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Working document for the End-User

Chapter 14 to 19 of basic document: **“Technical Information to Consult with End-User, proposed data, form and format, version from January 09, 2018”**.

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# Proposed content and format of input files for ESTE Annual Impacts (for normal operation)

## Content and format of input file with discharges to the atmosphere

See example of input file in „txt” format and “xls” format (both formats are allowed):

example\_ATMOSPHERIC\_discharges.txt;

example\_ATMOSPHERIC\_discharges.xls.

Explanations:

1st line: Version:1.0

*version of the file format (Note: Version is important for the SW in order to enable/to recognize other formats in future)*

2nd line: Year:2017

*Calendar year of discharges*

3rd line: Type:Atmospheric

4th line: Unit:[Bq]

5.line: Nuclide;1;2;3;4;5;6;7;8;9;10;11;12

*“Nuclide” means name of element and isotopic number;*

*“1;2;3;4;5;6;7;8;9;10;11;12“ means month in calendar year*

6.line: empty line

7.line and further lines: discharges of given isotope, month by month

***Example of the content****:*

*Version:1.0*

*Year:2017*

*Type:Atmospheric*

*Unit:[Bq]*

*Nuclide;1;2;3;4;5;6;7;8;9;10;11;12*

*AG110M;999000000;999000000;999000000;999000000;999000000;999000000;999000000;999000000;999000000;999000000;999000000;999000000*

*etc (next nuclide)*

*etc (next nuclide)*

### Questions to the End-User

1) Maybe you have applied some other format and content of the file with operational atmospheric discharges, please kindly provide example of the file. We will apply it.

2) Please kindly let us know which nuclides do you really (typically) measure/detect in discharges. Please also let us know if you measure only total gamma or beta activity of operational discharges to the atmosphere. Are discharges listed in the file “nuclide by nuclide”, “month by month”, acceptable for you?

3) What is the time interval of evaluation (of the balance) of monitored discharges?

4) Do you distinguish in your reported discharges particular and elemental iodine? Or which one is monitored and reported in discharges?

5) Do you monitor C-14 in atmospheric discharges? Do you distinguish between inorganic and organic form of C-14 in reported discharges?

6) We assume that there is only one point (ventilation stack) through which operational discharges are released to the atmosphere from Bushehr NPP. Please confirm or give us description of other points.

## Content and format of input file with discharges to the hydrosphere (to Persian Gulf)

See example of input file in „txt” format and “xls” format (both formats are allowed):

example\_HYDROSPHERE\_discharges.txt;

example\_HYDROSPHERE\_discharges.xls.

Explanations:

1st line: Version:1.0

*version of the file format (Note: Version is important for the SW in order to enable/to recognize other formats in future)*

2nd line: Year:2017

*Calendar year of discharges*

3rd line: Type:Hydrosphere

4th line: Unit:[Bq]

5.line: Nuclide;1;2;3;4;5;6;7;8;9;10;11;12

*“Nuclide” means name of element and isotopic number;*

*“1;2;3;4;5;6;7;8;9;10;11;12“ means month in calendar year*

7.line and further lines: discharges of given isotope, month by month

***Example of the content****:*

*Version:1.0*

*Year:2017*

*Type:Hydrosphere*

*Unit:[Bq]*

*Nuclide;1;2;3;4;5;6;7;8;9;10;11;12*

*H3;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000;16700000000*

*etc (next nuclide)*

*etc (next nuclide)*

### Questions to the End-User

Our questions are similar like in case of discharges to the atmosphere.

1) Maybe you have applied some other format and content of the file with operational discharges to the hydrosphere, please kindly provide example of the file. We will apply it.

2) Please kindly let us know which nuclides do you really (typically) measure/detect in discharges. Please also let us know if you measure only total gamma or beta activity of discharges to the hydrosphere. Are discharges listed in the file “nuclide by nuclide”, “month by month”, acceptable for you?

3) What is the time interval of evaluation (of the balance) of monitored discharges?

4) Do you monitor C-14 in liquid discharges? What form of C-14 is reported in liquid discharges (if any)?

## Content and format of input file with on-site measured meteorological data

See example of input file in „txt” format and “xls” format (both formats are allowed):

example\_METEO on-site.txt;

example\_METEO on-site.xls.

Explanations:

1st column: DateTime

*Date and time, hour by hour, calendar day by calendar day, for the whole year*

2nd column: WindDir

*Direction in* *[°] (degs), number between 0 and 360 [°], an average during last 1 hour,-+ measured or interpreted at the height of 10 m above the terrain*

3rd column: WindSpeed

*Wind Speed in* *[m/s], number between 0 and 100 [m/s], an average during last 1 hour, measured or interpreted at the height of 10 m above the terrain*

4th column: Precipitation

*Precipitation in [mm/h], integral during last hour, number between 0 and 50 mm/h*

5th column: Stability

*Category of stability, according to Pasquil, number between 1 and 6, 1 means “A”, 2=”B”, 3=”C”, 4=”D”, 5=”E”, 6=”F”*

***example of the content:***

*DateTime;WindDir;WindSpeed;Precipitation;Stability*

*01.01.2017 00:00;3.46E+02;1.04E+00;0.00;6*

*01.01.2017 01:00;2.37E+02;9.83E-01;0.00;6*

*01.01.2017 02:00;6.88E+01;1.22E+00;0.00;6*

*01.01.2017 03:00;3.41E+02;1.39E+00;0.00;5*

*etc (next hour)*

*etc.*

### Questions to the End-User

1) Maybe you have more than one measuring point of meteorological data on-site. Please kindly let us know. If yes, please provide description (geographical coordinates) of measuring points.

2) Please kindly let us know what meteorological parameters are monitored on site and how they are interpreted. What is the height of measurements (level above the terrain, in [m])?

What is the frequency of meteo data collection?

## Content and format of input file with flow currents in Persian Gulf in the vicinity of Bushehr NPP.

The End-User has 3 different possibilities regarding the flow currents. The user can:

**1st option)** Use prepared database of flow currents, implemented inside the program. In this case, the user runs the program simply without entering any input flow current data.

Database consists of flow currents for the vicinity of Bushehr NPP (region in the Persian Gulf approximately 200km x 100km). Density of computational grid is 2km x 2km. See also “Conceptual model” in Chapter 8.2.1. The grid consists of 5414 points, and the calculation requires flow currents defined on that computational grid.

Mean flow currents were calculated for every month of calendar year and implemented into the program. Database consists of representative flow currents for January, February, ..., up to December. The database was prepared using the data server of HYCOM (publicly available from https://hycom.org/) , particularly by means of global data for u- and v-component of the daily average flow currents. The database was calculated on the base of data for the year 2015.

