear Regulatory Authority to share experience and promote best international practices;
* Support improvements to the Iranian regulations on nuclear and radiation safety;
* Strengthen safety assessment capabilities;
* Support the implementation of the post-Fukushima stress test for Bushehr NPP;
* Provide training and tutoring.

## Results to be achieved by the Contractor

* Concept design for a nuclear safety center drafted and approved;
* Nuclear and radiation safety regulations established, or reviewed and improved;
* Training on Deterministic Safety Analysis delivered;
* Training on Probabilistic Safety Analysis delivered;
* Stress tests self-assessment report reviewed and approved;
* National Stress test Report established;
* Training and tutoring delivered.

# ASSUMPTIONS & RISKS

## Assumptions underlying the project

The project is assumed to contribute to the improvement of the governance in the policy area of nuclear safety in Iran. It will enhance the capacity and regulatory capabilities of the Iranian Nuclear Regulatory Authority INRA and its TSO, the Reactor and Nuclear Safety Research Institute.

It is assumed that the INRA and its TSO have sufficient human resources and are capable to undertake relevant measures aimed to contribute to implementation of the project in a safe and successful manner.

Successful implementation of the project requires the full support from the Iranian project partners. In addition, it is assumed that these organisations will mobilise the necessary resources and capabilities for the management of the project and make the required human resources available.

It is expected to establish a constructive dialogue among the project stakeholders as necessary, in order to solve potential issues at all stages of project implementation.

## Risks

The risks concerned with the project implementation are:

* Documents to be delivered by the local partners are not submitted in due time or delayed;
* Experts of the Partner Country needed for implementation of the project are not available during the specified period of time (possibly in case of exceeding the absorption capacity of INRA);

The above risks are planned to be mitigated through a close monitoring of project implementation.

# SCOPE OF THE WORK

## General

### Project description

The project will consist of four main activities implemented by the successful tenderer: firstly, support in the design of the Nuclear Safety Centre that will be established in the framework of the implementation of the Joint Comprehensive Plan of Action; secondly, cooperation with the Iranian Nuclear Regulatory Authority to share experience and promote best international practices, to support improvements in the Iranian regulations for nuclear and radiation safety, and to strengthen (deterministic and probabilistic) safety assessment capabilities; thirdly to support the implementation of the post-Fukushima stress test of the Bushehr NPP; and finally, further training and tutoring including a scientific visit and on-the-job training of Iranian officials.

### Geographical area to be covered

Tehran - Iran.

### Target groups

The Atomic Energy Organisation of Iran and the concerned Departments under its authority:

* The Iranian Nuclear Regulatory Authority (INRA), which is the national regulator;
* The regulator's Technical Support Organisation: the Reactor and Nuclear Safety Research Institute.

## Specific work

The contents of the various project tasks are described in the subsections below.

Task 0 addresses activities of project management, and tasks 1 to 4 are technical tasks.

Regarding the technical tasks, it is expected that most project resources will be spent on task 2 and 3.

The technical tasks (as well as the subtasks 2.1, 2.2.1 and 2.2.2) are to be implemented in parallel. Task 1 is to be implemented as soon as possible, and within 12 months. Task 3 will have to wait for input from NPPD, the operator of the Bushehr NPP, regarding the stress test self-assessment (methodology, self-assessment report).

### Task 0: Project Management

Objective of the task

The objective of this task is to manage all tasks, both technically and administratively, in an effective manner ensuring that its objectives are fully met within the foreseen schedule and budget.

The Contractor shall be responsible for managing the project in compliance with the instructions and requirements regarding project management as specified in further detail in these Terms of Reference (ToR). The Contractor is responsible for the overall management of the project and for preparing and/or issuing all documents and reports related to contractual and financial matters, including deliverables, cost statements and invoices, requests for contractual amendments, etc. The Contractor is responsible for preparing the detailed work plan, identifying technical interfaces within the project, input/output information, meetings and workshops, establishing the inception, progress, technical and final reports.

Activities to be performed in the task

The task shall include the following activities:

*a) Contractor*

At the initial (inception) stage of the project the Contractor shall:

* Establish a Joint Working Group consisting of the project managers and coordinators from all parties involved, as well as technical experts of the Contractor and the consortium partners who will be involved in the project implementation activities on a daily basis.
* Establish a Steering Committee with representatives from EC, the Contractor, and the Project Partner/End User.
* Organise an inception (kick-off) meeting not later than two months after the contract's date of entry into force. The inception meeting shall address organisational aspects; ascertain project implementation strategy, interaction patterns, necessary input information, schedule of input information supply and delivery submission, etc. In the interest of conducting an efficient inception meeting, it may be preceded by technical meetings, possibly per task, in order to update and to validate work plan and project implementation schedule.
* Develop a detailed project work plan, implementation schedule, working procedures and a project-specific Quality Assurance Plan (QAP), in agreement with the End User. The QAP includes, inter alia, the definition of
  + project organisation, responsibilities, interfaces
  + document control
* The following documents shall be submitted to the End User before the inception meeting:
  + work plan and project implementation schedule
  + draft of the Quality Assurance Plan
  + full list of project Key Performance Indicators (see Section 8.1 and Appendix 1)
* Based on the inception meeting results, the Contractor shall elaborate the Inception report including the detailed work plan with project implementation schedule, risk analysis and project Quality Assurance Plan.

During the project phases following the inception period the Contractor shall:

* Organise progress meetings and task meetings to enable timely and effective oversight and monitoring of project progress, both in terms of its quality and compliance with the project schedule and objectives.
* Issue project reports according to the reporting requirements (see Section 7).
* Organise a final meeting to evaluate the work performed (in particular, in terms of its main outcomes and their sustainability), disseminate the outcomes more widely and identify the need for and nature of future cooperation.

*b) End User*

In order to fulfil this project task, the End User shall:

* Delegate appropriately qualified personnel to participate actively in the project meetings, in the Joint Working Group and in the Steering Committee.
* Review and agree on the project work plan, implementation schedule, Quality Assurance Plan and list of project Key Performance Indicators.
* Organise the local aspects of the inception meeting, progress meetings and final meeting.
* Provide all required and available inputs, documents, information, etc. for achieving the best results during project implementation.
* Provide inputs to the meeting minutes, inception report, progress reports, individual tasks reports and final report.
* Review and approve the Inception report, progress reports, individual task reports and the Final report.

Expected deliverables

* Minutes of inception, progress and final meetings
* Inception report, including the consolidated detailed Project Work Plan, the detailed Project Schedule and the Project Quality Assurance Plan (QAP)
* Progress reports
* Task reports (see also below)
* Final report

### Task 1: Designing the future Nuclear Safety Centre

Objective of the task

The objectives of this task are:

* To perform a feasibility study together with INRA, describing in detail the technical and administrative requirements for the set-up of a modern and state-of-the-art Nuclear Safety Centre (NSC) compatible with the provisions foreseen in the JCPoA, supporting and facilitating technical and professional training and exchange of lessons learned for reactor and facility operators, regulatory authority personnel and related supportive organisations.

Activities of the task

The implementation of this task shall be compatible with the provisions foreseen in the JCPoA (in particular: JCPoA Annex III, §8 Nuclear Safety).

The intention of the Nuclear Safety Centre (NSC) to be established in Iran and affiliated to INRA – which shall be equipped with necessary tools, techniques and equipment – is to support and facilitate technical and professional training and exchange of lessons learned for reactor and facility operators, regulatory authority personnel and related supportive organisations (JCPoA Annex III, §8.6).

The task will be implemented in close coordination with international stakeholders, including the E3/EU+3 parties. International stakeholders shall be invited to participate in appropriate (sub)task activities. Eventually, however, the task activities will not necessarily include participation of all E3/EU+3 parties (according to JCPoA Annex III, §3).

The task shall be completed within 12 months after project start. The task shall include the following activities:

*a) Contractor*

The Contractor shall:

* Depict and assess together with INRA the practical (rather than theoretical) activities that could be progressively covered by the Nuclear Safety Centre, as well as its potential beneficiaries and stakeholders. Document it in a need assessment report.
* Review existing international experience from organisations having similar functions and similar facilities that may serve as a basis to develop the Iranian Nuclear Safety Centre. Document it in a review report.
* Taking into account the above, draft a feasibility study to design the Nuclear Safety Centre.
* Organise two or more workshops with INRA for the review of the draft feasibility study.
* Revise the draft feasibility study according to the comments provided and obtain endorsement from INRA.
* In agreement with the EC project manager, organise and conduct an international workshop inviting relevant Iranian and international stakeholders to present the feasibility study report.

Possible candidate activities and areas envisaged to be progressively covered by the NSC include the following (but not limited to):

1. Technical activities that typically belong to a TSO in support of a nuclear regulatory authority in the field of nuclear and radiation safety
   * with the capacity to perform specific scientific and technical calculations
   * with the corresponding knowledge management
   * eventually covering all nuclear installations (including NPP, RR, fuel cycle facilities)
2. International training center
   * supporting and facilitating technical and professional training and exchange of lessons learned for reactor and facility operators, regulatory authority personnel and related supportive organisations
   * hosting international workshops
3. International documentation center
   * with access to (internal) scientific and technical information in libraries, documents, reports, journals, books, etc. For example: OECD reports, National Regulator reports from other countries. The procedures to be used to get such access shall be investigated.
4. Laboratories
   * calculation and simulation center, with access to scientific and technical computer codes. The procedures to be used to get such access shall be investigated.
   * Simulator for research reactors.
   * radiation metrology laboratory
   * testing facility, including non-destructive testing laboratory
   * standard dosimetry laboratory
5. Emergency Preparedness and Response (EPR) center
   * with monitoring and management functions
   * with calculation tools for decision making process
   * with communication between countries in the region to enhance safety
6. Others, such as
   * Nuclear security and safeguards
   * Research and Development (R&D)

It is envisaged to progressively involve in the NSC the following entities (and in this order of priority):

1. INRA itself
2. A new TSO for INRA (as part of the NSC)
3. Other Iranian organisations (such as existing TSOs, nuclear reactor and nuclear facility operators, universities)

In a later stage, the NSC could still be opened to other countries

Interaction between the NSC and other centers having similar functions shall be encouraged. The interconnectivity to be envisaged, and the way how to realise it, shall be investigated.

The feasibility study shall explicitly address the technical / economic / operational aspects for the progressive establishment of the future NSC. It shall also contain elaborated proposals for the definition and the realisation of, inter alia, the following elements:

* Scope and objectives of the NSC;
* Stakeholders of the future NSC and their potential roles;
* Main functions, processes and activities, as well as possible synergies;
* Possible organisational structure(s);
* Outline for a roadmap (creation phase, operational phase, further stepwise development, corresponding time scales), and first draft action plan with the definition of priorities;
* Legal and administrative requirements;
* Knowledge management and human resource requirements;
* Infrastructure and technical requirements (offices, meeting facilities, laboratories, tools, techniques, equipment, etc.);
* Estimation of the costs involved.

