MVM PAKS II. ZRT.

ERECTION OF NEW NUCLEAR POWER PLANT UNITS AT THE PAKS SITE

ENVIRONMENTAL IMPACT STUDY

INTERNATIONAL CHAPTER

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Introduction

The purpose of this chapter is to provide information to the exposed parties beyond the national borders in two topics. In the first part of the chapter the summary of the assessment results concerning transboundary impacts is presented, and the migration model simulation related to emissions originating from serious incidents is described. In the subsequent section answers are provided to the part of the questions and comments received to the Preliminary Consultation Document (EKD) which are not covered by the scope of Environmental Impact Assessment in the narrower sense, and therefore the opportunity was given in this chapter to react on them. With respect to the other questions not dealt with herein the observations and comments received from the citizens of the various countries were taken into consideration in the course of the preparations of the Environmental Impact Study, and therefore they are available in the relevant chapters for all interested stakeholders. The reason why the replies are not itemised is that that they were generated from the EKD which did not have the responsibility to provide these pieces of information. This way we are confident that by thorough reading of the Environmental Impact Study each inquirer will receive the answer to the question raised and even more.

1 The summary of cross border impacts

The erection/construction and operation of new units in nuclear power plants is covered by the Convention on Environmental Impact Assessment in a Transboundary Context (informally called the Espoo Convention), and by Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment as amended by the Council directives 97/11/EC, 2003/35/EC and 2009/31/EC of the European Community. The implementation of the Espoo Convention in Hungary is provided for by Government Decree No 148/1999. (X. 13.). Activities covered by the provisions laid down in the convention are contained in Appendix No 1 thereto. In the event of such activities countries which feel affected may request the completion of an international Environmental Impact Assessment irrespective whether or not the impact area covers their respective national territory according to the analyses carried out. The concept of transboundary or cross border impacts is defined in Government Decree No 148/1999. (X. 13.). In the course of the operation of a nuclear power plant primarily airborne and liquid emissions and discharges should be anticipated and the summary of their transboundary effects can be read below.

The impact area of indirect effects was determined for airborne emissions in the case of operating troubles due to design faults as the boundary of the 500 metres safety zone, therefore as a consequence no cross border effects need to be reckoned with. The auxiliary dose rate of wildlife in the close proximity of the power plant did not have an influence on the state of the wildlife even in the most exposed habitats, thus no cross border radiation exposure affecting the wildlife in another country is expected.

During the period of erection, operation and decommissioning of the new unit no transboundary radiological aquatic impact on the Danube and its wildlife exists which could be deemed to be important, and correspondingly, no such impact area can be defined, either.

With respect to heat loads the water temperature in the Danube does not reach the limit values set in the 500 metres long Danube reference profile (Danube 1525.75 river km) in the current state of affairs. However, in the period representing the highest level of exposure, that is when the six units operate simultaneously, a slight violation of the limit value applicable on the reference profile can be experienced at the discharge rates and water temperature levels taken as the most realistic scenario for the purposes of modelling but encountered quite infrequently on an annual basis. In order to avoid violation of the limit value measures (monitoring) and additional cooling efforts or other measures need to be applied. Since however the legal provisions require stringent limits for the 500 metres reference profile therefore no substantial cross border impact of heat loads should be anticipated.

According to the model simulations and assessments made with respect to the conventional (non-radiological) impacts it can be concluded that no cross border impacts can be assumed in the stages of implementation and operation. Estimates of the impacts upon decommissioning is very difficult to make due to the very long time horizon and the lack of information on the exact details of the decommissioning works. In general it can be stated that the loads defined for the construction period or somewhat lower than those may be taken into account.

In the event of environmental impacts concerning the quality of the air, terrestrial and aquatic wildlife, the urban environment and the landscape as such or with regard to the expected noise and vibration exposures the possibility of cross border impacts is not taken into account.

Impacts on waste management remain local in all of the cases and hence, no cross border impacts can be talked about.

In general it can be stated that cross border impact are not anticipated even in the case of operating troubles.

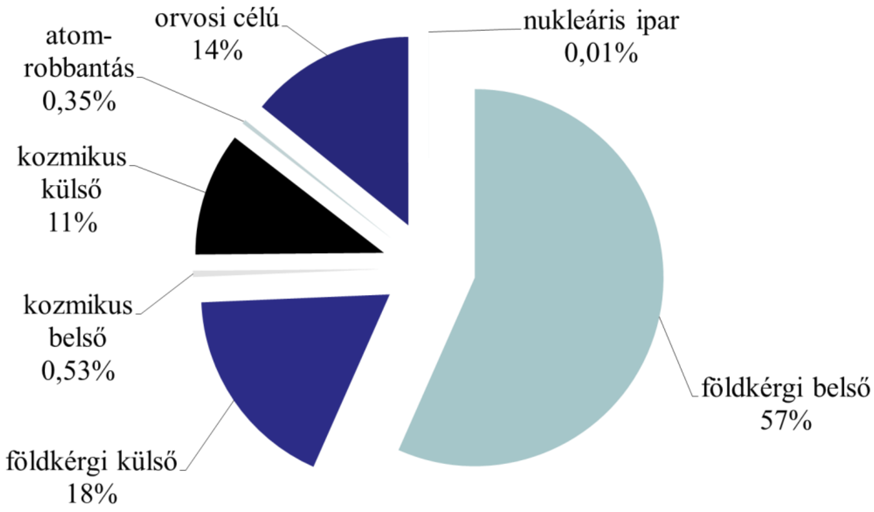
2 Cross border impacts of radioactive releases

