**Minutes of IAEA Expert Mission (12-15-July 2015)**

1. Introduction

(in this part the IAEA Technical Cooperation Framework and the description of the meeting will be included, prepared by Diego Telleria and discussed with BNPP and the Iranian Nuclear Regulator). To be finished up to August 2015.

List of participants and agenda is attached.

The IAEA will include in this introduction the justifications based on existing and in-preparation Safety Standards used to identify ESTE software as a suitable tool for supporting the decisions by the BNPP regarding protection of the public and the environment.

1. Objectives of the protocol for “Adaptation of ESTE software for Bushehr NPP”

The following protocol is established to determine the technical features necessary to facilitate the implementation of the system ESTE at Bushehr NPP.

The counterparts identified in this protocol will provide the necessary information and discuss any necessary aspects with the aim to reach an agreement.

The responsible organizations and the time schedule will be indicated in each of the topical issues (a summary table with responsibility and time schedule will be prepared).

1. Protocol of Technical Issues
   1. Hardware requirements (configuration of clients, servers, GPGPU CUDA for LPM)
      * The Provider indicated the hardware requirements (see annex 1)
      * hardware will be provided by BNPP
      * hardware must be ready at the time of installation on-site
   2. Input data requirements (formats, example of data, modifiable input data by user )
      * Formats requirements were discussed and the Provider provided the list of data (see annex 2)
      * BNPP will revise the list of requirements for the format and will submit the proposal of the formats, content and the example files to the Provider (August, September 2015)
      * Annex 3 consists of the list of parameters to be input by the user including meteorological data, technological and radiological data, etc. The possibility to modify the data by the user will be indicated, for e.g. change of units (mSv to Sv)
      * The acquisition of automatic meteorological data and the radiological data from the emergency planning zone was agreed
      * Stability category class (Pasquill category) should be provided by the user (BNPP). The Provider will propose methods to define the stability classes from available meteorological data at BNPP. BNPP will select and apply appropriate method.
   3. Manual / automatic-online inputs (interface, usb flash)
      * Discussion on manual and online inputs was done and possibilities for both modes of input data were described, for e.g. via usb flash, etc.
      * The Provider ensures that the code will accept both modes of data inputs
      * Definition of mode of use of the code (manual or automatic) is subject to the user (BNPP)
   4. Technical documentation
      * The Provider will prepare the full User Manual initially in English language (September 2015) and in Russian language (at the time of delivery)
      * The list of scientific references used for the models in the code will be included in the User Manual
      * Model descriptions (Puff Trajectory Model PTM, Lagrangean Particle Model LPM,…) will be included in the User Manual
      * The executable version of the code was prepared using the programming language C# and .NET Framework. The system (client and server) is running under Windows operation system
      * The testing, benchmarking and validation process of the systems will be described in the annexes to the User Manual
   5. Language of graphical user interface (English, Russian, warning messages in Farsi)
      * Language of the graphical user interface of client will be implemented in English and Russian (selectable by the operator of the specific client, switchable during the run)
      * Warning messages will be displayed in the selected language and also in Farsi
   6. Sea thermal plume of discharges in the coastal water
      * Thermal plume for the marine discharges will be considered at the local level in the vicinity of the discharge point in the Persian Gulf
      * The model will be described in User Manual (see d.)
   7. Technical support and maintenance (updates, upgrades, support during exercises)
      * The Provider will deliver the technical support and maintenance subject to the initial contract with IAEA and if necessary to additional contract which may result. An initial period for technical support and maintenance will be specified in the initial contract (for e.g. 6 months).
      * Some basic updates will be provided in the frame of technical support and maintenance specified in the initial contract.
      * For major upgrades further contract will be discussed.
      * Support to preparation of the scenarios for nuclear emergency exercises can be provided by the Provider in the frame of initial contract and can be subject of further future contract.
   8. Trial period
      * Trial period will be specified in the initial contract where the BNPP could report to the Provider the existence of technical issues or problems which were detected by the users (BNPP), for e.g. additional messages, changes in colors, background maps and problems with the installation or running of the system.
   9. Training (basic, advanced)
      * Basic 2-3 days training for the users of the code will be provided at the moment of installation of the system on-site of BNPP. The number of participants will be defined by BNPP. The training includes practical exercises.
      * Expected time needed for the installation of the system and testing of correct installation on-site is 2 days.
      * Advanced training can be provided for professional selected by BNPP either at the premises of the Provider (reduced number of participants) and if more participants at the IAEA (advanced training course at the IAEA). IAEA will explore funding options for the advanced training within the Technical Cooperation Programme.
      * The contents and length of the basic and advanced training will be discussed between IAEA, BNPP and the Provider. The content and the length of the training will be proposed by the Provider.
   10. Operating systems (Win 7, Win Server, MS Office - requirements and provision)
       * The licenses for operating systems and MS Office will be included in the provision of the code subject to the initial contract.
   11. Security aspects (client-server communication, data, plant safety)
       * The system is designed in such a way not to interfere with the plant safety.
       * The communication between clients implemented on-site or remote (headquarter or regulator) and server is secured by encryption (TLS) and certificates.
       * The system enables to operate using different levels of rights (to input data manually, to operate the system) controlled by passwords and user names. The users can be defined by the main responsible operator of the system.
   12. Scheme for implementation
       * According to the contract the following scheme for implementation is expected:
         1. One (minimum) or more central servers for emergency (BNPP or BNPP + headquarter + regulator)
         2. One (minimum) or more clients for emergency (BNPP or BNPP + headquarter + regulator)
         3. One stand-alone application for routine effluent (BNPP). Report can be prepared to provide for the regulator and headquarters, … .
   13. Networks, connections
       * The network and connections (between clients and servers, and between servers and data sources) is the responsibility of BNPP.
   14. Confidentiality (IAEA Confidentiality Framework, additional confidentiality needed, e.g. use of data, detectors, equipment, reference, publications, papers, citations, copy rights)
       * The provision is subject to the IAEA Confidentiality Framework.
       * Additional confidentiality needed by BNPP will be included in the initial contract, e.g. use of data, detectors, equipment, reference, publications, papers, citations, copy rights.
       * BNPP will provide to the IAEA the additional confidentiality demands which will be imposed by the IAEA to the Provider (October 2015).
2. Finance