*b) End User*

In order to fulfil this project task, the End User shall:

* Provide an input document specifying the needs and expectations of INRA regarding a future NSC. Discuss this document with the Contractor.
* Support the Contractor in the elaboration of all aspects of the feasibility study, and especially with respect to:
  + Identification of - and liaison with - potential stakeholders.
  + Specific legal aspects for Iran.
* Actively participate in discussions, workshops and meetings.
* Agree with the Contractor on the draft feasibility study, and approve the final feasibility study.
* Cooperate with the Contractor to organise and to conduct the international workshop.
* Review and endorse the task deliverables.

Expected deliverables

* Need assessment report;
* Review report on international similar facilities and experience;
* Minutes of the meetings and workshops;
* Draft feasibility study;
* Final feasibility study.

### Task 2: Support to the Iranian Nuclear Regulatory Authority

Objective of the task

The objectives of this task are:

* to jointly review and develop Iranian regulations for nuclear and radiation safety according to the IAEA standards, considering also EU and other relevant international standards;
* to enhance technical capacity in the development of safety assessments.

General remarks regarding training and tutoring

The subtask-related training and tutoring needs of INRA staff are identified in the sections below. The Contractor shall then provide for corresponding training and tutoring solutions, as follows:

* by actively referring to – and facilitating for participation in – adequate training and tutoring opportunities in the multi-country INSC Training & Tutoring projects (MC3.01/13, MC3.01/14, MC3.01/16 and future successors) where available, and/or
* by providing specific training and tutoring of INRA staff as part of the subtask activities in the present project, and/or
* by facilitating the participation of INRA staff in suitable external training activities – if any – on the project budget (after agreement of the EC project manager).

Where appropriate, the Contractor shall also consider the concept of 'training for trainers'.

In most cases, INRA personnel includes staff with (sometimes considerable) theoretical training but less practical experience, as well as newcomer staff. The Contractor shall take this into account, where appropriate, to optimise and to balance its proposals for training and tutoring.

INRA may also consider inviting representatives from its TSO and/or from the operator NPPD to selected training activities that are held in Iran.

#### Subtask 2.1: Review of regulations for nuclear and radiation safety in Iran

Objective of the subtask

The objective of this subtask is to review, together with INRA, the current Iranian regulations for nuclear and radiation safety and their alignment with European and international standards and best practice, to identify potential gaps, to make recommendations on the improvements required, to support INRA in the implementation of such improvements, to provide for relevant training and tutoring, and to encourage Iran to sign and to ratify the relevant safety conventions.

Activities of the subtask

The subtask shall include the following activities:

*a) Contractor*

The Contractor shall:

* Oversee the prevailing status and completeness of the legal and regulatory framework in Iran. A list of existing INRA/NNSD Regulations and Guides (latest versions) is given in Appendix 2. A list of INRA/NNSD Regulations for BNPP-2 (and their status) is given in Appendix 3.
* Support INRA in the finalisation of selected regulations, related guidance and technical documents - still under development or yet to be developed -, and in view of detailing and completing regulations applicable for existing installations: BNPP-1 (licensing and inspection during operation and decommissioning), for Research Reactors and for Fuel Cycle facilities.

A self-assessment with the IAEA SARIS tool is currently being performed. The detailed SARIS results will be available at contracting time. The identified gaps will constitute the main working topics for this subtask. Currently, the following XXX regulations are identified to be missing:

* + ... (to be defined at the Vienna IAEA GC meeting, 26 Sept 2016)
  + ...
  + ...
  + ...
  + ...

Prepare an action plan to address the issues identified by SARIS.

* In the field of ageing management and LTO, support INRA in developing regulations to be applied to BNPP-1 and to the research reactors. A training workshop shall also be held (see below).
* Support INRA in the finalisation of selected regulations, related guidance and technical documents needed for the current and the next stages of implementation of the upcoming BNPP-2 of type VVER-1000 AES-92. Site evaluation and environmental impact assessment (EIA) are performed, basic design is to be finalised by end 2016, start of construction by 2017. Provide corresponding training and tutoring (see below). Use the opportunity of the licensing of the new installation(s) for supporting the development of a consistently structured pyramid of regulatory documents.
* For the establishment or improvement of these regulations, propose and agree with INRA an adequate scope and working method to be adopted (e.g. comments/revisions by correspondence, training workshop, review workshop, joint development of selected parts of the regulations/guides, etc.), monitor the progress made, and differentiate or make necessary modifications in the working method in order to ensure its effectiveness and efficiency. In the particular case that a draft regulation or guide is not yet available, support INRA by e.g. providing relevant reference documents, and/or by jointly elaborating a concept document (table of contents, bullet lists) as a starting point for INRA, etc.
* Oversee important international treaties and conventions in the wider area of nuclear safety to which Iran has not yet acceded. The status of Iran's adherence to international conventions is given in Appendix 4.

Support INRA in accelerating Iran's accession to these international treaties and conventions that are not yet joined, e.g. by enhancing knowledge and sharing experience through focused training, by identifying and addressing any technical obstacles, by identifying laws and acts that would need to be amended or developed as a result of the Iranian accession to specific treaties and conventions. In particular:

* + Within the first year of the project, organise a practical workshop on the 'Convention on Nuclear Safety' and on the 'Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management', presenting the practices and experience of other countries in complying with the obligations forthcoming from these conventions, and then focusing on how to prepare the required reports.
  + Organise training on the topic of Physical Protection of Nuclear Materials, in view of the corresponding convention (see below).
* Identify related training and tutoring needs of INRA staff, and provide for training and tutoring.

Specific training activities shall include:

* + General training on regulatory approaches in the EU (prescriptive / performance-based / non-prescriptive)
  + Advanced training workshop on ageing management and LTO, in view of BNPP-1 and the Research Reactors.
  + Training on the topic of Physical Protection of Nuclear Materials, in view of the corresponding convention.
  + Targeted to the siting and the EIA for BNPP-2, training on nuclear regulatory issues of earth sciences including geology, seismicity, meteorology and hydrology, as well as models for seismic hazard assessment of nuclear installations. Calculation methods and computer codes used.

Specific tutoring activities shall include:

* + Targeted to analysis and review for NPP siting and EIA, tutoring for 2 people in the EU for up to 4 weeks.

*b) End User*

In order to fulfil this project subtask, the End User shall:

* Provide SARIS results (including an executive summary) and draft regulations for the identified gaps.
* Agree with the Contractor on an adequate working method for the finalisation of every regulation.
* Cooperate with the Contractor in developing / finalising the missing set of regulations.
* Cooperate with the Contractor for the acceleration of Iran's accession to international conventions.
* Actively participate in the workshops, and training and tutoring activities. Every tutee shall establish a detailed tutoring report.
* Review and endorse the subtask deliverables.

Expected deliverables

* Set of regulatory documents and guidance developed.
* Subtask report containing the description of the activities performed and results obtained (including working documents, minutes of meetings and proceedings of workshops, presentations and training material, tutoring reports).

#### Subtask 2.2: Safety Analysis

##### **Subtask 2.2.1: Co-operation with INRA in Deterministic Safety Analysis**

Objective of the subtask

The objective of this subtask is to cooperate with INRA to strengthen capabilities for independent review and verification of Deterministic Safety Assessments.

Current situation

Regarding deterministic safety assessments, INRA's current situation is similar to the one for probabilistic safety assessment (see subtask 2.2.2 for more details): the studies for BNPP-1 are performed by the vendor country, and are reviewed by the Russian TSO, VO "Safety". The corresponding calculation tools and specific input data are not available in Iran. For an independent assessment of these analyses and review results, INRA seeks to strengthen its own capabilities and to involve also the support of its Iranian TSO, the Reactor and Nuclear Safety Research Institute.

All these documents are available in English.

Activities of the subtask

The subtask shall include the following activities:

*a) Contractor*

The Contractor shall:

* Review the existing INRA methodology for the assessment of nuclear safety inspection reports. Provide INRA with proposals to enhance the methodology for the assessment of nuclear safety inspection reports for regulatory decision making.
* Develop and implement concrete proposals for the further development of capabilities within INRA in the field of Deterministic Safety Assessment. This will include transfer of knowledge, methodologies and practices through activities such as training courses, on-the-job training, workshops and possibly joint reviews. The priority areas where oversight and capabilities shall be enhanced are:
  + 1. Design Basis Accident analysis (including Loss of Coolant Accident analyses)
    2. Severe Accident analysis

In the current situation, INRA staff possesses basic information in these areas, but the advanced skills for performing the safety assessment are missing (for example: the skills for interpreting the results of calculations provided by the licensee).

Some specific topics regarding computer codes, as well as some specific topics for training and tutoring, are indicated below.

All proposed topics in these priority areas shall be set out in the technical offer of the Contractor and will be confirmed at the inception meeting in agreement with INRA.

* Present an overview of the use of computer codes and computer code systems for accident analysis. Investigate the issue of availability of relevant computer codes to INRA. Review and discuss the potentially available computer codes, including their validation and certification status, for the following technical areas:

In priority 1:

* + Reactor physics
  + Fuel behaviour
  + Thermal-hydraulics, including system codes

In priority 2:

* + Containment analysis
  + Severe Accident analysis, including core melting and relocation, vessel breach, direct containment heating, molten core-concrete interaction (MCCI), steam explosions, hydrogen combustion (mixing, deflagration, detonation), fission product release, transport, settling, re-suspension and removal in the reactor coolant system, containment behaviour, source term
  + Atmospheric dispersion and dose calculation

Develop proposals for suitable and appropriate codes to be acquired / procured by INRA. However, the supply of any equipment or computer codes to INRA is not a part of this service contract.

As the NSC is not yet established (see task 1), INRA is seeking in the short term for other opportunities to gain experience in using these computer codes. For this purpose, the Contractor shall propose INRA experts to spend some time in the EU for on-the-job training in using some of these computer codes.

* In order to implement the proposals above, propose and agree with INRA an adequate scope and working method to be adopted (e.g. training workshop with case studies, joint workshop reviewing concrete examples from Iran or other reference cases, etc.), monitor the progress made, and differentiate or make necessary modifications in the working method in order to ensure its effectiveness and efficiency. In the particular case that a required draft document is not yet available, support INRA by e.g. providing relevant reference documents, and/or by jointly elaborating a concept document (table of contents, bullet lists) as a starting point for INRA, etc.
* Identify related training and tutoring needs of INRA staff, and provide for training and tutoring.