**2nd option)** Input into the program mean value of flow current (a single vector, u- and v- component) evaluated for the region around the point of liquid discharges into the sea. The mean vector known month by month is expected by the program. The mean monthly value of the vector should be evaluated for the square 2km x 2km, the center of the square is at the grid point:

(in WGS84 decimal degrees): latitude = 28.82089° N, longitude = 50.87419° E

The values of the flow current for that single point are in this case entered into the program in a very easy way, through a simple table using the graphical user interface of the program (the values are entered from the keyboard):

|  |  |  |
| --- | --- | --- |
| Month | u-component | v-component |
| January |  |  |
| February |  |  |
| March |  |  |
| April |  |  |
| May |  |  |
| June |  |  |
| July |  |  |
| August |  |  |
| September |  |  |
| October |  |  |
| November |  |  |
| December |  |  |

Example:

|  |  |  |
| --- | --- | --- |
| Month | u-component | v-component |
| January | 0.0060 | -0.0064 |
| February | -0.0024 | 0.0023 |
| March | 0.0024 | -0.0026 |
| April | 0.0246 | -0.0263 |
| May | 0.0080 | -0.0085 |
| June | 0.0243 | -0.0259 |
| July | 0.0126 | -0.0134 |
| August | 0.0060 | -0.0064 |
| September | 0.0096 | -0.0103 |
| October | 0.0049 | -0.0052 |
| November | 0.0213 | -0.0228 |
| December | 0.0250 | -0.0267 |

**3rd option)** Prepare and enter to the program his own database of flow currents. The user should prepare input data file as follows:

The file includes flow currents for the vicinity of Bushehr NPP for the computational grid applied in the program. The computational grid consists of 5414 points (each point corresponds to a square of the size of 2km x 2 km). The mean flow currents should be calculated for every month of the corresponding calendar year, i.e. for January, February, ..., up to December of the year. The input data file (for monthly averages) should be calculated from the source of numerical data available for the End-User.

See example of input file in „txt” format and “xls” format (both formats are allowed):

example\_Flow\_Currents.txt;

example\_Flow\_Currents.xls.

**Explanations:**

1st column: Latitude

- Definition of the grid point: Geographical latitude in UTM 39R.

2nd column: Longitude

- Definition of the grid point: Geographical longitude in UTM 39R.

3rd column: u01

- 01 means January;

- u-component of the flow current in [m/s], real number in the range from -100.0 to +100.0 [m/s].

4th column: v01

- 01 means January;

- v-component of the flow current in [m/s], real number in the range from -100.0 to +100.0 [m/s].

5th column: u02

6th column: v02

- 02 means February.

etc, up to

...

25th column: u12

26th column: v12

- 12 means December.

**Example** of the content of “example\_Flow\_Currents.txt” (each column is separated by semicolon):

Latitude;Longitude;u01;v01;u02;v02;u03;v03;u04;v04;u05;v05;u06;v06;u07;v07;u08;v08;u09;v09;u10;v10;u11;v11;u12;v12;

3231850.6;353226.3;-2.658E-02;-1.249E-02;-1.198E-02;-1.632E-03;1.115E-02;-5.997E-03;-1.488E-03;1.023E-02;-4.564E-02;1.593E-02;-6.046E-02;-3.198E-03;-7.773E-02;9.865E-04;-1.070E-01;-3.530E-02;-4.674E-02;-2.286E-02;2.036E-02;4.934E-03;1.750E-02;-2.476E-03;1.620E-02;7.446E-03;

3230068.6;354134.3;-2.777E-02;-1.301E-02;-1.151E-02;-1.690E-03;1.153E-02;-6.039E-03;-2.147E-03;1.092E-02;-4.526E-02;1.494E-02;-6.095E-02;-2.883E-03;-8.075E-02;1.423E-03;-1.104E-01;-3.611E-02;-4.687E-02;-2.301E-02;1.975E-02;5.388E-03;1.640E-02;-2.433E-03;1.504E-02;7.579E-03;

### Questions to the End-User

1) Maybe the End-User has available outputs of numerical model with flow currents for Persian Gulf.

If yes, please kindly provide samples of data (flow currents) available.

What is the time step of numerical data available?

Are numerical data (flow currents) available as 2D or 3D data? If 3D, what are the levels of 3D data?

What is the space resolution of data available?

Is the End-User (or his data provider) able to prepare 2D data as a mean monthly flow currents?

# Proposed behaviors of representative person

1) **Shielding factor:**

In calculation of individual doses from external exposure to deposited activity, to airborne concentration and in calculation of committed doses by inhalation we assume no shielding (shielding factor is set to =1) for exposure of representative person.

2) **Leafy vegetables:**

Representative person consumes his whole annual consumption of leafy vegetables from foodstuffs (even hypothetically) produced in the sector where he is living.

3) **Other agricultural products, and milk and meat:**

In case of other agricultural products, representative person consumes 75% of his annual consumption from that sector and the rest is clean non-contaminated product.

4) Representative person living **in village near the sea shore** consumes:

**Fish:**

Representative person consumes his whole annual consumption of fish meat from the fish living all its life in that part of sea (in calculation sector) which is adjacent to that village.

**Other seafood:**

The same assumption like in case of fish. Representative person consumes his whole annual consumption of other seafood (shellfish) from sea animals living all its life in that part of sea (in calculation sector) which is adjacent to that village.

**Fishing:**

Representative person, at the age category above 16 years, spends 8 hours a day by fishing on the boat (on open sea) in that part of sea (in calculation sector) which is adjacent to that village. Calculation sector assumed here is the same like in case of fish meat.

**Swimming:**

Representative person, at any age category above 5 years, spends 3 hours a day by swimming in that part of the sea (in calculation sector) which is adjacent to that village.

## Assumptions on consumption rates applied for effective dose calculation, by age categories

| Age category | Breathing rate, [m3/h] | Milk,  [kg/year] | Leafy vegetables  [kg/year] | Bovine meat | Poultry meat | Goat and Mutton meat | Cereals | Sea fish meat |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Average value per capita,  Source: Statistical Centre of Iran. 1382, 1390 Sources: Ministry of Jihad-e-Agriculture. | - | 59.5 | ? | 5.8 | 25.9 | 3.4 | ? | 8.1 |
|  | *Source: ICRP-101, Tab.A1* |  | *Source: ICRP-101, Tab.A1* |  |  |  |  |  |
| 0-1 y. | 0.12 | 59.5 | 15 | 5.8 | 25.9 | 3.4 |  | 8.1 |
| 1-2 y. | 0.22 | 59.5 | 30 | 5.8 | 25.9 | 3.4 |  | 8.1 |
| 2-7 y. | 0.37 | 59.5 | 32.5 | 5.8 | 25.9 | 3.4 |  | 8.1 |
| 7-12 y. | 0.64 | 59.5 | 35 | 5.8 | 25.9 | 3.4 |  | 8.1 |
| 12-17 y. | 0.84 | 59.5 | 45 | 5.8 | 25.9 | 3.4 |  | 8.1 |
| adult | 0.92 | 59.5 | 80 | 5.8 | 25.9 | 3.4 |  | 8.1 |

## Questions to the End-User

1) Are there any behaviors of representative person which are not mentioned in Chapter 15 and you would suggest to add them/ to modify?

2) Is there in the Bushehr region any facility performing desalination of the sea water? If yes, please kindly let us know the position. Is desalinated water used as drinking water? Is desalinated water used for irrigation?

3) Please kindly modify (make them correct) values about consumption by age categories in Table 15.1 according to your best knowledge. The End User will be also allowed to change these values in any time in future.

# Other assumptions and questions regarding operational discharges from NPP Bushehr

## Discharge points

Table: Definition and description of discharge points

| Parameter | Value |
| --- | --- |
| Height of ventilation stack (atmospheric discharges) | 115 m |
| Position of the stack: Lat | 28.829264° N |
| Position of the stack: Long | 50.886541° E |
| Discharges to hydrosphere: Discharge point distance from the shore, (pipe to the gulf); | 1250 m |
| Position of discharge point: Lat | ? |
| Position of discharge point: Long | ? |
| Water depth at the discharge point | d = 12 m |

### Questions to the End-User

1) Are the parameters (height and position) of ventilation stack in Table 16.1 correct? If no please kindly report correct values.

2) Is there any other monitored point of discharges to the atmosphere from NPP Bushehr? If yes, please kindly report its definition/description.