The provisions of financial support for the obtaining of the system described in the current protocol including additionally related activities like training or the delivery of required hardware are subject to the budget of the IAEA Technical Cooperation Programme and will need all the clearance by the national organization and the IAEA.

The IAEA will provide to the BNPP an initial estimation of the cost of the provision and the budget that is approved by the Technical Cooperation Department and will inform the BNPP the details and including the additional financial support if needed (for e.g. to expand the number of clients, number of servers, advanced training, etc.).

The IAEA will provide this information in September 2015.

**Annex 1: Hardware requirements**

Server for emergency (for example HP proline DL370G3, or HP Z840):

|  |  |
| --- | --- |
|  |  |
|  | Opt. |
| **CPU** | Xeon, E5540, 2,53 GHz |
| **RAM** | 12 GB |
| **HDD** | 240 GB SATA, RAID 1 |
| **GPU** | Nvidia Quadro 2200/4200 |
| **GPGPU** | Nvidia Tesla c2050 / k20 |
| **Other** | DVD/CD-ROM, keyboard, mouse |
| **OS** | WIN Server 2008 64bit (EN) |
| **LCD** | resolution min 1280x1024 |

Client for emergency (for example Dell OptiPlex 3030, HP ProOne400):

|  |  |
| --- | --- |
|  |  |
|  | Opt. |
| **CPU** | Intel (R) Core(TM) i5-3470 3,20GHz |
| **RAM** | 6 GB |
| **HDD** | min 40 GB SATA |
| **GPU** | 1GB (e.g. NVIDIA Quadro 400 / 420) |
| **GPGPU** | - |
| **Other** | DVD/CD-ROM, keyboard, mouse, all-in-one type of desktop PC |
| **OS** | Windows 7 64bit (EN) |
| **LCD** | resolution min 1280x1024 |