Specific training activities shall include:

* + Investigate the possibility to make some computer codes for accident analysis (at least temporarily) available to INRA, and perform training in the use of a selection of suitable and appropriate computer codes for accident analysis in the technical areas mentioned above, with the objective that INRA staff will be able to prepare input data, run the codes, analyse the output and perform uncertainty and sensitivity analyses. This may also include practical training on real case exercises for the development of input decks for BNPP.
  + Practical training in the field of DBA analysis, in order to develop advanced skills, for example for interpreting the results of calculations provided by the licensee. This may also include practical training on real case results for BNPP-1 from existing calculations performed for BNPP.

The tutoring to be provided in Europe for INRA staff members shall include:

* + Opportunities to gain experience in using computer codes for accident analysis. For this purpose, the Contractor shall propose INRA experts to spend some time in the EU for on-the-job training in using some of these computer codes, possibly also working on real calculations for BNPP-1.

*b) End User*

In order to fulfil this project subtask, the End User shall:

* Provide background information on the current status in Iran of the topics in this subtask, and indicate current priority areas and expectations
* Discuss priorities with the Contractor and obtain a common agreement on the way forward.
* Agree with the Contractor on an adequate scope and working method for the further development of capabilities of INRA in the area of Deterministic Safety Analysis, and actively cooperate in its implementation.
* Select appropriate experts to participate in training and tutoring activities. Every tutee shall establish a detailed tutoring report.
* Review and endorse the subtask deliverables.

Expected deliverables

* Subtask report containing the description of the activities performed and results obtained (including working documents, minutes of meetings and proceedings of workshops, presentations and training material, tutoring reports).

##### **Subtask 2.2.2: Co-operation with INRA in Probabilistic Safety Analysis (PSA)**

Objective of the subtask

The main objective of this task is to support INRA in the strengthening of Probabilistic Safety Assessment capabilities, including regulatory review of PSA as well as PSA applications in the regulatory and decision making processes.

Current situation

Current Iranian regulatory requirements regarding PSA, formulated in the years 1990 during the construction phase and the first operational phase of BNPP-1, are mainly based on the Russian requirements and on the IAEA requirements from this period.

There exists a PSA level 1 study report for BNPP-1, established by the vendor country. The review of revisions 0 and 1 of the PSA was performed by the Russian TSO, VO "Safety", and the new PSA revision 2 is currently available. For an independent assessment of these analyses and review results, INRA seeks to strengthen its own capabilities and to involve also the support of its Iranian TSO, the Reactor and Nuclear Safety Research Institute. INRA does not have access to the corresponding (RiskSpectrum) computer model and code. The reliability data are available in paper format.

Likewise, reports for shutdown PSA, fire PSA and seismic PSA were submitted to INRA. INRA is considering requiring a PSA level 2 study as well (which actually seems already to be available to the operator NPPD, but which was not yet submitted to INRA). The level 2 PSA report mainly contains results obtained with the severe accident code SOCRAT, with boundary conditions and initial conditions (but without the actual input data).

All these documents are available in English.

Activities of the subtask

The subtask shall include the following activities:

*a) Contractor*

The Contractor shall:

* Based on EU and international good practice, provide and present an overview on PSA applications to regulatory activities, as well as on the use of PSA in the licensing process of NPPs. Provide examples from several EU countries that could be relevant to the specific case of Iran.
* Support INRA in establishing an overall policy for use of PSA. Advise and actively provide support in the selection of PSA applications to regulatory activities to be envisaged in Iran.
* Support INRA in establishing an appropriate Iranian regulatory guide for the use of PSA according to EU and international good practice (using adequate reference standards and guides) and in the perspective of the regulatory PSA applications to be envisaged.
* Support establishing and implementing a regulatory PSA review process at INRA according to EU and international good practice, and support INRA in developing a regulatory guide for the review of PSA.

Use existing PSA reports for BNPP-1 for further hands-on training and capacity building for reviewing the PSA, and also support INRA in interpreting existing review results from foreign and national TSOs.

* In order to implement the activities above, propose and agree with INRA an adequate scope and working method to be adopted (e.g. training workshop with case studies, joint workshop reviewing concrete examples from Iran or other reference cases, etc.), monitor the progress made, and differentiate or make necessary modifications in the working method in order to ensure its effectiveness and efficiency. In the particular case that a required draft document is not yet available, support INRA by e.g. providing relevant reference documents, and/or by jointly elaborating a concept document (table of contents, bullet lists) as a starting point for INRA, etc.
* Identify related training and tutoring needs of INRA staff, and provide for training and tutoring.

Specific training activities shall include (non-exhaustive list):

* + Comprehensive training for all the methodological steps to PSA. Devote particular attention to human reliability analysis, and to introducing PSA for external hazards other than seismic hazard.
  + As a general training, present and discuss an overview of PSA level 1, 2 and 3 computer codes. Address also the issue of availability of relevant computer codes to INRA, in particular the RiskSpectrum computer code (which is used in the vendor country), and facilitate access to the providers of the codes.

The supply of any equipment or computer codes to INRA is not a part of this service contract.

*b) End User*

In order to fulfil this project subtask, the End User shall:

* Provide background information on the current status in Iran of the topics in this subtask, and indicate current priority areas and expectations
* Discuss priorities with the Contractor and obtain a common agreement on the way forward.
* Agree with the Contractor on an adequate scope and working method for the further development of capabilities of INRA in the area of Probabilistic Safety Analysis, and actively cooperate in its implementation.
* Select appropriate experts to participate in training and tutoring activities. Every tutee shall establish a detailed tutoring report.
* Review and endorse the subtask deliverables.

Expected deliverables

* Overall policy for use of PSA.
* Iranian regulatory guides for review of PSA and for use of PSA.
* Subtask report containing the description of the activities performed and results obtained (including working documents, minutes of meetings and proceedings of workshops, presentations and training material, tutoring reports).

### Task 3: Support to INRA for the review of the BNPP Stress Test self-assessment and preparation of the Iranian National Stress Test Report

Objective of the task

The objective of this task is to support INRA in the preparation of the INRA requirements of the stress test and in the review of the self-assessment stress test (SAST) report of the Bushehr NPP, and to support INRA in the preparation of the National Stress Test Report for Iran. The preparation of INRA requirements will be based on the ENSREG stress test requirements, adapted to the national regulatory context and framework of Iran.

Activities of the task

The main activities of the Contractor in this task shall be the preparation of the INRA requirements of the stress test, the review of the SAST report and the review of the preliminary National Stress Test Report.

All information which during course of this task will be handed over to the Contractor, as well as the task results, shall be treated as confidential and shall not be under any circumstances be handed over to any third parties without prior written permission of INRA.The task shall include the following activities:

*a) Contractor*

The Contractor shall:

* Conduct a workshop with a detailed presentation on the ENSREG stress test specification and a discussion on its application in Iran. Address not only stress tests for NPPs, but also RRs. Support INRA in the preparation of the INRA requirements of the stress test for nuclear reactors, according to the ENSREG stress test specification, and including NPPs and RRs. Address and include the requirements for an Action Plan. Also include the expected Format and Content for the SAST. This activity shall be performed and completed immediately after the start of the project.
* Support INRA in the development of a written guideline for the regulatory review of the utilitie's stress test methodology and of the SAST report, and for the establishment of the national report. For this purpose, take also advantage of previous experiences and lessons learned from conducting the EU stress tests.
* Review the detailed stress test methodology proposed by NPPD, preferably in an early stage of the development of the SAST report in order to optimise the efficiency of the stress test activities. In agreement with INRA, the Contractor's review results shall be combined with those from INRA, and provided in an early stage by INRA to NPPD for consideration.

The review shall be carried out against INRA requirements, and shall also take advantage of previous experiences and lessons learned from conducting the EU stress tests.

* On request of INRA, review the SAST report, and especially the following sections:
  + Plant description (as BNPP is a unique design), to ensure that accurate, consistent and sufficient information is provided in a structured way, setting a common English vocabulary and common SSC denominations for the rest of the report, avoiding poor translations and subsequent confusion, avoiding the need for subsequent major revisions, and serving the purpose of the stress test. As many experts and future peer reviewers are not familiar with the – in several aspects unique – design of BNPP, the importance of this descriptive part shall not be underestimated.
  + Approach and results of plant assessment relative to earthquake, flooding and other extreme weather conditions.
  + Approach and results of plant assessment relative to Loss of Electrical Power and Loss of Ultimate Heat Sink.
  + Approach and results of plant assessment relative to Severe Accident Management.
  + Proposed studies and safety measures to be implemented.

The review shall be carried out against INRA requirements, and in view of general consistency and quality, and shall also take advantage of previous experiences and lessons learned from conducting the EU stress tests.

Before transferring his review results to INRA, the Contractor shall apply an internal quality assurance process (which is to be defined in detail in his technical offer), in order to ensure – inter alia – that all review results originating from different authors/organisations are compiled, resumed and integrated into a single homogenous, well-structured and sufficiently concise set of comments, without remaining contradictions or duplications (to avoid unnecessary overloading of INRA and NPPD). This should enhance the efficiency of the stress test activities.

* In agreement with INRA, the Contractor's review results shall be combined with those from INRA (applying again a quality assurance process), and fed by INRA into a process of comment resolution at NPPD. This process might require a few iterative steps before all important issues are resolved. In agreement with INRA, the Contractor shall participate in all these iterative steps, and review subsequent modifications to the SAST report.

On request of INRA, the Contractor shall participate in corresponding meetings between INRA and NPPD, and support INRA in obtaining clarifications where needed (e.g. during NPPD's presentation of the SAST report) and in addressing the regulatory comments (e.g. to help clarifying regulatory comments, to support INRA in the discussions). To allow for a proper review, appropriate time periods should be foreseen between receiving (updated) parts of the SAST report and conducting such joint meetings.

* Assist INRA in elaborating the National Stress Test Report, and above all perform a review of the National Stress Test Report in accordance with the INRA recommended Format and Content. This shall include the following:
  + In close cooperation with INRA, propose a method for transforming the SAST report into a harmonised and comprehensive National Stress Test Report. The Contractor shall take advantage of previous experiences and lessons learned from conducting the EU stress tests. On request of INRA, help establishing a distribution of tasks and an action plan with detailed milestones to be agreed.
  + In close cooperation with INRA, foresee in the National Stress Test Report also a National Action Plan (NAcP). This List of Actions shall contain the improvement measures following the outcome of the stress test (hardware and software modifications, further studies, decisions regarding operation of plants, indication of their implementation timescale) and required by the regulator INRA. This might be a different and longer list than the list of actions initially proposed by the operator NPPD.
  + Support INRA in identifying, requesting and obtaining in a timely way any additional information from NPPD that might be needed for the development of the National Stress Test Report. Help anticipating the point in time when the industrial contractor of the operator support project IRN3.01/16 Lot 2 will have completed his project duration time, possibly leaving some issues unresolved.
  + Review the National Stress Test Report as soon as there is a consistent draft version, and provide early feedback to INRA in the form of comments and possibly also with detailed recommendations as to their resolution. Conduct comment presentation and discussion meetings with INRA, as appropriate. Review subsequent updates of the National Stress Test Report. Until the final version of the National Stress Test Report is obtained, this review process might require a few iterations.