3) Please report description of discharge point to the Gulf, especially please report its position (Lat, Long).

## Population by villages, by age, in 100 km surrounding of the BNPP

100 km surrounding means all villages, which are placed inside the circle with radius of 100 km and with the central point of the circle in Bushehr NPP (in position of ventilation stack of 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 which is used in the map file (shapefile, GIS). The code can be fully artificial, assigned artificially to every village, or real codes of villages can be applied by the End-User.

### Questions to the End-User

1) Please kindly include in the table 16.2 names and codes of all villages/cities in 100 km surrounding of BNPP.

2) Please kindly include/ report number of inhabitants by age for every village in the table 16.2.

# Proposed content and format of input files for ESTE Bushehr (for emergencies)

## Plant data (data from technology)

Note: Data could be in file as xls, XML, html or txt. Frequency of data renewal at the input to ESTE Bushehr can be between 10 s and 60 s, depends on the End-User’s capabilities.

| Description of argument | Unit | Response from the End-User | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name of the signal at BNPP | Argument is available, Y/N | Unit | Range of measurement | | Typical value |
| Min | Max |  |
| CORE\_OUTPUT\_PRESSURE (more than one measurement is advisable) | [MPa] |  |  |  |  |  |  |
| PRESSURIZER PRESSURE (more than one measurement is advisable) | [MPa] |  |  |  |  |  |  |
| CORE\_OUTPUT\_TEMPERATURE/1 | [deg] |  |  |  |  |  |  |
| CORE\_OUTPUT\_TEMPERATURE/2 | [deg] |  |  |  |  |  |  |
| CORE\_OUTPUT\_TEMPERATURE/3 | [deg] |  |  |  |  |  |  |
| CORE\_OUTPUT\_TEMPERATURE/4 | [deg] |  |  |  |  |  |  |
| CORE\_OUTPUT\_TEMPERATURE/5 | [deg] |  |  |  |  |  |  |
| REACTOR\_VESSEL\_WATER\_LEVEL (more than one measurement is advisable) | [cm] |  |  |  |  |  |  |
| 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/1 | [Gy/h] |  |  |  |  |  |  |
| CONTAINMENT\_DOSE\_RATE/2 | [Gy/h] |  |  |  |  |  |  |
| CONTAINMENT\_TEMPERATURE/1 | [ deg ] |  |  |  |  |  |  |
| CONTAINMENT\_TEMPERATURE/2 | [ deg ] |  |  |  |  |  |  |
| CONTAINMENT\_H2\_CONCENTRATION/1 | [ % ] |  |  |  |  |  |  |
| CONTAINMENT\_H2\_CONCENTRATION/2 | [ % ] |  |  |  |  |  |  |
| CONTAINMENT\_H2\_CONCENTRATION/3 | [ % ] |  |  |  |  |  |  |
| ABS\_PRESSURE\_CONTAINMENT/1 | [kPa] |  |  |  |  |  |  |
| ABS\_PRESSURE\_CONTAINMENT/2 | [kPa] |  |  |  |  |  |  |
| ABS\_PRESSURE\_CONTAINMENT/3 | [kPa] |  |  |  |  |  |  |
| CONTAINMENT\_WATER\_LEVEL  (more than one measurement is advisable) | [cm] |  |  |  |  |  |  |
| CONTAINMENT\_SUMP\_WATER\_LEVEL (more than one measurement is advisable) | [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 (signal) | [0-1,  No-Yes] |  |  |  |  |  |  |
| LOCA (signal), if available | [0-1,  No-Yes] |  |  |  |  |  |  |
| Leak SG (signal), if available | [0-1,  No-Yes] |  |  |  |  |  |  |
| Signal: Station Blackout, if available | [0-1,  No-Yes] |  |  |  |  |  |  |
| 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 (more than one measurement is advisable) | [cm] |  |  |  |  |  |  |
| PORV (pressurizer valve) opened/1 | [0-1,  No-Yes] |  |  |  |  |  |  |
| PORV (pressurizer valve) opened/2 | [0-1,  No-Yes] |  |  |  |  |  |  |
| PORV (pressurizer valve) opened/3 | [0-1,  No-Yes] |  |  |  |  |  |  |
| 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\_Activity\_service\_water | [Bq/m3] |  |  |  |  |  |  |
| 2\_Activity\_service\_water | [Bq/m3] |  |  |  |  |  |  |
| 3\_Activity\_service\_water | [Bq/m3] |  |  |  |  |  |  |
| Activity (or dose rate) inside the pipes or tanks of high pressure/low pressure ECCS,1 | [Bq/m3] |  |  |  |  |  |  |
| Activity (or dose rate) inside the pipes or tanks of high pressure/low pressure ECCS,2 | [Bq/m3] |  |  |  |  |  |  |
| Activity (or dose rate) inside the pipes or tanks of high pressure/low pressure ECCS,3 | [Bq/m3] |  |  |  |  |  |  |
| Activity (or dose rate) inside the pipes or tanks of high pressure/low pressure ECCS,4 | [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 (more than one measurement is advisable) | [%] |  |  |  |  |  |  |
| Reactor\_Power\_Thermal\_Power (more than one measurement is advisable) | [%] |  |  |  |  |  |  |
| ACTVITY\_PRIMARY\_CIRCUIT | [Bq/m3] |  |  |  |  |  |  |
| SG1\_PRESSURE | [MPa] |  |  |  |  |  |  |
| SG2\_PRESSURE | [MPa] |  |  |  |  |  |  |
| SG3\_PRESSURE | [MPa] |  |  |  |  |  |  |
| SG4\_PRESSURE | [MPa] |  |  |  |  |  |  |
| SFP: water level in SFP | [cm] |  |  |  |  |  |  |
| SFP: temperature of water in SFP | [ deg ] |  |  |  |  |  |  |
| SFP: dose rate above the SFP | [Gy/h] |  |  |  |  |  |  |
| Signal: Reactor in shutdown (if available, means reactor in normal operational shutdown) | [0-1,  No-Yes] |  |  |  |  |  |  |
| Signal: Open reactor/reactor core temporarily in SFP (if available, means during normal operational shutdown) | [0-1,  No-Yes] |  |  |  |  |  |  |
| Signal: Loss of cooling in SFP (if available, means emergency loss of cooling, or similar signal) | [0-1,  No-Yes] |  |  |  |  |  |  |
| Signal: Containment is hermetically sealed (automatically sealed in case of event), if available | [0-1,  No-Yes] |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

### Format of input files with plant data

Example as XML, preferred format is XML. Another possibility is txt format, or html, or please suggest what is available on side of End-User.

<?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>

**“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>

### Questions to the End-User

1) Please kindly provide your response regarding the plant data explicitly to the table 17.1.

2) Maybe some higher amount of data could be available/accessible for ESTE Bushehr, in such case please provide us a list of available arguments.

3) We kindly ask you for more information about dose rate monitor(s) inside the containment (if such monitors are in operation in the BNPP). The response of monitor(s) should be used as a symptom of confirmed “core damage”. We kindly ask you for description of position of monitor(s) in containment structure.

4) We kindly ask you for more information about the measurement of reactor vessel level (if such measurements are in operation at the BNPP). This measurement will be used as a symptom of threat of core damage. We kindly ask you for description/explanation what response of monitor (what measured level) corresponds to the level of the top of fuel in active zone of reactor.

5) Please provide your response regarding format of input files, Table 17.1 (XML, txt, html, other).

6) Please give us your response regarding time frequency of input data files renewal, Table 17.1: every 10 s? every 60 s? or let us know what time step is realistically available.