Stand-alone application for routine effluents (for example Dell OptiPlex 9030, HP ProOne600):

|  |  |
| --- | --- |
|  |  |
|  | Opt. |
| **CPU** | Intel(R) Core(TM) i7-3612QM CPU @ 2.10GHz |
| **RAM** | 8 GB |
| **HDD** | 240 GB SATA, RAID 1 |
| **GPU** | 1GB (e.g. NVIDIA Quadro 400 / 420) |
| **GPGPU** | - |
| **Other** | DVD/CD-ROM, keyboard, mouse, all-in-one type of desktop PC |
| **OS** | Windows 7 64bit (EN) |
| **LCD** | resolution min 1280x1024 |

**Annex 2: The list of required data (including formats of common inputs), system for normal operational effluents**

*Formats requirements were discussed and the Provider provided the list of data*

*BNPP will revise the list of requirements for the format and will submit the proposal of the formats, content and the example files to the Provider (August, September 2015)*

**Content:**

1) Normal effluents - meteorological data (\*.xls, or \*.txt file), structure

2) Airborne effluents data (\*.xls or \*.txt file), structure (noble gasses known as a group)

3) Airborne effluents data (\*.xls or \*.txt file), structure (noble gasses known by nuclides)

4) Liquid discharges data (\*.xls or \*.txt file), structure (noble gasses known by nuclides)

5) The list of other parameters and data assumed for normal operation

6) TABLE – Croplands, Wheat, Barley, Grapes, Apples, Oranges, Greenhouses

7) Table - livestock (meat), density of livestock per area

8) Table - milk, production of milk

9) Population by villages, by age at the 100 km vicinity of the BNPP

**1) Normal effluents - meteorological data (\*.xls, or \*.txt file), structure:**

| **Hourly averages** | | | | |
| --- | --- | --- | --- | --- |
|  | **Wind direction** | **Wind rate**  (in 10 m) | **Precipitation** | **Pasquill category of stability** |
| **Date, time** | **[°]** | **[m/s]** | **[mm/h]** | **[1/2/3/4/5/6 ]** |
| 01.01.2014 | 119,75E+00 | 5,23E+00 | 000,00E+00 | 4,00E+00 |
| 01.01.2014 01:00 | 117,08E+00 | 5,30E+00 | 000,00E+00 | 4,00E+00 |
| 01.01.2014 02:00 | 120,33E+00 | 5,46E+00 | 000,00E+00 | 4,00E+00 |
| 01.01.2014 03:00 | 120,92E+00 | 5,98E+00 | 000,00E+00 | 4,00E+00 |
| 01.01.2014 04:00 | 118,50E+00 | 5,55E+00 | 000,00E+00 | 4,00E+00 |
| 01.01.2014 05:00 | 113,45E+00 | 6,51E+00 | 000,00E+00 | 4,00E+00 |

etc.

**2) Airborne effluents data (\*.xls or \*.txt file), structure (noble gasses known as a group):**

txt format:

*the first row:* Airborne effluents

*the second row:* Period from: 01-01-2014

*the third row:* Period to: 31-12-2014

*other rows: name of nuclide, dimension (=Bq), effluent in the 1.month, effluent in the 2.month, effluent in the 3.month, etc., ..., effluent in the 12.month,*

"noble gasses","Bq","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14"

"I-131 aer.","Bq","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08"

"I-131 el.","Bq","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09"

"Sr-90","Bq","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06"

"Cs-137","Bq","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07"

etc.

or xls format:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Airborne effluents |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period from 01-01-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period to 31-12-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| noble gasses | Bq | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 |
| I-131 aer. | Bq | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 |
| I-131 el. | Bq | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 |
| Sr-90 | Bq | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 |
| Cs-137 | Bq | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 |

etc.