The review shall be carried out against INRA requirements, and shall also take advantage of previous experiences and lessons learned from conducting the EU stress tests.

* + Support INRA in addressing version control, and harmonisation of parts of the National Stress Test Report that are developed by different authors/organisations. The drafting language should be English from in the beginning, avoiding the need for constant translations, poor efficiency and delays.
* If delays or other reasons would lead to a certain overlap between (1) the review/update of the SAST report and (2) the elaboration of the National Stress Test Report, the Contractor shall be flexible and adopt its approach accordingly.
* If requested by INRA (and during the project duration time), support INRA in presenting the final National Stress Test Report to the European Nuclear Safety Regulators Group (ENSREG) for its international peer review.

*b) End User*

INRA (and its TSO) plays a major role in this task. INRA is responsible for the review the SAST report presented by the Iranian operator NPPD, and for the development of a consolidated version of the National Stress Test Report according to the INRA recommended Format and Content (see Appendix 6). In particular the development of the National Stress Test Report will require a major involvement of INRA’s human resources.

In order to fulfil this project task, the End User shall:

* In cooperation with the Consultant, establish the INRA stress test specification. Endorse the INRA stress test specification and put it formally in force, in view of the stress tests to be performed for Bushehr NPP (and later also for a RR).
* Review the detailed stress test methodology proposed by NPPD against ENSREG requirements. Consider also the Consultant’s review results. Provide combined review results to NPPD for consideration.
* Review the SAST report from NPPD against ENSREG requirements. Consider also the Consultant’s review results. Provide combined review results into a process of comment resolution at NPPD. This process might require a few iterative steps before all important issues are resolved. Cooperate with the Contractor in all these iterative steps, and review subsequent modifications to the SAST report. Consider involving the Contractor in support of INRA in corresponding meetings with NPPD. To allow for a proper review, appropriate time periods should be foreseen between receiving (updated) parts of the SAST report and conducting such joint meetings.
* Consider the Contractor’s proposal for transforming the SAST report into a harmonised and comprehensive National Stress Test Report. Agree on the approach to be adopted.
* Possibly in cooperation with the Contractor, establishing an internal distribution of tasks and an action plan with detailed milestones to establish the National Stress Test Report. In particular, estimate the human resources required from INRA (and its possible TSO’s) and provide them.

In cooperation with the Contractor, monitor the development of the preliminary National Stress Test Report.

* With the support of the Contractor, identify, request and obtain any additional information from NPPD that might be needed for the development of the National Stress Test Report.
* Consider the Contractor’s review results of the preliminary National Stress Test Report This review process might require a few iterations.
* Consider presenting the final National Stress Test Report to the European Nuclear Safety Regulators Group (ENSREG) for its peer review.

Expected deliverables

* …
* Review report, including all comments on the SAST report.
* Review report, including all comments on the National Stress Test Report.
* National Stress Test Report of Iran, prepared in accordance with the ENSREG Template and including a National Action Plan (NAcP)
* Task report containing the description of the activities performed and results obtained (including working documents, minutes of meetings and proceedings of workshops, presentations and training material).

### Task 4: Further training and tutoring activities

Objective of the task

The objective of this task is to provide further training and tutoring for INRA staff (not yet addressed in previous tasks).

General remarks regarding training and tutoring

The same general remarks on training and tutoring apply as in section 4.2.3.

Activities of the task

*a) Contractor*

The Contractor shall:

* Provide for the following training activities in Iran:
  + Advanced quality system management. How to make the quality management system (QMS) work in practice, and focus also on safety culture (1 week training WS in Iran). A QMS exists on paper for the scope of nuclear and radiation safety. INRA has no quality system certificate yet.
  + Advanced training on radiation protection (i.e. dose assessment techniques, shielding calculations, tools).
* Provide for the following tutoring activity in Europe:
  + Inspection programmes and joint inspections during operation of NPPs (tutoring, max 2 INRA staff)
* Provide for the following study visit to Europe:
  + Emergency preparedness and response, round trip visiting 2 to 3 EU countries,1.5 weeks, up to 4 people.
* The Contractor will also provide support for the support of INRA staff to attend international conferences/trainings/evens. The support will be limited to cover maximum 15 days of conference attendance per calendar year for maximum 3 experts alltogether.

*b) End User*

* Select appropriate experts to participate in training and tutoring activities. Every tutee shall establish a detailed tutoring report.
* Review and endorse the task deliverables.

Expected deliverables

* Task report containing the description of the activities performed and results obtained (including working documents, minutes of meetings and proceedings of workshops, presentations and training material, tutoring reports).

## Project management

### Responsible bodies

* Contracting Authority – European Commission
* Partner Country – Islamic Republic of Iran
* Beneficiary – Atomic Energy Organization of Iran (AEOI)
* End User – Iranian Nuclear Regulatory Authority (INRA), and its technical support organisation, the Reactor and Nuclear Safety Research Institute
* The Contractor
* EC Monitors

### Management structure

#### EU stakeholders

During the implementation of the project, the Contractor and the other project participants must interact with the European Commission (EC) through the following bodies involved in the implementation of the INSC programme:

* The unit B5 “Instrument for Stability, Nuclear Safety” of the Directorate General for International Cooperation and Development: this unit formulates the annual programme (on the basis of the multi-annual plan), identifies the projects, and is responsible for the project descriptions as well as for all tendering. The EC Project Manager responsible for the management of the work to be performed under this contract is based in unit B5.
* The unit B6 “Financial and Contract Management” of Directorate General for International Cooperation and Development: this unit is responsible for the financial management of the contract and invoice settlement.
* The EC Monitors: these are external experts mandated by the EU to check and monitor implementation of INSC projects in the Partner Country. They report to the EU.
* The future EU Delegation in Iran will be the local representative body of the EU.
* The Joint Research Centre (JRC) of the EU: JRC provides technical support to the EU services and is involved in ToR preparation, tender evaluation, project technical follow-up, review of reports, etc.

During the course of the implementation of the project, the Contractor and the other project participants should apply modern management practices in order to have a close follow-up of the project's progresses and regularly report to the European Commission (EC). The Contractor will use modern computer software tools for the management of the project.

After the signature of the contract, the Contractor will initiate with the Partner Country negotiation to have a **Communication Procedure** - describing the exchange of the documents between the partners - ideally signed before or at the latest at the Inception Meeting.

#### End User

The End User is the Iranian Nuclear Regulatory Authority (INRA) and its Technical Support Organisation, the Reactor and Nuclear Safety Research Institute.

The End User should provide during the inception phase full information of other past, ongoing and planned future cooperation projects. During implementation, it should, together with the Contractor, co-ordinate the work to avoid overlapping and ensure complementarities, as appropriate.

During the implementation of the contract, the End User shall:

* Approve the Inception Report as well as any further updates of the work plan and the schedule, and the project related procedures established by the Contractor.
* Prepare all formal documents that may be required for implementation of project tasks at the End User’s facilities by Partner Country’s national or industry standards, rules and regulations.
* Provide the Contractor with all necessary technical information, design documentation, specific local regulations, input data, etc., as required by these ToR or deemed necessary by the Contractor for performance of technical tasks and preparation of technical reports.
* Analyse the results of the project phases.
* Receive and comment on the project results, the final report and the specific deliverables.
* Provide, as necessary, information for the project-related actions taking place in or out of Iran.
* Endorse all technical deliverables of the project (reports or other products), before they enter the approval procedure as defined in Section 7.2 of these ToR.
* Support the Contractor in working at the End User’s facilities during project implementation. The End User shall arrange all necessary permits for the Contractor experts to access the specified End Users’ facilities and assist them in the work with the facility equipment to the extent necessary and permitted to the Contractor.
* Provide necessary interpretation from and to the Partner Country language for project-related activities, like workshops, training activities, visits to technical facilities, etc., taking place inside the Partner Country.
* Appoint a senior member of its staff to liaise with the Contractor and ensure that staff of an appropriate level is made available to work alongside the staff of the Contractor. Staff of the End User shall not be paid from project funds.
* Provide all reasonable assistance to solve unforeseen problems that the Contractor may face locally in Iran. The possible failure to solve some of the Contractor's problems encountered locally will not free the Contractor from meeting its contractual obligation vis-à-vis the Contracting Authority.

#### The Contractor

The Contractor is the legal person with whom the European Commission has concluded the contract. The Contractor is responsible for all the achievements of the project and for the assistance and transfer of know-how to the Partner Country organisations. He/she shall directly perform part of the work within the scope and limits that are described in these ToR.

The Contractor, inter alia, shall:

* Assure the interface with the European Commission (DEVCO B5). In particular, the Contractor's Project Leader will regularly brief and de-brief the European Commission project manager on meetings and achievements.
* Assure the co-ordination between all participating organisations and definition of procedures for exchange of information.
* Establish the planning and schedule of the activities as well as the inception report.
* Perform the project according to the scope, as described in these Terms of Reference, and the agreed time schedule.
* Survey other related activities and establish inter-relationships with other parties involved in the work of this project.
* Prepare the administrative reports and technical task reports as described in Section 7 and have them circulated for approval according to the procedure set out in Section 7.2.
* Organise regular project progress meetings and prepare minutes of the meetings; the minutes will be produced in English.
* Be responsible for translating selected technical reports and related written deliverables (User‘s manuals, training/workshop materials, etc.) into Iranian language, if justified. The selection will be proposed and justified by INRA and agreed by the project partners (some documents to be delivered to higher level authorities (e.g. to Governmental or Ministerial levels) shall be translated to Iranian language).
* Provide necessary interpretation from and to the Partner Country language for project-related activities, like workshops, training activities, visits to technical facilities, etc., taking place outside the Partner Country. Note that in principle interpretation may be required only for those events, where participants are mainly from other Iranian stakeholders and not only from INRA.
* Assure a sound financial project management.
* Organise the final project meeting and participate in the final project presentation for the dissemination of results.
* Assure coordination with other cooperation or support projects (e.g. IAEA) in order to avoid overlaps.
* Take care, in accordance with applicable procedures of the European Commission, of:
  + Travel, accommodation, local travel, subsistence and medical insurance for the experts of the counterpart organisations who will be travelling to/within/from the European Union (EU) at the request of the Contractor.
  + The necessary interpretation in case of visits and joint work in the EU countries.
  + Local transport and accommodation arrangements for the above mentioned experts when they travel with or at the request of the Contractor outside their normal place of work.
  + Translation of documents when necessary

Meetings between the Contractor and EuropeAid Project Manager and other appropriate EU Commission services will be organised by the respective parties as appropriate. Meetings between representative of the End User, the Contractor, the EuropeAid Project Manager, Commission Delegation may be called as appropriate.