## Radiation measurements inside the plant area or close to the plant area)

| Description of argument | Unit | Response from the End-User | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name  of the argument at BNPP | Long | Lat | Height above ground | Argument is available, Y/N | Unit | Range of measurement | | Typical value |
| Min | Max |  |
| Dose Rate monitor No.1  (please you can give your own name/marking of the monitor) | [Gy/h] |  |  |  |  |  |  |  |  |  |
| Dose Rate monitor No.2 | [Gy/h] |  |  |  |  |  |  |  |  |  |
| please add other monitors available,  also add monitors of activity in air, if available |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

### Questions to the End-User

1) Radiation measurements listed in Table 17.2 will be used in the process of source term assimilation (recalculation of predicted release with the aim to evaluate really observed release (release rate, in Bq/h, to the atmosphere of the environment). Please kindly give your response regarding radiation measurements inside the plant area or close to the plant area, explicitly to the table 17.2.

2) Proposed format of input files with radiation measurements listed in Table 17.2 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other).

3) Please give us your response regarding time frequency of input data files renewal, Table 17.2: every 1 minute? every 5 minutes? or let us know what time step is available.

## Radiation data from emergency planning zone

| Description of argument | Unit | Response from the End-User | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Long | Lat | Height above ground  [m] | Argument is available, Y/N | Unit | Range of measurement | | Typical value |
| Min | Max |  |
| Dose Rate monitor No.1  (please you can give your own name/marking of the monitor) | [Gy/h] |  |  |  |  |  |  |  |  |
| Dose Rate monitor No.2 | [Gy/h] |  |  |  |  |  |  |  |  |
| please add other monitors available,  also add monitors of activity in air, if available |  |  |  |  |  |  |  |  |  |
| etc. |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

### Questions to the End-User

1) Radiation measurements listed in Table 17.3 will be used in the process of source term assimilation as well as for comparison between measured and calculated radiation situation in EPZ. Please kindly give your response regarding radiation measurements in emergency planning zone, explicitly to the table 17.3.

2) Proposed format of input files with radiation measurements listed in Table 17.3 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other).

3) Please give us your response regarding time frequency of input data files renewal, Table 17.3: every 5 minutes? every 10 minutes? or let us know what time step is available.

## Meteorological data measured on-site

| Description of argument | Unit | Response from the End-User | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Long | Lat | Height above ground  [m] | Argument is available, Y/N | Unit | Range of measurement | | Typical value |
| Min | Max |  |
| METEO: *WindSpeed* | [m/s] |  |  |  |  |  |  |  |  |
| METEO: WindDir | [deg] |  |  |  |  |  |  |  |  |
| METEO: Precipitation | [mm/h] |  |  |  |  |  |  |  |  |
| METEO: Stability | [0 -6] |  |  |  |  |  |  |  |  |
| please add other measurement (on-site) if available,  please add measurements of wind speed in other height levels, if available |  |  |  |  |  |  |  |  |  |

**Explanations:**

***WindDir:*** *Direction in* *[°] (degs), number between 0 and 360 [°], actually measured value*

**WindSpeed:** *Wind Speed in* *[m/s], number between 0 and 100 [m/s], actually measured value*

**Precipitation:** *Precipitation in [mm/h], integral during last hour, number between 0 and 50 mm/h*

**Stability:** *Category of stability, according to Pasquill, number (integer) between 1 and 6, 1 means “A”, 2=”B”, 3=”C”, 4=”D”, 5=”E”, 6=”F”*

### Questions to the End-User

1) Meteorological data measured on-site listed in Table 17.4 will be used in the process of radiological impacts calculation (dispersion) as well as in the process of evaluation of really observed release (release rate, in Bq/h, to the atmosphere of the environment). Please kindly give your response regarding METEO data measured on-site, explicitly to the table 17.4.

2) Proposed format of input files with meteorological measurements listed in Table 17.4 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other).

3) Please give us your response regarding time frequency of input data files renewal, Table 17.4: every 5 minutes? every 10 minutes? or let us know what time step is available.

## Numerical weather prediction data for the region around the NPP Bushehr

**Proposed characteristics and parameters:**

1) Format: GRIB1 or GRIB2 or “netcdf” or other

2) Monitored area: LAT N25–N35.5 (≈1150km), LON E46-E55 (≈900km).

3) Resolution: 0.10 x 0.10 degrees (it is equal to approximately 10 x 10 km).

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

5) Number of levels: 10 to 15 model levels for height fields + ground level (levels will be applied for the height from 30 m to about 5000 m above the ground)

6) Optimal assembly:

|  |
| --- |
| 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 |
| Boundary layer height (BLH, m) |
| Convective precipitation (CP, kg/m2 |
| Large scale precipitation (LSP, kg/m2) |
| Land/sea mask (LSM) |
| Orography (Z, m) |
| 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) |

### Questions to the End-User

1) Numerical weather prediction data described and listed in 17.5 will be used in the process of radiological impacts calculation (dispersion) in emergency planning zone and across the territory of the country. Please give your response regarding availability of data.

2) Please kindly provide an example of data files with numerical weather prediction data (17.5) available.

3) Proposed format of input files with numerical weather prediction data (17.5) is GRIB1 or GRIB2 or “netcfd”. Other format can be acceptable, please let us know the example and let us know the format available.

# Other assumptions and questions regarding ESTE Bushehr (for emergencies)

## Emergency planning zone

Table: Parameters of the EPZ.

| Parameter | Response from the End-User |
| --- | --- |
| Radius of emergency planning zone, EPZ, [km] |  |
| Is the EPZ divided into sectors? (Yes/No) |  |
| What is the number of sectors applied? |  |
| Is the EPZ divided into inner and outer circle? (Yes/No) |  |
| What is the radius of inner circle? [km]  *Note: This is meant as 360° area around the BNPP where urgent measures are implemented independently of downwind direction.* |  |
| What is the central point of EPZ ? |  |
| Latitude of the centre of EPZ = |  |
| Longitude of the centre of EPZ = |  |
| Is the “key-hole” concept applied for urgent protective measures implementation? (Yes/No) |  |
|  |  |
|  |  |

### Questions to the End-User

1) Parameters of Emergency Planning Zone in Table 18.1 will be used in the process of automatic generation of recommended protective measures and other outputs of ESTE Bushehr. Please kindly provide your response regarding the EPZ explicitly to the table 18.1.

2) Please kindly describe the concept applied for urgent protective measures implementation, if the “key-hole” concept is not applied for the EPZ of Bushehr NPP.

## Reference levels for urgent protective actions

**(1) IAEA Criteria (IAEA TecDoc 955,** **IAEA GENERIC INTERVENTION LEVELS FOR URGENT PROTECTIVE**

**ACTIONS ):**

| Action | Projected dose or avertable dose by the protective action |
| --- | --- |
| Iodine thyroid blocking: | Equivalent dose to thyroid caused by iodines  = 100 mSv |
| Evacuation | Effective dose  = 50 mSv |
| Sheltering | Effective dose  = 10 mSv |

**(2)** **Maximum levels for activity concentration in foodstuffs**

Reference levels of European Commission regarding the activity of nuclides in foodstuffs. Action: The foodstuff cannot be placed on the market.