**3) Airborne effluents data (\*.xls or \*.txt file), structure (noble gasses known by nuclides):**

txt format:

*the first row:* Airborne effluents

*the second row:* Period from: 01-01-2014

*the third row:* Period to: 31-12-2014

*other rows: name of nuclide, dimension (=Bq), effluent in the 1.month, effluent in the 2.month, effluent in the 3.month, etc., ..., effluent in the 12.month,*

"Xe-133","Bq","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14"

"Ar-41","Bq","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14","0,8E+14"

"Kr-85","Bq","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12","3E+12"

"I-131 aer.","Bq","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08"

"I-131 el.","Bq","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09","5,2E+09"

"Sr-90","Bq","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06"

"Cs-137","Bq","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07"

etc.

or xls format:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Airborne effluents |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period from 01-01-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period to 31-12-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Xe-133 | Bq | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 |
| Ar-41 | Bq | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 | 8E+13 |
| Kr-85 | Bq | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 | 3E+12 |
| I-131 aer. | Bq | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 |
| I-131 el. | Bq | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 | 5.2E+09 |
| Sr-90 | Bq | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 |
| Cs-137 | Bq | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 |

etc.

**4) Liquid discharges data (\*.xls or \*.txt file), structure (noble gasses known by nuclides):**

txt format:

*the first row:* Liquid effluents

*the second row:* Period from: 01-01-2014

*the third row:* Period to: 31-12-2014

*other rows: name of nuclide, dimension (=Bq), effluent in the 1.month, effluent in the 2.month, effluent in the 3.month, etc., ..., effluent in the 12.month,*

"H-3","Bq","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14","1,67E+14"

"I-131 aer.","Bq","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08","1,7E+08"

"Sr-90","Bq","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06","7,8E+06"

"Cs-137","Bq","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07","1,6E+07"

etc.

or xls format:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Liquid effluents |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period from 01-01-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Period to 31-12-2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H-3 | Bq | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 | 1.6E+14 |
| I-131 aer. | Bq | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 | 1.7E+08 |
| Sr-90 | Bq | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 | 7,8E+06 |
| Cs-137 | Bq | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 | 1,6E+07 |

etc.

**5) The list of other parameters and data assumed for normal operation:**

| Parameter | Value | Response from the BNPP |
| --- | --- | --- |
| Height of ventilation stack (airborne effluents point) | 115 m |  |
| Lat | 28.829264° N |  |
| Long | 50.886541° E |  |
|  | | |
| discharge point distance from the shore, (pipe to the gulf); | 1250 m |  |
| Lat | ? |  |
| Long | ? |  |
|  | | |
| coastal current (parallel to the shoreline) overall circulation is counter clockwise,  but in winter time we will assume clockwise in the vicinity of the site); | UC=0.1 m/s |  |
|  | | |
| water depth at the discharge point | d = 12 m |  |
|  | | |
| depth of discharge point | ? |  |
|  | | |
| discharge flow (it is the discharge + cooling water) | =65 m3/s |  |
|  | | |
| discharge temperature: difference between sea and discharge | = 5 degree Celsius |  |
| the difference in the radius of 200 m from the discharge point, by design | < 3 degrees Celsius |  |
|  | | |
| consumption of fish meat for critical (representative) person | = 8.1 kg /capita/yr. |  |
| crustaceans | = 0.1 kg /capita/yr. |  |
| demersal fish | = 0.9 kg /capita/yr. |  |
| marine fish | ? |  |
| mollusks | ? |  |
| algae | ? |  |
| cephalopods | ? |  |
|  | | |
| Model approach to critical (representative) person | person (group of persons) which realize the whole consumption of fish meat from the fish (etc.) which lives all the life in defined compartment of the sea |  |
| 10-12 hours per day works outside |  |
| village BANDARGAAH |  |
| village (next to the NPP from the north) ? |  |
| Morvarid Camp |  |
|  | | |
| Other consumptions: |  |  |
| Bovine Meat | 5.8 kg /capita/yr. |  |
| Poultry Meat | 25.9 kg /capita/yr. |  |
| Mutton & Goat Meat | 3.4 kg /capita/yr. |  |
|  | | |
| Mollusks, Other | 0 kg /capita/yr. |  |
| Cephalopods | 0 kg /capita/yr. |  |
| Aquatic Animals, Others | 0.1 kg /capita/yr. |  |
| Freshwater Fish | 3.9 kg /capita/yr. |  |
| Crustaceans | 0.1 kg /capita/yr. |  |
| Demersal Fish | 0.9 kg /capita/yr. |  |
| Pelagic Fish | 3.1 kg /capita/yr. |  |
| Marine Fish, Other | 0.2 kg /capita/yr. |  |
| **Fish, Seafood + (Total)** | **8.1** kg /capita/yr. |  |
|  | | |
| Eggs | 5.5 kg /capita/yr. |  |
| Milk - Excluding Butter | 59.5 kg /capita/yr. |  |
|  | | |
| Cereals | ? |  |
| Datles | ? |  |
| Figues | ? |  |
| Tobacoo | ? |  |
|  |  |  |