### Project language

The official language of the project is English. The working language for the documentation within the project is English and/or Farsi, as appropriate.

All input and working documents (normative, technical, training, etc.) will be submitted to the Contractor in Farsi language; the English versions shall be provided, if available. Most documents are however available in English. The volume of translations to be foreseen by the Contractor is mentioned in section 6.5 on Incidental Expenditure.

The technical reports and deliverables prepared by the Contractor are prepared in English as specified in Section 7.2.

# LOGISTICS AND TIMING

## Location

Iran, Tehran and Bushehr Nuclear Power Plant, and possibly other locations linked to the work of the Action, e.g. research reactors, fuel cycle facilities or other locations where nuclear and radiation activities are carried out in Iran.

The operational base for the project shall be Tehran and the Bushehr Nuclear Power Plant (BNPP) (Iran).

The normal places of posting of the Contractor are Tehran and the Bushehr Nuclear Power Plant (Iran) and the premises of the Contractor.

## Start date and period of implementation

The intended start date is the Contract signature and the period of implementation of the contract will be **42 months** from this date. Please refer to Articles 19.1 and 19.2 of the Special Conditions for the actual start date and period of implementation.

An explicit work plan and schedule must be provided in the Contractor's "Organisation and Methodology" document. At the project start, a detailed schedule identifying the various interfaces of the project, input/output information, deliverables, etc. will be laid down by the Contractor with the agreement of the End User in the "Inception Report".

# REQUIREMENTS

## Staff

Note that civil servants and other staff of the public administration, of the Partner Country or of international/regional organisations based in the country, shall only be approved to work as experts if well justified. The justification should be submitted with the tender and shall include information on the added value the expert will bring as well as proof that the expert is seconded or on personal leave.

A team of experts belonging to or with experience at Regulatory Authorities/TSOs from different EU Member States shall be set up to cooperate with and support the Partner organisation. Their experience in partner relations with the Iranian regulator and its technical support organization, as well as familiarity with current nuclear regulatory requirements of Iran would be an asset.

Clearly structured information shall be provided in the Contractor’s "Organisation and Methodology" for the following items:

* A diagram covering the responsibilities for each of the tasks of the project, involving the Contractor, the End User and other stakeholders. This diagram shall indicate the names of the key persons carrying responsibility for the management of the work.
* A table regarding the breakdown of planned manpower, providing the expected number of man-days, per task (also indicating the part spent in the EU and in Iran), and in total.
* A log frame matrix, clearly indicating objectives, targets, inputs, outputs, milestones, progress and performance indicators, monitoring, etc. Examples given in Appendixes I A and I B should be adapted and developed in the offer.

### Key experts

Key experts have a crucial role in implementing the contract.

These terms of reference contain the required key experts’ profiles. The tenderer shall submit CVs and Statements of Exclusivity and Availability for the following key experts.

The profiles of the key experts for this contract are as follows:

Key expert 1: Project Leader

Qualifications and skills:

General professional experience:

Specific professional experience:

This Key expert is also expected to carry out large parts of xxx.

Key expert 2: Senior expert Nuclear Safety Regulation

Qualifications and skills:

General professional experience:

Specific professional experience:

This Key expert is also expected to carry out large parts of xxx.

Key expert 3: Senior expert Nuclear Safety Assessment

Qualifications and skills:

General professional experience:

Specific professional experience:

This Key expert is also expected to carry out large parts of xxx.

Key expert 4: Senior expert Nuclear Safety Assessment focused on ST

Qualifications and skills:

General professional experience:

Specific professional experience:

This Key expert is also expected to carry out large parts of xxx.

All experts must be independent and free from conflicts of interest in the responsibilities they take on.

(no other language than EN, no regional experience)

### Non-key experts

CVs for non-key experts should not be submitted in the tender but the tenderers will have to demonstrate in their offer that they have access to experts with the required profiles.

The Contractor must select and hire other experts as required according to the profiles identified in the Organisation & Methodology or these Terms of Reference. They must indicate clearly which profile they have so it is clear which fee rate in the budget breakdown will apply. All experts must be independent and free from conflicts of interest in the responsibilities they take on.

Two types of experts can be distinguished:

* Senior experts: they should have at least 10 years professional experience in the area defined for the tasks they will be committed to;
* Junior experts: they should have at least 5 years professional experience in the area defined for the tasks they will be committed to.

The selection procedures used by the Contractor to select these non-key experts shall be transparent, and shall be based on pre-defined criteria, including professional qualifications, language skills and work experience. The findings of the selection panel shall be recorded.

The selected experts shall be subject to approval by the Contracting Authority before the start of their implementation of tasks.

### Support staff & backstopping

The Contractor will provide support facilities to their team of experts (back-stopping) during the implementation of the contract.

The support staff shall include personnel in charge of administrative and financial management of the project.

Backstopping and support staff costs must be included in the fee rates of the experts.

## Office accommodation

Office accommodation of a reasonable standard and of approximately 10 square metres for the experts while working in Tehran or at the BNPP on this contract is to be provided by the Partner Country/End User.

The workplaces shall be equipped with desks, chairs, telephone and Internet connection. The costs for the telephone line and Internet connection are to be covered by the fees.

## Facilities to be provided by the Contractor

The Contractor shall ensure that experts are adequately supported and equipped. In particular it shall ensure that there is sufficient administrative, secretarial and interpreting provision to enable experts to concentrate on their primary responsibilities. It must also transfer funds as necessary to support its activities under the contract and to ensure that its employees are paid regularly and in a timely fashion.

## Equipment

No equipment (hardware or software) is to be purchased on behalf of the Contracting Authority / Partner Country as part of this service contract or transferred to the Contracting Authority / Partner Country at the end of this contract.

## Incidental expenditure

The Provision for incidental expenditure covers the ancillary and exceptional eligible expenditure incurred under this contract. It cannot be used for costs which should be covered by the Contractor as part of its fee rates, as defined above. Its use is governed by the provisions in the General Conditions and the notes in Annex V of the contract. It covers:

* Travel costs and subsistence allowances for missions, outside the normal place of posting, undertaken as part of this contract:
* Travel costs and subsistence allowances for missions of **EU experts**, outside the normal places of posting, undertaken as part of this contract (within EU or within Iran). These travels must receive prior written approval by the EC Project Manager.
* Travel costs, per diems, visa and insurance expenses for missions to be undertaken as part of this contract by **technical experts** **of the Beneficiary/End User** outside Tehran or BNPP (to EU or within Iran) (e.g Working Group meetings, workshops, project progress meetings, scientific visits or training organised by the Contractor). These travels must receive prior written approval by the EC Project Manager.
* Logistics costs related to all meetings (kick-off, working group meeting, progress meetings, final meeting), scientific visits, expert visits, workshops and trainings (renting of meeting rooms, renting of technical equipment, catering services etc).
* Cost related to translation of documents: To be foreseen are: up to 100 pages for the translation of Farsi input documents into English (mainly documents on radiation safety), and ca. 150 pages for the translation of the final version of the Stress Test National Report from English into Farsi. Interpretation is not necessary.

It is reminded that the travels to/from the base of operations and per diems of international experts are included in their fee rates.

Note: all invitation letters have to be provided at least 1 month in advance to allow for visa application.

The provision for incidental expenditures is **230.000.** This amount must be included unchanged in the Budget Breakdown.

Daily subsistence costs may be reimbursed for missions foreseen in these terms of reference or approved by the Contracting Authority, and carried out by the contractor’s authorised experts, entailing overnight stays outside the expert’s normal place of posting.

The per diem is a flat-rate maximum sum covering daily subsistence costs. These include accommodation, meals, tips and local travel, including travel to and from the airport. Taxi fares are therefore covered by the per diem. Per diem are payable on the basis of the number of hours spent on the mission by the contractor's authorised experts for missions carried out outside the expert's normal place of posting. The per diem is payable if the duration of the mission is 12 hours or more. The per diem may be paid in half or in full, with 12 hours = 50% of the per diem rate and 24 hours = 100% of the per diem rate. Any subsistence allowances to be paid for missions undertaken as part of this contract must not exceed the per diem rates published on the website - <http://ec.europa.eu/europeaid/work/procedures/implementation/per_diems/index_en.htm>

- at the start of each such mission.

The Contracting Authority reserves the right to reject payment of per diems for time spent travelling, if the most direct route and the most economical fare criteria have not been applied.

Prior approval by the Contracting Authority for the use of the incidental expenditure is not needed [with the exception of training for INRA experts in the EU.

## Lump sums

No lump sums are foreseen in this contract.

## Expenditure verification

The Provision for expenditure verification covers the fees of the auditor who has been charged with the expenditure verification of this contract in order to proceed with the payment of any pre-financing instalments and/or interim payments.

The Provision for expenditure verification for this contract **is € 30.000**. This amount must be included unchanged in the Budget breakdown.

This provision cannot be decreased but can be increased during the execution of the contract.

# Reports

## Reporting requirements

Please see Article 26 of the General Conditions. Interim reports must be prepared every six months during the period of implementation of the tasks. They must be provided along with the corresponding invoice, the financial report and an expenditure verification report defined in Article 28 of the General Conditions. There must be a final report, a final invoice and the financial report accompanied by an expenditure verification report at the end of the period of implementation of the tasks. The draft final report must be submitted at least one month before the end of the period of implementation of the tasks. Note that these interim and final reports are additional to any required in Section 4.2 of these Terms of Reference.

Each report must consist of a narrative section and a financial section. The financial section must contain details of the time inputs of the experts, incidental expenditure and expenditure verification.

To summarise, in addition to any documents, reports and output specified under the duties and responsibilities of each key expert above, the Contractor shall provide the following reports:

|  |  |  |
| --- | --- | --- |
| **Name of report** | **Content** | **Time of submission** |
| Inception Report | Analysis of existing situation and work plan for the project | No later than 1 month after the start of implementation |
| 6-month Progress Report | Short description of progress (technical and financial) including problems encountered; planned work for the next 6 months accompanied by an invoice and the expenditure verification report. | No later than 1 month after the end of each 6-month implementation period. |
| Draft Final Report | Short description of achievements including problems encountered and recommendations. | No later than 1 month before the end of the implementation period. |
| Final Report | Short description of achievements including problems encountered and recommendations; a final invoice and the financial report accompanied by the expenditure verification report. | Within 1 month of receiving comments on the draft final report from the Project Manager identified in the contract. |

For the sake of dissemination of project results and possible re-use for similar projects in other countries, the Contractor shall provide the European Commission with electronic copies of all deliverables and any training material prepared under this project.

A final press release, summarizing the achievements of the project, shall be pro­duced by the Contractor and has to be approved by the EC before publication;

A final presentation meeting for the dissemination of the project results organized by the Contractor. The proposal for such meeting needs approval from the End User and from the Commission in order to ensure the dissemination of the results under an audience as wide as possible. Organization and costs (except the travel expenses of EC representatives) shall be borne by the Contractor (part of incidental expenditure). There­fore the Contractor shall include a proposal for the organization and attendance of such meeting in his offer as well as a provision for its cost in his financial proposal.