*Source: Regulation 3954/87, Council. 1987. “Council Regulation (EURATOM) No 3954/87.” Official Journal of the European Communities L 371 3954 (87): 0011-0013*.

|  | **Concentration in foodstuff, Bq/kg** | | | | |
| --- | --- | --- | --- | --- | --- |
| **Baby food** | **Dairy products**  (milk, cream) | **Other foodstuff except minor** | **Liquid foodstuffs**  (fruit juices) | **Minor foodstuffs**  (e.g. spices, garlic) |
| Strontium isotopes,  especially Sr-90 | 75 | 125 | **750** | 125 | 7 500 |
| Iodine isotopes,  especially I-131 | 150 | 500 | **2 000** | 500 | 20 000 |
| Alpha-particle-emitting plutonium isotopes and transplutonium elements, especially Pu 239, Am 241 | 1 | 20 | **80** | 20 | 800 |
| All other nuclides with half-lives of more than 10 days, especially Cs-134, Cs-137 | 400 | 1 000 | **1 250** | 1 000 | 12 500 |

### Questions to the End-User

1) **IAEA generic intervention levels** for urgent protective actions are given in 18.2 (1) and **Maximum levels for activity concentration in foodstuffs** as defined by European Commission are given in 18.2 (2).

Please kindly provide and describe your **National Guidance** to urgent protective measures – subsequently we will implement your reference levels and your guidance to ESTE Bushehr.

2) In case of lack of other guidance, we will apply to ESTE Bushehr levels as defined in 18.2 (1) and 18.2 (2).

## Population by villages, by age, inside the EPZ

This information will be applied for evaluation of number of inhabitants which are recommended by ESTE to be sheltered/evacuated/ etc. This information will serve to the Crisis Staff to better manage urgent measures implementation.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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 which is used in the map file (shapefile, GIS). The code can be fully artificial, assigned artificially to every village, or real codes of villages can be applied by the End-User.

### Questions to the End-User

1) Please kindly include in the table 18.3 names and codes of all villages/cities inside the EPZ of BNPP.

2) If it is possible, please provide/report number of inhabitants by age for every village in the table 18.3.Please alternatively change age categories/apply knowledge about other age categories according to your data available.

## Data from the PRIS IAEA to verify or modify

Table: Design Characteristics, Bushehr-1 (according to the PRIS/IAEA).

Please kindly check, modify or provide correct values if relevant.

Please kindly check/confirm especially information in yellow lines.

| **Systems** | | | **Response from the End-User** |
| --- | --- | --- | --- |
| **Primary Systems** | | |  |
| **1** | **Reactor pressure vessel** |  |  |
| 2 | Reactor vessel shape | Cylindrical, Hemispherical End |  |
|  | Reactor vessel centreline orientation | Vertical |  |
|  | Reactor vessel material | Alloyed Steel |  |
|  | Reactor vessel material specification | 15Ch2MFA; 2,5%Cr0.6°Mo0,25%V |  |
|  | Vessel cladding material | Stainless Steel |  |
|  | Vessel cladding material specification | 08%Cr18%Ni10%Ti |  |
|  | Reactor vessel overall length/height [m] | 11.18 |  |
|  | Inside shell diameter [m] | 4.13 |  |
|  | Shell thickness [mm] | 199.5 |  |
|  | **Reactor Core** |  |  |
|  | Fuel assembly geometry | Hexagonal |  |
|  | Fuel Form | Pellets |  |
|  | Fuel material | UO2 |  |
|  | Refuelling type | OFF-line |  |
|  | Moderator material | H2O |  |
|  | Fuel clad material | Zirconium Alloy |  |
|  | Fuel clad material specification |  |  |
|  | Average fuel enrichment [% of U235] | 2.45 |  |
|  | Refuelling frequency [month] | 10 |  |
|  | Part of the core refuelled [%] | 33 |  |
|  | Average discharge burnup [MWd/t] | 43000 |  |
|  | Active core diameter [m] | 3.16 |  |
|  | Active core height/length [m] | 3.53 |  |
|  | Number of fissile fuel assemblies/bundles | 163 |  |
|  | Fuel weight [t] | 79.840 |  |
|  | Moderator weight [t] | 391 |  |
|  | Number of fuel elements per assembly/bundle | 311 |  |
|  | Fuel clad thickness [mm] | 0.685 |  |
|  | Average core power density [kW/dm3] |  |  |
|  | Average fuel power density [kW/kgU] |  |  |
|  | Fuel linear heat generation rate [kW/m] | 16.67 |  |
|  | **Reactivity control** |  |  |
|  | Control rod material | Boron Carbide |  |
|  | Burnable neutron absorber material | Other - CrB2+Al |  |
|  | Burnable neutron absorber material specification |  |  |
|  | Soluble neutron absorber material | Boric Acid H3BO3 |  |
|  | Secondary shutdown system |  |  |
|  | Number of control rod assemblies | 103 |  |
|  | **Reactor coolant system** |  |  |
|  | Number of external reactor coolant loops | 4 |  |
|  | Coolant type | H2O |  |
|  | Coolant weight [t] | 391.6 |  |
|  | Operating coolant pressure [MPa] | 15.7 |  |
|  | Reactor outlet temperature [°C] | 321 |  |
|  | Reactor inlet temperature [°C] | 291 |  |
|  | Coolant mass flow at the rated power [t/h] | 84800 |  |
|  | **Steam generators (SG)/drum separators** |  |  |
|  | Type of SG | Horizontal |  |
|  | SG output | Saturated Steam |  |
|  | Number of SG | 4 |  |
|  | Tube shape | U-tube |  |
|  | Tube material | 08CH18N10T SS |  |
|  | SG shell material | 10GN2MFA alloyed carbon steel |  |
|  | Design thermal capacity per SG [MW] | 753 |  |
|  | Design heat transfer surface [m2] | 6115 |  |
|  | **Main coolant pumps/circulators** |  |  |
|  | Total number of pumps/circulators | 4 |  |
|  | Number of pumps per RCS loop | 1 |  |
|  | Pump motor rating [MW] | 5 |  |
|  | Design pressure difference [MPa] | 0.588 |  |
|  | **Pressurizer** |  |  |
|  | Total volume [m3] | 79 |  |
|  | Number of safety valves | 3 |  |
|  | Number of relief valves | 3 |  |
|  | Installed heater power [kW] | 2520 |  |
|  | **Containment systems** |  |  |
|  | Containment type | Double |  |
|  | Containment Shape | Spherical |  |
|  | Containment structure | Reinforced Concrete+Steel |  |
|  | Pressure suppresion system | Spray |  |
|  | Total containment volume [m3] | 91654 |  |
|  | Number of containment spray pumps | 4 |  |
|  | Containment design pressure [MPa] | 0.46 |  |
|  | Design leakage rate [% per day] | 0.25 |  |
|  | Type of H2 recombiner | Passive |  |
|  | **Emergency core cooling systems** |  |  |
|  | Number of HPSI systems | 4 |  |
|  | Number of LPSI systems | 4 |  |
|  | Number of hydroaccumulators | 12 |  |
|  | HPSI systems pressure [MPa] | 5 |  |
|  | LPSI system pressure [MPa] | 0.9 |  |
|  | HPSI system flowrate [t/h] | 200 |  |
|  | LPSI system flowrate [t/h] | 1102 |  |
|  | **Reactor protection system** |  |  |
|  | Control equipment technology | Digital/Analog |  |
|  | Number of independent system divisions | 2 |  |
|  | **Engineered Safeguard Feature Actuation System** |  |  |
|  | Control equipment technology | Digital/Analog |  |
|  | Number of independent system divisions | 4 |  |
| **Secondary systems** | | |  |
|  | **Turbine** |  |  |
|  | Turbine type | Saturated steam |  |
|  | Number of turbine-generators per unit/reactor | 1 |  |
|  | Turbine speed [rpm] | 3000 |  |
|  | Number of HP cylinders per turbine | 1 |  |
|  | Number of IP cylinders per turbine |  |  |
|  | Number of LP cylinders per turbine | 3 |  |
|  | HP cylinder inlet steam pressure [MPa] | 5.88 |  |
|  | HP cylinder Inlet steam moisture [%] | 0.2 |  |
|  | HP cylinder inlet steam temperature [°C] | 274.3 |  |
|  | HP cylinder Inlet steam flow rate [t/h] | 5980 |  |
|  | **Main generator** |  |  |
|  | Rated active power [MWe] | 1000 |  |
|  | Rated apparent power [MVA] | 1176.47 |  |
|  | Output voltage [kV] | 27 |  |
|  | Output frequency [Hz] | 50 |  |
|  | **Main condenser** |  |  |
|  | Primary means of condenser cooling | Sea (once-through) |  |
|  | Number of condensers per turbine-generator | 2 |  |
|  | Condenser tube material | Titanium |  |
|  | Number of main condensate pumps | 3 |  |
|  | Number of main condensate pumps required for full power | 2 |  |
|  | Condenser vacuum at the full power (absolute pressure) [kPa] | 7.55 |  |
|  | **Feedwater system** |  |  |
|  | Number of motor-driven main feedwater pumps | 3 |  |
|  | Number of feedwater pumps required for full power operation | 2 |  |
|  | Feedwater discharge pressure [MPa] | 7.6 |  |
|  | Steam generator feedwater inlet temperature [°C] | 220 |  |
|  | **Auxiliary / Emergency feedwater** |  |  |
|  | Number of electrical motor-driven pumps |  |  |
|  | Number of diesel driven pumps |  |  |
|  | Number of turbine driven pumps |  |  |
|  | **Fire protection system** |  |  |
|  | On-site fire suppression/extinguishing system | Water+Supplementary chemical systems |  |
|  | Fire retardant cable coating used for |  |  |
|  | Cable segregation within the unit used for |  |  |
|  | On-site fire brigade |  |  |
|  | Off-site fire brigade response time |  |  |
|  | **Emergency power supply systems** |  |  |
|  | Number of alternate power sources from the transmission grid (standby transformers available per unit) | 2 |  |
|  | Number of on-site safety related diesel generators (available per unit) | 8 |  |
|  |  |  |  |
|  | Number of on site non-safety related diesel generator | 1 |  |
|  |  |  |  |
|  | Other on-site emergency AC power sources |  |  |
|  | Estimated time reserve of the batteries at full load [h] | 1 |  |
|  | Total installed capacity of the on-site emergency power sources per unit [MW] | 24.9 |  |
|  | Total battery capacity [Ah] | 1500 |  |
| **Spent fuel storage** | | |  |
|  | Reactor building spent fuel pool capacity (number of spent fuel assemblies) | 639 |  |