**6) TABLE – Croplands, Wheat, Barley, Grapes, Apples, Oranges, Greenhouses**

*Source: Statistical Centre of Iran. 1382, 1390*

*Note: This data will be used as default in the programme ESTE Annual Impacts for the BNPP.*

|  |  |  |
| --- | --- | --- |
|  | **BUSHER**  **Ostan** | **Iran**  **(Islamic Republic of)**  **Total area** |
| Lands area with cropland [ha] | 348641 | 17665198 |
|  |  |  |
| Area under cultivation of wheat [ha]  Total (irrigated+rainfed) | 213497 | 6941286 |
| Area under production of wheat [ton]  Total (irrigated+rainfed) | 62387 | 11676252 |
| Yield of wheat [kg/ha]  Total (irrigated+rainfed) | 292 | 1682 |
| Area under cultivation of barley [ha]  Total (irrigated+rainfed) | 34119 | 1817572 |
| Area under production of barley [ton]  Total (irrigated+rainfed) | 8206 | 2631691 |
| Yield of barley [kg/ha]  Total (irrigated+rainfed) | 241 | 1448 |
|  |  |  |
| Irrigated Grapes – production [ton] | 14 | 1334498 |
| Apples – production [ton] | 1 | 1147386 |
| Oranges – production [ton] | 312 | 735106 |
| Greenhouses – area [ha] | 3 | 2420 |
|  |  |  |

**7) Table - livestock (meat), density of livestock per area**

*Source: Statistical Centre of Iran. 1382, 1390 Sources: Ministry of Jihad-e-Agriculture.*

*Note: This data will be used as default in the programme ESTE Annual Impacts for the BNPP.*

|  |  |  |
| --- | --- | --- |
|  | **BUSHER - Ostan**  **Number of livestock**  **[head]** | **Iran (Islamic Republic of)**  **Number of livestock**  **[head]** |
| Sheep & lambs | 205383 | 50214617 |
| Goats & kids | 475184 | 22094251 |
| Cattle & calves | 22968 | 6075772 |
| Buffaloes & calves | 0 | 0 |
| Camels & calves | 0 | 0 |
| Number of poultry - chickens | 315 | 24783 |
| Number of poultry - Duck, goose and turkey | 14 | 5916 |
|  |  |  |
| Production of RED MEAT | 13 000 tons | 997 000 tons |
|  |  |  |
| Production of chicken meat | 24 000 tons | 1 871 000 tons |
|  |  |  |
| Production of egg | 1 000 tons | 913 000 tons |

**8) Table - milk, production of milk**

*Source: Statistical Centre of Iran. 1382, 1390 Sources: Ministry of Jihad-e-Agriculture.*