## Submission and approval of reports

Three copies of the reports referred to above must be submitted to the Project Manager identified in the contract. The reports must be written in English. The Project Manager is responsible for approving the reports. The End User shall be involved in commenting on and approving the reports.

# MONITORING AND EVALUATION

The project will be monitored according to standard procedures as the "EU Result Oriented Monitoring Programme for the European Neighbourhood and Partnership Countries and for the Instrument for Nuclear Safety Cooperation (INSC)". Project monitoring and evaluation will be based on periodic assessment of progress on delivery of specified project results and towards achievement of project objectives.

## Definition of indicators

Suitable, objectively quantifiable, Key Performance Indicators related to the project itself and the impact of the project on nuclear safety have been defined by the Contracting Authority, supported as necessary by the Monitoring Consultant, and are presented in the Indicative Framework Matrix (Appendix 1).

## Special requirements

None

# LIST OF ACRONYMS

AAP Annual Action Programme

AEOI Atomic Energy Organization of Iran

AD Action Document

AM Ageing Management

BDBA Beyond Design Basis Accident

BNPP Bushehr Nuclear Power Plant, subsidiary of NPPD

CFD Computational Fluid Dynamics

DBA Design Basis Accident

DEVCO EuropeAid Co-operation Office (EC)

DSA Deterministic Safety Assessment

E3/EU+3 China, Russia, USA / EU + France, Germany, United Kingdom

EC European Commission

EEAS European External Action Service (EU)

ENSREG European Nuclear Safety Regulators Group

EOP Emergency Operating Procedure

EPR Emergency Preparedness and Response (also: EP&R)

ESARDA European Safeguards Research and Development Association

EU European Union

Euratom European Atomic Energy Community

EuropeAid EuropeAid Co-operation Office (EC)

IAEA International Atomic Energy Agency

INRA Iranian Nuclear Regulatory Authority, part of AEOI

INSC Instrument for Nuclear Safety Cooperation (EC)

ISO International Organization for Standardization

JCPoA Joint Comprehensive Plan of Action, agreed between E3/EU+3 and Iran

JRC Joint Research Centre (EC)

JWG Joint Working Group

KPI Key Performance Indicator

KWU Kraftwerk Union

LOCA Loss of Coolant Accident

LOOP Loss of Off-site Power

LTO Long Term Operation

MCCI Molten Core-Concrete Interaction

NAcP National Action Plan (from the Regulatory Authority) (Stress Test)

NIAEP-ASE Nizhny-Novgorad Atomenergoproekt – Atomstroyexport

NNSD National Nuclear Safety Directorate (INRA)

NNSG National Nuclear Safeguards Directorate (INRA)

NPP Nuclear Power Plant

NPPD Nuclear Power Production & Development Company of Iran, subsidiary of AEOI

NRA Nuclear Regulatory Authority

NRPD National Radiation Protection Directorate (INRA)

NSC Nuclear Safety Centre

OJT On-the-job Training

PHARE Poland and Hungary: Assistance for Restructuring their Economies (EC)

PSA Probabilistic Safety Assessment

PWR Pressurised Water Reactor

RA Regulatory Authority

RP Radiation Protection

RR Research Reactor

QA Quality Assurance

SA Severe Accident

SAM Severe Accident Management

SAMG Severe Accident Management Guidelines

SAR Safety Analysis Report

SAST report Self-Assessment Stress Test report (from the Licensee)

SBO Station Blackout

SSC Systems, Structures and Components

ST Stress Test

T&T Training and Tutoring

TACIS Technical Assistance to the Commonwealth of Independent States (EC)

TC Technical Cooperation (IAEA)

ToR Terms of Reference

TSO Technical Support Organisation (to a Regulatory Authority)

UHS Ultimate Heat Sink

VVER Vodo-Vodianoï Energuetitcheski Reaktor (Water-Water Energy Reactor)

WENRA Western European Nuclear Regulators Association

# Appendix 1: Indicative framework matrix

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Intervention Logic** | **Objectively Verifiable Indicators** | **Sources of Verification** | **Assumptions and risks** |
| **Overall Objective** |  |  |  |  |
| **Project Purpose** |  |  |  |  |
| **Activities** |  |  |  |  |
|  |  |  |  |  |

# Appendix 2: List of existing INRA/NNSD Regulations and Guides (latest versions)

|  |  |  |
| --- | --- | --- |
| **N°** | **Label** | **Title** |
| 1 | INRA-NS-WI-200-30-01-0 | \* Working instruction for inspection of Nuclear Facilities |
| 2 | INRA-NS-RG-051-33/03-0-Nov.2004 | Guidelines for Supervision over Observance of Safety Assurance Requirements during Carrying out Electrical Equipment Installation in BNPP-1 Construction |
| 3 | INRA-NS-RG-051-33/02-0-Nov.2004 | Guidelines for Supervision over Observance of Safety Assurance Requirements during Installation of Mechanical Equipment in the BNPP-1 Construction |
| 4 | INRA-NS-RG-051-33/01-0-Nov.2004 | Guidelines for Supervision over Observance of Safety Assurance Requirements in Implementation of Civil Construction and Installation Activities in BNPP-1 Construction |
| 5 | INRA-NS-RG-051-33/04-0-Nov.2004 | Guidelines for Supervision over Observance of Safety Assurance Requirements in Installation of I&C Equipment, Engineering means and Subsystems in BNPP-1 Construction |
| 6 | INRA-NS-RE-051-34/01-0-Jun.2009 | Instructions for Supervision over Safety Assurance in BNPP-1, Commissioning |
| 7 | INRA-NS-RE-051-33/01-0-Nov.2004 | Instruction for Supervision over Safety Assurance in BNPP-1, Construction |
| 8 | INRA-NS-RG-051-13/01-0-Aug.2007 | Procedure for Registration of the Bushehr Nuclear Power Plant Vessels and Pipelines Operating Under Pressure |
| 9 | INRA-NS-PR-051-37/02-0-Jan.2007 | Procedure for Regulatory Supervision over Nuclear and Radiation Safety During Fresh and Spent Fuel Handling at the BNPP-1 |
| 10 | INRA-NS-PR-051-33/01-0-Feb.2007 | Procedure for Supervision and Control of Technical Examination of the BNPP-1،Equipment and Pipelines Operating under Pressure |
| 11 | INRA-NS-RE-051-10/03-2- Jan.2010 | Procedure of Granting Permits for the BNPP-1 Construction and Commissioning |
| 12 | INRA-MA-RE-200-50/01-0-Jun.2010 | Regulations on Radioactive Waste Management |
| 13 | INRA-NS-RE-051-35/01-0-Nov.2008 | Regulations For Supervision Over Fire Safety Assurance at the BNPP-1 |
| 14 | INRA-NS-RE-051-10/01-1- Oct.2013 | Licensing Procedure for the BNPP-1 Construction and Operation |
| 15 | INRA-NS-RE-080-10/01-0-Feb.2002 | Licensing Procedure for Non-Reactor Nuclear Fuel Cycle Facilities |
| 16 | INRA-NS-RE-061-10/01-0-Dec.2001 | Licensing Procedure for Tehran Research Reactor Operation & Decommissioning |
| 17 | INRA-NS-RE-051-10/02-0-Aug.2004 | Procedure of Granting Permits for Design, Manufacturing & Transportation of the BNPP-1 Fresh Nuclear Fuel & Associated Core Components |
| 18 | INRA-NS-RE-080-50/01-7- Nov.2006 | Quality Assurance Criteria for Nuclear Facilities |
| 19 | INRA-NS-RE-010-50/01-0-Oct.2007 | Regulation for Licensing of Uranium Mining and Milling Facilities |
| 20 | INRA-NS-RE-052-10/01-1-Sep.2007 | Regulation for Licensing of IR-360 Nuclear Power Plant |
| 21 | INRA-NS-RE-051-55/01-0-Jan.2008 | Regulations for Radiation Protection during Operation of BNPP-1 |
| 22 | INRA-NS-RE-080-56/01-0-Jul.2008 | Regulations for Radiation Protection during Operation of Uranium Fuel Cycle Facilities |
| 23 | INRA-NS-RE-051-16/01-1- Jun.2010 | Requirements for Obtaining License by Shift Personnel of the BNPP-1 |
| 24 | INRA-NS-RE-051-14/01-0-Feb.2006 | Requirements on the BNPP-1 Reactor Plant Passport |
| 25 | INRA-NS-RE-080-57/01-1-May2005 | Safety Regulations for Nuclear Fuel Transportation by Vehicle |
| 26 | INRA-NS-RE-050-57/01-1-Dec.2004 | Safety Regulations for Storage, Transportation & Handling of Fresh Nuclear Fuel at a Nuclear Power Plant |
| 27 | INRA-NS-RE-050-30/01-0- Nov.2006 | Supervisory Procedure for Assurance of Safety of Nuclear Power Plants in Iran |
| 28 | INRA-NS-PL-051-30/01-0-Jan.2009 | General Plan of Inspection in Stage of the BNPP-1 Construction, Commissioning, Operation and Decommissioning |
| 29 | INRA-NS-LI-000-50/01-0-Mar.2008 | IAEA, USNRC and INRA Safety Regulations and Guides for nuclear Facilities |
| 30 | INRA-NS-PR-051-50/01-0- Dec.2000 | The Procedure of Flow and Review of Documents for BNPP-1 Completion and Reconstruction |
| 31 | INRA-NS-RG-200-50/01-1-Feb.2007 | Administrative Regulation for National Nuclear Safety Department |
| 32 | INRA-NS-PR-051-30/01-0-Oct.2001 | The Procedure of Performance of QA Audits at the Organizations Engaged in the BNPP-1 Completion Project |
| 33 | INRA-NS-AD-200-30/01-0-Mor.1387 | \* Administrative documents for Inspection group |
| 34 | INRA-NS-RE-000-52/01-0-Kho.1388 | \* Regulations of determination of Exclusion area, low populated zone and distance of population center from Nuclear facilities |
| 35 | INRA-NS-WI-000-20/01-1-Meh.1388 | \* Working instruction for preparation of safety assessment reports |
| 36 | INRA-NS-RE-062-10/01-Oct.2009 | Licensing procedure IR-40 nuclear research Reactor |
| 37 | INRA-NS-RE-060-10/01-0-Oct.2009 | Regulation for Licensing Procedure of “HWZPR/MNSR” Research Reactors Operation & Decommissioning |
| 38 | INRA-NS-PR-051-00/01-01-Mar.2013 | Procedure of investigation and registration of safety-related events at BNPP-1 |
| 39 | INRA-NS-RE-062-10/01-1-Apr.2010 | Regulation for licensing of IR-40 nuclear research reactor |
| 40 | INRA-NS-RG-062-00/01-0- Apr.2010 | The procedure of granting permits for IR-40 construction and commissioning |
| 41 | INRA-NS-PR-050-00/01-0-Jan.2011 | Quality Audits Procedure for the Organizations Engaged in NPPs Installation and Operation |
| 42 | INRA-NS-RE-052-05/01-0-Jan.2011 | Requirements for Obtaining License by Shift Personnel of IR-360 |
| 43 | INRA-NS-RE-052-30/01-0-Jan.2011 | Regulation for Supervision over Fire Safety Assurance at IR-360 |
| 44 | INRA-NS-RG-062-10/01-0-Jan.2011 | The Procedure of Flow and Review of Licensing Documents for IR-360 Nuclear Power Plant Administrative Document |
| 45 | INRA-NS-WI-200-08/01-0-Ord.1390 | \* Working instruction for NNSD newcomers staff in BNPP-1 site |
| 46 | INRA-NS-PR-051-10/01-0-Jun.2011 | Procedure for INRA/NNSD Approval of Operating Organization Decisions Important to BNPP-1 Nuclear and Radiation Safety |
| 47 | INRA-NS\_RE-000-02/01-0-Jan.2012 | Regulation for Siting of Nuclear Installation |
| 48 | INRA-NS-PR-051-15/01-0-May.2012 | Procedure of Consideration of BNPP-1 Operational Documents, OD Modifications, OD Revisions, FSAR chapter modifications & Technical Decisions by INRA/NNSD and FSUE VO ”Safety” |
| 49 | INRA- NS-RE-051-15/01-0- Jan.2014 | Regulation for Granting Permits during Operation of BNPP-1 |
| 50 | INRA-NS-RG-052-33/01-0-Oct.2013 | Guidelines for Inspection of Civil Construction and Installation Activities at NPP |
| 51 | INRA-NS-RG-051-25/01-0-Tir.1393 | \* Regulatory requirements for preparing reports for liquid and gaseous releases from BNPP-1 |
| 52 | INRA-NS-RG-200-10/01-0-Aug. 2014 | Software Certification Process |
| 53 | INRA-NS-RE-000-01/01-0-Mar.2015 | Seismic Regulations for Safety of Nuclear Installations |
| 54 | INRA-NS-WR-080-35/01-0-Bah-1393 | \* Procedure for reporting of events in fuel cycle facilities |
| 55 | INRA-NS-RE-000-00/01-8-Nov.2014 | Management system Regulations for nuclear facilities |