### Questions to the End-User

1) In the Table 18.4 please kindly check/confirm information in yellow lines. This information will be used for inventory of the reactor core initial calculation.

2) Please kindly provide information what is the state of the SFP which should be assumed by ESTE Bushehr for inventory of the SFP calculation.

If it is possible, please let us know what is the number of spent fuel assemblies discharged to the pool?

How old are groups of these assemblies?/fuel from how many refueling periods has been placed into the pool?

This information will be used for initial calculation of the SFP inventory.

3) Please kindly confirm information on the design leakage rate of the containment (0,25% per day). This value or other value provided by End-User will be applied in the process of calculation of source terms database.

Is there any free space between inner and outer containment (of double containment structure)?

Is/can be the free space between inner and double containment ventilated to the stack?

If yes, are there in the pathway to the stack any aerosol and iodine filters, which would be applied in case of emergency conditions?

4) Please kindly provide information on possible pathways for release in case of “interfacing system LOCA”.

Are some pipes and tanks of ECCS placed outside containment?

Can be the structures and parts (pipes, tanks) of ECCS assumed as potential pathway for by-pass of containment in case of leak from primary circuit to the ECCS ?

Can the system of essential service water (pipes, tanks) be assumed as potential pathway for bypass of containment in case of leak from primary circuit to the ESW system?

This information provided by End-User will be applied in the process of calculation of source terms database for ESTE Bushehr.

## Warning messages in Farsi

Table: Warning messages and short explanation in English and Russian

|  |  |  |  |
| --- | --- | --- | --- |
| in English | in Russian | | in Farsi |
| Symptoms of initiating event identified | Опознаны симптомы исходного аварийного события | | please add your translation in Farsi |
| *Explanation:*  *This “red” warning message is generated by ESTE Bushehr automatically in case the symptoms of initiating event, like LOCA, SGTR, IS-LOCA, event at the SFP, have been identified. This message serves as warning to the user, that potential accidental conditions have been identified.* | | *Объяснение:*  *Идентификация симптомов исходного события (исходного аварийного события). Предупреждающее сообщение (красного цвета) генерируемое системой ЕSTE автоматически в случае идентификации симптомов события LOCA, SGTR, IS-LOCA, или события в бассейне отработанного топлива (SFP).*  *Это сообщение служит как предупреждение для кризисного персонала (пользователя ЕSTE), что были опознаны системой ЕSTE условия потенциальной аварии.* | |
| Symptoms of uncovered core (gap release) identified | Повреждение активной зоны.  Опознаны симптомы повреждения оболочек топлива, выброс летучих продуктов деления | | please add your translation in Farsi |
| *Explanation:*  *This “red” warning message is generated by ESTE Bushehr automatically in case the symptoms of gap release (reactor core or part of the fuel uncovered for 15-30 minutes) have been identified.*  *This message serves as warning to the user that accidental conditions are getting worse, state of active zone is getting worse and potentiality for the release to the environment exists.* | | *Объяснение:*  *Предупреждающее сообщение (красного цвета) генерируемое системой ЕSTE автоматически*  *в случае идентификации симптомов повреждения оболочек топлива, выброс летучих продуктов деления (активная зона или часть топлива в активной зоне непокрыта водой 15-30 мин.)*  *Это сообщение служит как предупреждение для кризисного персонала (пользователя ЕSTE), что аварийные условия ухудшаются, состояние активной зоны ухудшается и существует возможность выбросов в окружающую среду.* | |
| Symptoms of core damage identified | Повреждение активной зоны.  Опознаны симптомы расплавления активной зоны | | please add your translation in Farsi |
| *Explanation:*  *This “red” warning message is generated by ESTE Bushehr automatically in case the symptoms of core damage (reactor core is melted, the fuel is uncovered for more than 30 minutes) have been identified.*  *This message serves as warning to the user that accidental conditions are getting severe, active zone is damaged and potentiality for the release to the environment is high.* | | *Объяснение:*  *Предупреждающее сообщение (красного цвета) генерируемое системой ЕSTE автоматически*  *в случае идентификации симптомов расплавления активной зоны (активная зона непокрыта водой более 30 мин.)*  *Это сообщение служит как предупреждение для кризисного персонала (пользователя ЕSTE), что аварийные условия очень тяжёлые и ухудшаются, существует очень высокая возможность выбросов в окружающую среду.* | |
| Symptoms of release to the environment identified | Опознаны симптомы выбросов в окружающую среду | | please add your translation in Farsi |
| *Explanation:*  *This “red” warning message is generated by ESTE Bushehr automatically in case the symptoms of really observed release to the atmosphere of the environment have been identified. Identification is based on radiation monitors in the area of BNPP or radiation monitors in the stack.*  *This message serves as warning to the user that potential radiological impacts to the inhabitants in the EPZ are now not only predicted, but must be really expected.* | | *Объяснение:*  *Предупреждающее сообщение (красного цвета) генерируемое системой ЕSTE автоматически*  *в случае идентификации симптомов действительного выброса в атмосферу окружающей среды.*  *Идентификация основана на радиационных мониторах на площадке BNPP или на радиационных мониторах в вентиляционной трубе.*  *Это сообщение служит как предупреждение для кризисного персонала (пользователя ЕSTE), что радиационное воздействие на жителей в зоне аварийного планирования (EPZ) теперь уже не только прогнозировано, но даже очень реально существует.* | |

### Questions to the End-User

1) In the Table 18.5.1 please kindly insert warning messages in Farsi language.