*Note: This data will be used as default in the programme ESTE Annual Impacts for the BNPP.*

|  |  |  |
| --- | --- | --- |
|  | **BUSHER**  **Ostan** | **Iran**  **(Islamic Republic of)** |
| Total milk production [ton] | 7120 | 6600895 |
| Sheep milk | 73 | 459843 |
| Goat milk | 2079 | 205059 |
| ‍‍‍Cattle milk | 4967 | 5935994 |
|  |  |  |
| Quantity of milk produces in modern cattle farm | 2 000 tons | 3 216 000 tons |
|  |  |  |

**9) Population by villages, by age at the 100 km vicinity of the BNPP**

Note: The list of villages and towns and number of inhabitants by age is expected from the BNPP.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Code** | **Total** | **0-1** | **1-2** | **2-7** | **7-12** | **12-17** | **17+** |
| **Bandargaah** | *01* |  |  |  |  |  |  |  |
| **Bandar Bushehr** | *02* |  |  |  |  |  |  |  |
| **Sadabad** | ***..*** |  |  |  |  |  |  |  |
| **Ahram** |  |  |  |  |  |  |  |  |
| **….** |  |  |  |  |  |  |  |  |

Note: Code – village/town ID utilized in the map file (shapefile, GIS)

**Annex 3: List of parameters to be input by the user / List of required data (types of data including formats of common inputs), system for emergencies**

*including meteorological data, technological and radiological data, etc. The possibility to modify the data by the user will be indicated, for e.g. change of units (mSv to Sv)*

**Content:**

1) Data from technology - primary and secondary systems, the list of data expected at the input of the SW ESTE

2) Radiation measurements inside the plant area or close to the plant area), the list of data expected at the input of the SW ESTE

3) Radiation measurements in the EPZ (outside the plant area), the list of data expected at the input of the SW ESTE

4) Description of preferred format of input data - preferred format is XML

5) “xsd” Scheme (definition of XML) for Imported Signals

6) Numerical weather prediction (wind field), format: GRIB1 or GRIB2

7) Population data inside emergency planning zone: by villages by age

**1) Data from technology - primary and secondary systems, the list of data expected at the input of the SW ESTE:**

format: xls or XML or html or txt

CORE\_OUTPUT\_PRESSURE [MPa]

CORE\_OUTPUT\_TEMPERATURE [deg]

1\_COLD\_LEG\_TEMPERATURE [deg]

2\_COLD\_LEG\_TEMPERATURE [deg]

3\_COLD\_LEG\_TEMPERATURE [deg]

4\_COLD\_LEG\_TEMPERATURE [deg]

1\_HOT\_LEG\_TEMPERATURE [deg]

2\_HOT\_LEG\_TEMPERATURE [deg]

3\_HOT\_LEG\_TEMPERATURE [deg]

4\_HOT\_LEG\_TEMPERATURE [deg]

CONTAINMENT\_NOBLE\_GAS\_ACTIVITY [Bq/m3]

CONTAINMENT\_DOSE\_RATE [Gy/h]

CONTAINMENT\_TEMPERATURE [ deg ]

CONTAINMENT\_H2\_CONCENTRATION [ % ]

ABS\_PRESSURE\_CONTAINMENT [kPa]

CONTAINMENT\_WATER\_LEVEL [cm]

1\_FLOW\_LOW\_PRESSURE\_INJECTION [t/h]

2\_FLOW\_LOW\_PRESSURE\_INJECTION [t/h]

3\_FLOW\_LOW\_PRESSURE\_INJECTION [t/h]

4\_FLOW\_LOW\_PRESSURE\_INJECTION [t/h]

1\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

2\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

3\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

4\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

5\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

6\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

7\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

8\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

9\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

10\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

11\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

12\_HYDROACCUMULATOR\_WATER\_LEVEL [cm]

RPS\_TRIP [No.]