\*: These marked documents are only available in Farsi.

# Appendix 3: List of INRA/NNSD Regulations for BNPP-2 (and their status)

| No. | Subject | Status |
| --- | --- | --- |
| 1 | Basic Radiation Safety Standards (Rev. 0, October 1999) | Available |
| 2 | Safety Requirement for Nuclear power Plants | In preparation |
| 3 | Management System Regulation for Nuclear Facilities | In preparation |
| 4 | Regulations for Siting of Nuclear Installation | Available |
| 5 | Regulation for Licensing of Bushehr-2 Nuclear Power Plant | In preparation |
| 6 | Regulatory Supervision over Safety Assurance of NPPs | Available |
| 7 | Regulatory Supervision for Storage, Transportation, and Handling of Fresh Nuclear Fuel at NPPs | Available |
| 8 | Regulatory Supervision over Nuclear and Radiation Safety during Fresh and Spent Fuel Handling at the BNPP-2 | In preparation |
| 9 | Requirements on the BNPP-2 Reactor Plant Passport | Available |
| 10 | Requirements for Obtaining License by Shift Personnel of the BNPP-2 | Available |
| 11 | Procedure of Granting Permits for Design, Manufacturing, Transportation of Fresh fuel and Associated core components at NPPs | In preparation |
| 12 | Instructions for Supervision over Safety Assurance in BNPP-2 Siting | In preparation |
| 13 | Instructions for Supervision over Safety Assurance in BNPP-2 Construction | Available |
| 14 | Instructions for Supervision over Safety Assurance in BNPP-2 Commissioning | Available |
| 15 | Regulatory Supervision and Control of Technical Examination of Equipment and Pipelines Operating under Pressure at NPPs | Available |
| 16 | Guidelines for Supervision over Safety Assurance Requirements in Installation of I&C Equipment, Engineering-mean and Subsystems in BNPP-2 Construction | In preparation |
| 17 | Guidelines for Supervision over Safety Assurance Requirements in Installation of Civil construction and Installation Activities in BNPP-2 Construction | Available |
| 18 | Guidelines for Supervision over Safety Assurance Requirements during Installation of Mechanical Equipment in BNPP-2 Construction | Available |
| 19 | Guidelines for Supervision over Safety Assurance Requirements during Carrying out Electrical Equipment Installation in BNPP-2 Construction | In preparation |
| 20 | Quality Audits procedure for the Organizations Engaged in NPPs Design, Manufacturing, Installation and Operation | Available |
| 21 | Regulation for Radiation Protection during Operation of NPPs | Available |
| 22 | Procedure of Granting Permits during Siting, Design, Manufacturing, Construction, Commissioning, and Operation of BNPP-2 (Rev.0, 2014) | In preparation |
| 23 | Regulations for Supervision over Fire Safety Assurance at the BNPP-2 | Available |
| 24 | Regulations on Radioactive Waste Management | Available |
| 25 | Instruction of Investigation and Registration of Safety-related Events at BNPP-2 | In preparation |
| 26 | Procedure for Registration of the BNPP-2 Vessels and Pipelines Operating under Pressure | Available |
| 27 | Procedure of Flow and Review of Documents for BNPP-2 Construction and Operation (Rev.0, 2014) | In preparation |
| 28 | Procedure for INRA/NNSD Approval of Operating Organization Decision Important to BNPP-2 Nuclear and Radiation Safety (Rev.0, 2014) | In preparation |
| 29 | Software Certification Process | Available |
| 30 | Regulation on Emergency Preparedness and response for Nuclear Facilities on site | In preparation |
| 31 | Regulation on Seismic Safety on Nuclear Facilities | Available |

# Appendix 4: Status of Adherence to International Conventions in Iran

1. Joined Conventions / Protocols:
2. Convention on Early Notification of a Nuclear Accident
3. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
4. Additional Protocol on Safeguards Agreements
5. Conventions not yet joined, but recommended by INRA and currently under consideration at Government Level:
6. Convention on Nuclear Safety
7. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
8. Convention on the Physical Protection of Nuclear Materials
9. Vienna Convention on Civil Liability for Nuclear Damage

# Appendix 5: ENSREG stress test specification

# Appendix 6: WENRA Contents and Format of the Final Stress Test Report

Post-Fukushima “stress tests” of european nuclear power plants – CONTENTS AND FORMAT OF National Reports

This document is intended to provide guidance for the European Nuclear Regulators and for the European Nuclear Licensees on application of ENSREG document ***Annex I, EU “Stress test” specifications***. It is obvious that each Licensee will in addition take into account the specifications given by his National Nuclear Regulator.

The guidance is given by way of indication. It is liable to be adjusted during the writing and integration of the report (e.g. to summarize aspects to improve comprehensibility of licensee’s explanations). It should be used by the European Nuclear Licensees so that the reports are as homogeneous as possible.

The National Reports shall be written in English and be aimed for full release to the public. They should be detailed enough to give adequate understanding of the robustness of the design but avoid revealing security relevant details. This implies that presenting information on details of systems design and on location and physical protection of equipment should be avoided.

The Licensee Reports are preferably also written in English. These reports should be available as reference material for the peer reviews. They shall provide accurate information as explained in this guidance, including systems details, the plant lay-out, and equipment location. This information could partly be released to the public as identified by the authors, but some parts are evidently sensitive from security point of view. No details must be released that could be used for planning terrorist acts to the plants.

For giving a good overview of the robustness of the design, a comprehensive and detailed description should be presented at the beginning of the report on all systems that could be used for providing or supporting main safety functions. Guidance on this information is given under Section 1.3. This information can then be referred to in later text, without a need to repeat it in detail.

# General data about site/plant

## Brief description of the site characteristics

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

## Main characteristics of the units

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

## Systems for providing or supporting main safety function

In this section, 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.

### 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.

### Heat transfer from reactor to the ultimate heat sink

#### 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.

#### 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.

#### 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).

#### 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).

#### 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).

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

#### 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).

#### Respective information on lay out, physical protection, time constraints of use, power sources, and cooling of equipment as explained under 1.3.2.

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

#### 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).

#### Respective information on lay out, physical protection, time constraints of use, power sources, and cooling of equipment as explained under 1.3.2.

### AC power supply

#### Off-site power supply

* + - * 1. Information on reliability of off-site power supply: historical data at least from power cuts and their durations during the plant lifetime.
        2. 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.

#### Power distribution inside the plant

* + - * 1. Main cable routings and power distribution switchboards.
        2. Lay-out, location, and physical protection against internal and external hazards.

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

* + - * 1. On-site sources that serve as first back-up if offsite power is lost.
        2. Redundancy, separation of redundant sources by structures or distance, and their physical protection against internal and external hazards.
        3. Time constraints for availability of these sources and external measures to extend the time of use (e.g., fuel tank capacity).

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

* + - * 1. 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).
        2. Respective information on location, physical protection and time constraints as explained under 1.3.5.3.

#### 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

* + - * 1. Potential dedicated connections to neighbouring units or to nearby other power plants.
        2. Possibilities to hook-up transportable power sources to supply certain safety systems.
        3. Information on each power source: power capacity, voltage level and other relevant constraints.
        4. 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, as well as arrangements for accessing these, including where they are stored (both in relation to the site and protection from potential hazards), and whether they are shared between units or sites.

### Batteries for DC power supply

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

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

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

#### Alternative possibilities for recharging each battery bank.

## Significant differences between units

This section 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.

## Scope and main results of Probabilistic Safety Assessments

Scope of the PSA is explained both for level 1 addressing core meltdown frequency and for level 2 addressing frequency of large radioactive release as consequence of containment failure.

At each level, and depending on the scope of the existing PSA, the results and respective risk contributions are presented for different initiating events such as random internal equipment failures, fires, internal and external floods, extreme weather conditions, seismic hazards.

Information is presented also on PSA’s conducted for different initiating conditions: full power, small power, or shutdown.

# Earthquakes

Both the reactor and spent fuel pools, as well as spent fuel storages at site, are to be considered.

## Design basis

### Earthquake against which the plant is designed

#### Characteristics of the design basis earthquake (DBE)

Level of DBE expressed in terms of maximum horizontal peak ground acceleration (PGA). If no DBE was specified in the original design due to the very low seismicity of the site, PGA that was used to demonstrate the robustness of the as built design.