## Proposed mode of communication and proposed communication ports between ESTE systems

|  |  |
| --- | --- |
| **Description/Question** | **Response from the End-User** |
| How will ESTE Bushehr (emergencies) access the files with input data:  Remote access service “ftp” / “sftp”  or  access to shared directory, service “SMB”  or  please propose other method (Oracle, MySQL, or other) | |
| Plant data |  |
| Radiation measurements |  |
| On-site meteorological measurements |  |
| Numerical weather prediction |  |
| What will be the names of input files to ESTE Bushehr:  “ESTE\_YYYY-MM-DD\_HH\_MM\_SS”  or  please propose appropriate name.  *(Note: Time stamp in the name of the file is assumed to be in UTC.)* | |
| Plant data file:  “ESTE\_YYYY-MM-DD\_HH\_MM\_SS\_plant” |  |
| Radiation measurements file:  “ESTE\_YYYY-MM-DD\_HH\_MM\_SS\_rad” |  |
| On-site meteorological measurements data file:  “ESTE\_YYYY-MM-DD\_HH\_MM\_SS\_meteo” |  |
| Numerical weather prediction file(s):  “ESTE\_YYYY-MM-DD\_HH\_MM\_SS\_NWP”  *(Note: Apply the names of files as they are generated by the source of NWP data, probably more than 1 data file will be read in frame of one prediction.)* |  |
| Agreement on “copy and delete” of files at the side of source directory.  Once the file with data is read (copied) to ESTE:  we (the ESTE) will delete it  or  you (the End-User) will take care about management of files in your directory, we (the ESTE) will not delete old files in the source directory  or  please propose appropriate procedure. |  |
| Proposed communication ports | |
| Server of ESTE Bushehr and clients of ESTE Bushehr communicate each other on the port 9978/protocol TCP  or please propose other port. |  |
| In case the input files into ESTE are read through:  “ftp” the port 21/TCP should be applied or please propose appropriate port  and  “sftp” the port 22/TCP should be applied or please propose appropriate ports  and  “SMB” the port 445/TCP (this port cannot be changed as it is set internally by Windows).  Please confirm or please propose appropriate ports. |  |
| Desktop applications of ESTE Annual Impacts (for normal operation) will communicate each other on the port 8880/protocol TCP  or please propose other port. |  |
| Remote access/remote service | |
| Will the End-User allow us to access the server and/or clients of ESTE Bushehr remotely?  (From Bushehr to Tehran during implementation on-site, or from Slovakia to Bushehr during 6 months service and maintenance period). |  |

### Questions to the End-User

1) In the Table 18.6 please kindly provide your response to the questions regarding ftp/sftp, communication ports, etc. If the communication with input data will be by other method (Oracle, MySQL, ...), then please provide your description of proposed communication, especially description of attributes in the table. Other particulars will be agreed in the next phase.