1\_FLOW\_HIGH\_PRESSURE\_INJECTION [t/h]

2\_FLOW\_HIGH\_PRESSURE\_INJECTION [t/h]

3\_FLOW\_HIGH\_PRESSURE\_INJECTION [t/h]

4\_FLOW\_HIGH\_PRESSURE\_INJECTION [t/h]

PRESSURIZER\_LEVEL [cm]

1\_FLOW\_OUTPUT\_SPRAY\_SYSTEM [t/h]

2\_FLOW\_OUTPUT\_SPRAY\_SYSTEM [t/h]

3\_FLOW\_OUTPUT\_SPRAY\_SYSTEM [t/h]

4\_FLOW\_OUTPUT\_SPRAY\_SYSTEM [t/h]

SG1\_FEEDWATER\_LEVEL [cm]

SG2\_FEEDWATER\_LEVEL [cm]

SG3\_FEEDWATER\_LEVEL [cm]

SG4\_FEEDWATER\_LEVEL [cm]

ACTIVITY\_SG1 [Bq/m3]

ACTIVITY\_SG2 [Bq/m3]

ACTIVITY\_SG3 [Bq/m3]

ACTIVITY\_SG4 [Bq/m3]

1\_A\_service\_water [Bq/m3]

2\_A\_service\_water [Bq/m3]

3\_A\_service\_water [Bq/m3]

Dose\_rate\_Inner\_stack [Gy/h]

Flow\_air\_Inner\_stack [m3/h]

A\_NG\_Inner\_stack [Bq/m3]

A\_Aer\_Inner\_stack [Bq/m3]

A\_Iod\_Inner\_stack [Bq/m3]

Dose\_rate\_Outer\_stack [Gy/h]

Flow\_air\_Outer\_stack [m3/h]

A\_NG\_Outer\_stack [Bq/m3]

A\_Aer\_Outer\_stack [Bq/m3]

A\_Iod\_Outer\_stack [Bq/m3]

Reactor\_Power\_Neutron\_Power [%]

Reactor\_Power\_Thermal\_Power [%]

ACTVITY\_PRIMARY\_C [Bq/m3]

SG1\_PRESSURE [MPa]

SG2\_PRESSURE [MPa]

SG3\_PRESSURE [MPa]

SG4\_PRESSURE [MPa]

Dose\_Rate\_1 [Gy/h]

Dose\_Rate\_xy [Gy/h]

...

Dose\_Rate\_Tangak [Gy/h]

...

METEO\_wind\_rate [m/s]

METEO\_direction [deg]

METEO\_precipitation [mm/h]

METEO\_stability [A-F]

**2) Radiation measurements inside the plant area or close to the plant area), the list of data expected at the input of the SW ESTE:**

format: xls or XML or html or txt

dose rate monitor No.1, Longitude=...., Latitude =......, dimension [Gy/h]

up to

dose rate monitor No.xy,

**3) Radiation measurements in the EPZ (outside the plant area), the list of data expected at the input of the SW ESTE:**

format: xls or XML or html or txt

dose rate monitor No.EPZ-1, Longitude=...., Latitude =......, dimension [Gy/h]

up to

dose rate monitor No.EPZ-xy,

and other monitors (if available, e.g. iodine or aerosol monitors)

**4) Description of preferred format of input data - preferred format is XML:**

(EXAMPLE)

<?xml version="1.0"?>

<Signals xmlns:xsd="<http://www.w3.org/2001/XMLSchema>" xmlns:xsi="<http://www.w3.org/2001/XMLSchema-instance>">

  <SignalItems>

    <Signal>

      <Name>NameSig1</Name>

      <Value>1.14E+15</Value>

      <Valid>true</Valid>

    </Signal>

    <Signal>

      <Name>NameSig2</Name>

      <Value>0.25</Value>

      <Valid>true</Valid>

    </Signal>

    <Signal>

      <Name>NameSig3</Name>

      <Value>215</Value>

      <Valid>true</Valid>

    </Signal>

    <Signal>

      <Name>NameSig4</Name>

      <Value>-15</Value>

      <Valid>false</Valid>

    </Signal>

  </SignalItems>

</Signals>

**5) “xsd” Scheme (definition of XML) for Imported Signals:**

<?xml version="1.0" encoding="utf-8"?>

<xs:schema elementFormDefault="qualified" xmlns:xs="<http://www.w3.org/2001/XMLSchema>">