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

Expected frequency of DBE, statistical analysis of historical data, geological information on site, safety margin.

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

Reassessment of the validity of earlier information taking into account the current state-of-the-art knowledge.

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

#### Identification of systems, structures and components (SSC) that are required for achieving safe shutdown state and are most endangered during an earthquake. Evaluation of their robustness in connection with DBE and assessment of potential safety margin.

#### Main operating contingencies in case of damage that could be caused by an earthquake and could threaten achieving safe shutdown state.

#### Protection against indirect effects of the earthquake

* + - * 1. 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.
        2. Loss of external power supply that could impair the impact of seismically induced internal damage at the plant.
        3. Situation outside the plant, including preventing or delaying access of personnel and equipment to the site.
        4. Other indirect effects (e.g. fire or explosion).

### Compliance of the plant with its current licensing basis

#### 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.

#### 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.

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

## Evaluation of safety margins

### Range of earthquake leading to severe fuel damage

Weak points and cliff edge effects: estimation of PGA above which loss of fundamental safety functions or severe damage to the fuel (in vessel or in fuel storage) becomes unavoidable.

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

Estimation of PGA that would result in loss of integrity of the reactor containment.

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

Possibility of external floods caused by an earthquake and potential impacts on the safety of the plant. Evaluation of the geographical factors and the physical possibility of an earthquake to cause an external flood on site, e.g. a dam failure upstream of the river that flows past the site.

### Measures which can be envisaged to increase robustness of the plant against earthquakes

Consideration of measures, which could be envisaged to increase plant robustness against seismic phenomena and would enhance plant safety.

# Flooding

Both the reactor and spent fuel pools, as well as spent fuel storages at site, are to be considered.

## Design basis

### Flooding against which the plant is designed

#### Characteristics of the design basis flood (DBF)

Maximum height of flood postulated in design of the plant and maximum postulated rate of water level rising. If no DBF was postulated, evaluation of flood height that would seriously challenge the function of electrical power systems or the heat transfer to the ultimate heat sink.

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

Reassessment of the maximum height of flood considered possible on site, in view of the historical data and the best available knowledge on the physical phenomena that have a potential to increase the height of flood. Expected frequency of the DBF and the information used as basis for reassessment.

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

### Provisions to protect the plant against the design basis flood

#### 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.

### Plant compliance with its current licensing basis

#### 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.

#### 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.

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

## Evaluation of safety margins

### Estimation of safety margin against flooding

Estimation of difference between maximum height of flood considered possible on site and the height of flood that would seriously challenge the safety systems, which are essential for heat transfer from the reactor and the spent fuel to ultimate heat sink.

### Measures which can be envisaged to increase robustness of the plant against flooding.

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

# Extreme weather conditions

## Design basis

### Reassessment of weather conditions used as design basis

#### 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.

#### Postulation of proper specifications for extreme weather conditions if not included in the original design basis.

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

#### Consideration of potential combination of weather conditions.

#### Conclusion on the adequacy of protection against extreme weather conditions

## Evaluation of safety margins

### Estimation of safety margin against extreme weather conditions

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.

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.

### Measures which can be envisaged 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.

# Loss of electrical power and loss of ultimate heat sink

For writing Chapter 5, it is suggested that detailed systems information given in Section 1.3 is used as reference and the emphasis is in consecutive measures that could be attempted to provide necessary power supply and decay heat removal from the reactor and from the spent fuel.

Chapter 5 should focus on prevention of severe damage of the reactor and of the spent fuel, including all last resort means and evaluation of time available to prevent severe damage in various circumstances. As opposite, the Chapter 6 should focus on mitigation, i.e. the actions to be taken after severe reactor or spent fuel damage as needed to prevent large radioactive releases. Main focus in Chapter 6 should thus be in protection of containment integrity.

## Nuclear power reactors

### Loss of electrical power

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.

#### Loss of off-site power

* + - * 1. Design provisions taking into account this situation: back-up power sources provided, capacity and preparedness to take them in operation.
        2. Autonomy of the on-site power sources and provisions taken to prolong the time of on-site AC power supply

#### Loss of off-site power and loss of the ordinary back-up AC power source

* + - * 1. Design provisions taking into account this situation: diverse permanently installed AC power sources and/or means to timely provide other diverse AC power sources, capacity and preparedness to take them in operation
        2. Battery capacity, duration and possibilities to recharge batteries

#### Loss of off-site power and loss of the ordinary back-up AC power sources, and loss of permanently installed diverse back-up AC power sources

* + - * 1. Battery capacity, duration and possibilities to recharge batteries in this situation
        2. Actions foreseen to arrange exceptional AC power supply from transportable or dedicated off-site source
        3. Competence of shift staff to make necessary electrical connections and time needed for those actions. Time needed by experts to make the necessary connections.
        4. Time available to provide AC power and to restore core cooling before fuel damage: consideration of various examples of time delay from reactor shutdown and loss of normal reactor core cooling condition (e.g., start of water loss from the primary circuit).

#### Conclusion on the adequacy of protection against loss of electrical power

#### Measures which can be envisaged to increase robustness of the plant in case of loss of electrical power

### Loss of the ultimate heat sink

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.

#### Design provisions to prevent the loss of the primary ultimate heat sink, such as alternative inlets for sea water or systems to protect main water inlet from blocking.

#### Loss of the primary ultimate heat sink (e.g., loss of access to cooling water from the river, lake or sea, or loss of the main cooling tower)

* + - * 1. Availability of an alternate heat sink
        2. Possible time constraints for availability of alternate heat sink and possibilities to increase the available time.

#### Loss of the primary ultimate heat sink and the alternate heat sink

* + - * 1. External actions foreseen to prevent fuel degradation.
        2. Time available to recover one of the lost heat sinks or to initiate external actions and to restore core cooling before fuel damage: consideration of various examples of time delay from reactor shutdown to loss of normal reactor core cooling condition (e.g., start of water loss from the primary circuit).

#### Conclusion on the adequacy of protection against loss of ultimate heat sink

#### Measures which can be envisaged to increase robustness of the plant in case of loss of ultimate heat sink

### Loss of the primary ultimate heat sink, combined with station black out (i.e., loss of off-site power and ordinary on-site back-up power source).

#### Time of autonomy of the site before loss of normal reactor core cooling condition (e.g., start of water loss from the primary circuit).

#### External actions foreseen to prevent fuel degradation.

#### Measures, which can be envisaged to increase robustness of the plant in case of loss of primary ultimate heat sink, combined with station black out

## Spent fuel storage pools

Where relevant, equivalent information is provided for the spent fuel storage pools as explained in Section 5.1 for nuclear power reactors.

### Loss of electrical power

#### Measures which can be envisaged to increase robustness of the plant in case of loss of electrical power

### Loss of the ultimate heat sink

#### Measures which can be envisaged to increase robustness of the plant in case of loss of ultimate heat sink

### Loss of the primary ultimate heat sink, combined with station black out (i.e., loss of off-site power and ordinary on-site back-up power source).

#### Measures, which can be envisaged to increase robustness of the plant in case of loss of primary ultimate heat sink, combined with station black out

# Severe accident management

## Organisation and arrangements of the licensee to manage accidents

Section 6.1 should cover organization and arrangements for managing all type of accidents, starting from design basis accidents where the plant can be brought to safe shutdown without any significant nuclear fuel damage and up to severe accidents involving core meltdown or damage of the spent nuclear fuel in the storage pool.

### Organisation of the licensee to manage the accident

#### Staffing and shift management in normal operation

#### Plans for strengthening the site organisation for accident management

#### Measures taken to enable optimum intervention by personnel

#### Use of off-site technical support for accident management

#### Procedures, training and exercises.

### Possibility to use existing equipment

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

#### Provisions for and management of supplies (fuel for diesel generators, water, etc.)

#### Management of radioactive releases, provisions to limit them

#### Communication and information systems (internal and external).

### Evaluation of factors that may impede accident management and respective contingencies

#### Extensive destruction of infrastructure or flooding around the installation that hinders access to the site

#### Loss of communication facilities / systems

#### Impairment of work performance due to high local dose rates, radioactive contamination and destruction of some facilities on site

#### Impact on the accessibility and habitability of the main and secondary control rooms, measures to be taken to avoid or manage this situation

#### Impact on the different premises used by the crisis teams or for which access would be necessary for management of the accident

#### 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 installations at site, including considerations of restricted availability of trained staff to deal with multi-unit, extended accidents.

### Conclusion on the adequacy of organisational issues for accident management

### Measures which can be envisaged to enhance accident management capabilities

## Accident management measures in place at the various stages of a scenario of loss of the core cooling function

### Before occurrence of fuel damage in the reactor pressure vessel/a number of pressure tubes (including last resorts to prevent fuel damage)

### After occurrence of fuel damage in the reactor pressure vessel/a number of pressure tubes

### After failure of the reactor pressure vessel/a number of pressure tubes

## Maintaining the containment integrity after occurrence of significant fuel damage (up to core meltdown) in the reactor core

### Elimination of fuel damage / meltdown in high pressure

#### Design provisions

#### Operational provisions

### Management of hydrogen risks inside the containment

#### Design provisions, including consideration of adequacy in view of hydrogen production rate and amount

#### Operational provisions

### Prevention of overpressure of the containment

#### Design provisions, including means to restrict radioactive releases if prevention of overpressure requires steam / gas relief from containment

#### Operational and organisational provisions

### Prevention of re-criticality

#### Design provisions

#### Operational provisions

### Prevention of basemat melt through

#### Potential design arrangements for retention of the corium in the pressure vessel

#### Potential arrangements to cool the corium inside the containment after reactor pressure vessel rupture

#### Cliff edge effects related to time delay between reactor shutdown and core meltdown

### Need for and supply of electrical AC and DC power and compressed air to equipment used for protecting containment integrity

#### Design provisions

#### Operational provisions

### Measuring and control instrumentation needed for protecting containment integrity

### Capability for severe accident management in case of simultaneous core melt/fuel damage accidents at different units on the same site

### Conclusion on the adequacy of severe accident management systems for protection of containment integrity

### Measures which can be envisaged to enhance capability to maintain containment integrity after occurrence of severe fuel damage

## Accident management measures to restrict the radioactive releases

### Radioactive releases after loss of containment integrity

#### Design provisions

#### Operational provisions

### Accident management after uncovering of the top of fuel in the fuel pool

#### Hydrogen management

#### Providing adequate shielding against radiation

#### Restricting releases after severe damage of spent fuel in the fuel storage pools

#### Instrumentation needed to monitor the spent fuel state and to manage the accident

#### Availability and habitability of the control room

### Conclusion on the adequacy of measures to restrict the radioactive releases

### Measures which can be envisaged to enhance capability to restrict radioactive releases

1. *Vodo-Vodianoï Energuetitcheski Reaktor or* *Water Water Energy Reactor* [↑](#footnote-ref-1)