# Summary of questions to the End-User

|  |  |
| --- | --- |
| 1 | In Chapter 14.1.  Maybe you have applied some other format and content of the file with operational atmospheric discharges, please kindly provide example of the file. We will apply it. |
|  |  |
| 2 | In Chapter 14.1.  Please kindly let us know which nuclides do you really (typically) measure/detect in discharges. Please also let us know if you measure only total gamma or beta activity of operational discharges to the atmosphere. Are discharges listed in the file “nuclide by nuclide”, “month by month”, acceptable for you? |
|  |  |
| 3 | In Chapter 14.1.  What is the time interval of evaluation (of the balance) of monitored discharges? |
|  |  |
| 4 | In Chapter 14.1.  Do you distinguish in your reported discharges particular and elemental iodine? Or which one is monitored and reported in discharges? |
|  |  |
| 5 | In Chapter 14.1.  Do you monitor C-14 in atmospheric discharges? Do you distinguish between inorganic and organic form of C-14 in reported discharges? |
|  |  |
| 6 | In Chapter 14.1.  We assume that there is only one point (ventilation stack) through which operational discharges are released to the atmosphere from Bushehr NPP. Please confirm or give us description of other points. |
|  |  |
| 7 | In Chapter 14.2.  Maybe you have applied some other format and content of the file with operational discharges to the hydrosphere, please kindly provide example of the file. We will apply it. |
|  |  |
| 8 | In Chapter 14.2.  Please kindly let us know which nuclides do you really (typically) measure/detect in discharges. Please also let us know if you measure only total gamma or beta activity of discharges to the hydrosphere. Are discharges listed in the file “nuclide by nuclide”, “month by month”, acceptable for you? |
|  |  |
| 9 | In Chapter 14.2.  What is the time interval of evaluation (of the balance) of monitored discharges? |
|  |  |
| 10 | In Chapter 14.2.  Do you monitor C-14 in liquid discharges? What form of C-14 is reported in liquid discharges (if any)? |
|  |  |
| 11 | In Chapter 14.3.  Maybe you have more than one measuring point of meteorological data on-site. Please kindly let us know. If yes, please provide description (coordinates) of measuring points. |
|  |  |
| 12 | In Chapter 14.3.  Please kindly let us know what meteorological parameters are monitored on site and how they are interpreted.  What is the height of measurements (level above the terrain, in [m])?  What is the frequency of meteo data collection? |
|  |  |
| 13 | In Chapter 14.4.  Maybe the End-User has available outputs of numerical model with flow currents for Persian Gulf.  If yes, please kindly provide samples of data (flow currents) available.  What is the time step of numerical data available?  Are numerical data (flow currents) available as 2D or 3D data? If 3D, what are the levels of 3D data?  What is the space resolution of data available?  Is the End-User (or his data provider) able to prepare 2D data as a mean monthly flow currents? |
|  |  |
| 14 | In Chapter 15.  Are there any behaviors of representative person which are not mentioned in Chapter 15 and you would suggest to add them/ to modify? |
|  |  |
| 15 | In Chapter 15.  Is there in the Bushehr region any facility performing desalination of the sea water? If yes, please kindly let us know the position. Is desalinated water used as drinking water? Is desalinated water used for irrigation? |
|  |  |
| 16 | In Chapter 15.  Please kindly modify (make them correct) values about consumption by age categories in Table 15.1, according to your best knowledge. The End User will be also allowed to change these values in any time in future. |
|  |  |
| 17 | In Chapter 16.1.  Are the parameters (height and position) of ventilation stack in Table 16.1 correct? If no please kindly report correct values. |
|  |  |
| 18 | In Chapter 16.1.  Is there any other monitored point of discharges to the atmosphere from NPP Bushehr? If yes, please kindly report its definition/description. |
|  |  |
| 19 | In Chapter 16.1.  Please report description of discharge point to the Gulf, especially please report its position (Lat, Long). |
|  |  |
| 20 | In Chapter 16.2.  Please kindly include in the table 16.2 names and codes of all villages/cities in 100 km surrounding of BNPP. |
|  |  |
| 21 | In Chapter 16.2.  Please kindly include/ report number of inhabitants by age for every village in the table 16.2. |
|  |  |
| 22 | In Chapter 17.1.  Please kindly provide your response regarding the plant data explicitly to the table 17.1. |
|  |  |
| 23 | In Chapter 17.1.  Maybe some higher amount of data could be available/accessible for ESTE Bushehr, in such case please provide us list of available arguments. |
|  |  |
| 24 | In Chapter 17.1.  We kindly ask you for more information about dose rate monitor(s) inside the containment (if such monitors are in operation in the BNPP). The response of monitor(s) should be used as a symptom of confirmed “core damage”. We kindly ask you for description of position of monitor(s) in containment structure. |
|  |  |
| 25 | In Chapter 17.1.  We kindly ask you for more information about the measurement of reactor vessel level (if such measurements are in operation at the BNPP). This measurement will be used as a symptom of threat of core damage. We kindly ask you for description/explanation what response of monitor (what measured level) corresponds to the level of the top of fuel in active zone of reactor. |
|  |  |
| 26 | In Chapter 17.1.  Please provide your response regarding format of input files, Table 17.1 (XML, txt, html, other). |
|  |  |
| 27 | In Chapter 17.1.  Please give us your response regarding time frequency of input data files renewal, Table 17.1: every 10 s? every 60 s? or let us know what time step is realistically available. |
|  |  |
| 28 | In Chapter 17.2.  Radiation measurements listed in Table 17.2 will be used in the process of source term assimilation (recalculation of predicted release with the aim to evaluate really observed release (release rate, in Bq/h, to the atmosphere of the environment). Please kindly give your response regarding radiation measurements inside the plant area or close to the plant area, explicitly to the table 17.2. |
|  |  |
| 29 | In Chapter 17.2.  Proposed format of input files with radiation measurements listed in Table 17.2 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other). |
|  |  |
| 30 | In Chapter 17.2.  Please give us your response regarding time frequency of input data files renewal, Table 17.2: every 1 minute? every 5 minutes? or let us know what time step is available. |
|  |  |
| 31 | In Chapter 17.3.  Radiation measurements listed in Table 17.3 will be used in the process of source term assimilation as well as for comparison between measured and calculated radiation situation in EPZ. Please kindly give your response regarding radiation measurements in emergency planning zone, explicitly to the table 17.3. |
|  |  |
| 32 | In Chapter 17.3.  Proposed format of input files with radiation measurements listed in Table 17.3 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other). |
|  |  |
| 33 | In Chapter 17.3.  Please give us your response regarding time frequency of input data files renewal, Table 17.3: every 5 minutes? every 10 minutes? or let us know what time step is available. |
|  |  |
| 34 | In Chapter 17.4.  Meteorological data measured on-site listed in Table 17.4 will be used in the process of radiological impacts calculation (dispersion) as well as in the process of evaluation of really observed release (release rate, in Bq/h, to the atmosphere of the environment). Please kindly give your response regarding METEO data measured on-site, explicitly to the table 17.4. |
|  |  |
| 35 | In Chapter 17.4.  Proposed format of input files with meteorological measurements listed in Table 17.4 is XML or txt or html, the same like in case of plant data in Table 17.1. Please kindly give us your response regarding format of input files (XML, txt, html, other). |
|  |  |
| 36 | In Chapter 17.4.  Please give us your response regarding time frequency of input data files renewal, Table 17.4: every 5 minutes? every 10 minutes? or let us know what time step is available. |
|  |  |
| 37 | In Chapter 17.5.  Numerical weather prediction data described and listed in 17.5 will be used in the process of radiological impacts calculation (dispersion) in emergency planning zone and across the territory of the country. Please give your response regarding availability of data. |
|  |  |
| 38 | In Chapter 17.5.  Please kindly provide an example of data files with numerical weather prediction data (17.5) available. |
|  |  |
| 39 | In Chapter 17.5.  Proposed format of input files with numerical weather prediction data (17.5) is GRIB1 or GRIB2 or “netcfd”. Other format can be acceptable, please let us know the example and let us know the format available. |
|  |  |
| 40 | In Chapter 18.1.  Parameters of Emergency Planning Zone in Table 18.1 will be used in the process of automatic generation of recommended protective measures and other outputs of ESTE Bushehr. Please kindly provide your response regarding the EPZ explicitly to the table 18.1. |
|  |  |
| 41 | In Chapter 18.1.  Please kindly describe the concept applied for urgent protective measures implementation, if the “key-hole” concept is not applied for the EPZ of Bushehr NPP. |
|  |  |
| 42 | In Chapter 18.2.  **IAEA generic intervention levels** for urgent protective actions are given in 18.2 (1) and **Maximum levels for activity concentration in foodstuffs** as defined by European Commission are given in 18.2 (2).  Please kindly provide and describe your **National Guidance** to urgent protective measures – subsequently we will implement your reference levels and your guidance to ESTE Bushehr.  In case of lack of other guidance, we will apply to ESTE Bushehr levels as defined in 18.2 (1) and 18.2 (2). |
|  |  |
| 43 | In Chapter 18.3.  Please kindly include in the table 18.3 names and codes of all villages/cities inside the EPZ of BNPP. |
|  |  |
| 44 | In Chapter 18.3.  If it is possible, please provide/report number of inhabitants by age for every village in the table 18.3.Please alternatively change age categories/apply knowledge about other age categories according to your data available. |
|  |  |
| 45 | In Chapter 18.4.  In the Table 18.4 please kindly check/confirm information in yellow lines. This information will be used for inventory of the reactor core initial calculation. |
|  |  |
| 46 | In Chapter 18.4.  Please kindly provide information what is the state of the SFP which should be assumed by ESTE Bushehr for inventory of the SFP calculation.  If it is possible, please let us know what is the number of spent fuel assemblies discharged to the pool?  How old are groups of these assemblies?/fuel from how many refueling periods has been placed into the pool?  This information will be used for initial calculation of the SFP inventory. |
|  |  |
| 47 | In Chapter 18.4.  Please kindly confirm information on the design leakage rate of the containment (0,25% per day). This value or other value provided by End-User will be applied in the process of calculation of source terms database.  Is there any free space between inner and outer containment (of double containment structure)?  Is/can be the free space between inner and double containment ventilated to the stack?  If yes, are there in the pathway to the stack any aerosol and iodine filters, which would be applied in case of emergency conditions? |
|  |  |
| 48 | In Chapter 18.4.  Please kindly provide information on possible pathways for release in case of “interfacing system LOCA”.  Are some pipes and tanks of ECCS placed outside containment?  Can be the structures and parts (pipes, tanks) of ECCS assumed as potential pathway for by-pass of containment in case of leak from primary circuit to the ECCS ?  Can the system of essential service water (pipes, tanks) be assumed as potential pathway for bypass of containment in case of leak from primary circuit to the ESW system?  This information provided by End-User will be applied in the process of calculation of source terms database for ESTE Bushehr. |
|  |  |
| 49 | In Chapter 18.5.  In the Table 18.5.1 please kindly insert warning messages in Farsi language. |
|  |  |
| 50 | In Chapter 18.6.  In the Table 18.6 please kindly provide your response to the questions regarding ftp/sftp, communication ports, etc. If the communication with input data will be by other method (Oracle, MySQL, ...), then please provide your description of proposed communication, especially description of attributes in the table. Other particulars will be agreed in the next phase. |
|  |  |