  <xs:element name="Signals" nillable="true" type="Signals" />

  <xs:complexType name="Signals">

    <xs:sequence>

      <xs:element minOccurs="0" maxOccurs="1" name="SignalItems" type="ArrayOfSignal" />

    </xs:sequence>

  </xs:complexType>

  <xs:complexType name="ArrayOfSignal">

    <xs:sequence>

      <xs:element minOccurs="0" maxOccurs="unbounded" name="Signal" nillable="true" type="Signal" />

    </xs:sequence>

  </xs:complexType>

  <xs:complexType name="Signal">

    <xs:sequence>

      <xs:element minOccurs="1" maxOccurs="1" name="Name" type="xs:string" />

      <xs:element minOccurs="1" maxOccurs="1" name="Value" type="xs:float" />

      <xs:element minOccurs="1" maxOccurs="1" name="Valid" type="xs:boolean" />

    </xs:sequence>

  </xs:complexType>

  <xs:element name="Signal" nillable="true" type="Signal" />

</xs:schema>

**6) Numerical weather prediction (wind field), format: GRIB1 or GRIB2**

**Monitored area:** LAT N24–N36 (≈1320km), LON E45-E56 (≈1100km).

(The region covers approximately area to the distance 500 km from the site + includes Tehran).

**Resolution:** 0.25 x 0.25 degrees (it is equal to approximately 25 x 25 km).

**Time step:** 3 h (00, 03, 06, … , 72 h) prediction up to 72 hours, actualized once a day

**Number of levels:** 9-11 model levels for height fields + ground level

- model levels:

a) Version A: levels in pre-defined heights above the terrain (e.g. 20-80-160-250-350-500-750-1000-1500-3000 m above terrain).

b) Version B: hybrid levels or pressure levels, which correspond approximately to 20-80-160-250-350-500-750-1000-1500-3000 m above terrain).

**Optimal assembly:**

Single level parameters\* – from both forecast and analysis

* 10 metre U-velocity (10U, m/s)
* 10 metre V-velocity (10V, m/s)
* 2 metre dewpoint temperature (2D, K)
* 2 metre temperature (2T, K)
* Surface pressure (SP, Pa)
* Total cloud cover (TCC, %)
* Surface sensible heat flux (SSHF, W/m2)
* Friction velocity (ZUST, m/s) or east/west and north/south surface stress

Single level parameters\* – from forecast

* Boundary layer height (BLH, m)
* Convective precipitation (CP, kg/m2)
* Large scale precipitation (LSP, kg/m2)

Single level parameters\* – from analysis

* Land/sea mask (LSM)
* Orography (Z, m)

Model level parameters\* – from both forecast and analysis

* Specific humidity (Q, kg/kg)
* Temperature (T, K)
* U-velocity (U, m/s)
* V-velocity (V, m/s)
* Vertical velocity (W, m/s)
* Geometric height (h, m)

**7) Population data inside emergency planning zone: by villages by age**

Format: xls file saved as csv

(code of the village is ID code used by government, or the code will be artificially generated by us and attached to the village)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Code** | **Total** | **0-1** | **1-2** | **2-7** | **7-12** | **12-17** | **17+** |
| **Bandargaah** | *01* |  |  |  |  |  |  |  |
| **Bandar Bushehr** | *02* |  |  |  |  |  |  |  |
| **Tangak** | ***..*** |  |  |  |  |  |  |  |
| **Delvar** |  |  |  |  |  |  |  |  |
| **….** |  |  |  |  |  |  |  |  |

Code – village/town ID utilized in map file (shapefile, GIS)