It is very difficult to judge and evaluate the physiological impacts of radiations, since radiation can only be measured with quite complex and sophisticated methods, and there is only a limited amount of experience available in particular in the case of low doses. Interpretation of the values in the tables presented in the chapter below will be assisted by the few explanatory sentences here which were inserted into this chapter in order to make comparisons easier.

Radiation carries energy a part of which is absorbed when interacting with certain materials and media and transmits such energy (for instance, the radiation of the Sun is absorbed in the soil and the soil warms up as a consequence). If a material is exposed to radioactive radiation, according to the experiences gained the changes experienced are proportional with the amount of energy absorbed. In order to estimate and forecast expected impacts quantities proportional with the absorbed amount of energy (the dose) are used. The amount of energy absorbed in the unit mass of the material exposed to the radiation is called the *absorbed radiation dose*. The concept of the dose which takes the type and energy of the radiation into account is the *dose equivalent* or DE. However, the doses applicable to various organs or tissues (dose equivalent doses) do not contribute to the health impairment of the human body in the same extent. There are tissues which are more sensitive, others are less vulnerable. This is taken into account by a weight factor expressing the rate by which each of the tissues contribute to the so called *effective dose* which predicts the damages to the body as a whole.

In Hungary the radiation exposure originating from all radiation sources is around 3 mSv[1] which is comparable with the 4 mSv value dose contribution of a medical CT examination, but even an X-ray image of a tooth causes a dose of 0.1 mSv. The figure below illustrates the percentage distribution of the radiation exposure of humans per source, where it is remarkably noted that the slice of the pie chart representing the nuclear industry is by far the smallest.

[1] **The concept of sievert (marked by: Sv) is the equivalent radiation dose, a derived unit of measurement in the system, evaluating the amount of ionising radiation according to its biological effects. 1 nSv is one billionth, 1 μSv one millionth, while 1 mSv is one thousandth part of the 1 Sv unit.*



földkéregi belső 57% - Earth crust internal 57%
földkéregi külső 18% - Earth crust external 18%
kozmikus belső 0,53% - cosmic internal 0.53%
kozmikus külső 11% - cosmic external 11%
atomrobbantás 0,35% - nuclear explosions 0.35%
orvosi célú 14% - medical 14%
nukleáris ipar 0,01% - nuclear industry 0.01%

Figure 1: Percentage distribution of the difference sources in the human radiation exposure

Residential radiation exposure in the direct neighbourhood of the Paks Nuclear Power Plant in Csámpa community is 50 nSv a year, which can be better understood if you are aware that the natural background radiation in Paks ranges around 80-100 nSv per hour, that is the same dose is provided by the power plant operation during a whole year in Csámpa, as otherwise within an hour somewhere outdoors in the Paks surroundings.

2.1 The method of radiological classification process

The following categories are used for the purposes of classification of radiological impacts:

Classification grade	Radiological effect (E=effective dose)
neutral	E < 90 µSv/year
acceptable	90 µSv/year < E < 1 mSv/year
burdening	1 mSv/year < E < 10 mSv/2 nap or 10 mSv/incident*
damaging	10 mSv/2 nap or 10 mSv/incident < E < 1 Sv/incident**
fatal	1 Sv/lifetime < E

**without the impact of the food chain*
*** full lifetime (50 years for adults, 70 years for children), excluding the impact of the food chain*

where:

90 µSv/year is the dose limit value defined by ÁNTSZ-OTH;

1 mSv/year is the residential dose limit;

10 mSv is the avoidable dose in the case deviating from the standard operation;

1 Sv/lifetime is the emergency intervention level on final resettlement.

2.2 The impacts of liquid radioactive discharges from Paks II

When cross border liquid discharges are calculated the standard operation are taken as the baseline. The correction factor at the Serbian border which is in a distance of 100 kilometres is substantially lower than at Gerjen due to the partial mixing.

Expected public radiation doses in the environment of the Serbian border are summarised in the table below:

Radionuclide	1-2 years old child			Adult		
	external	internal	total	external	internal	total
^{58}Co	1.8E-04	5.2E-04	7.0E-04	1.8E-04	2.5E-04	4.3E-04
^{60}Co	7.7E-03	2.2E-02	3.0E-02	7.8E-03	6.6E-03	1.4E-02
^{51}Cr	3.8E-06	2.9E-05	3.3E-05	3.9E-06	1.8E-05	2.2E-05
^{134}Cs	4.0E-02	1.1E+00	1.1E+00	4.0E-02	7.9E+00	8.0E+00
^{137}Cs	5.8E-02	1.4E+00	1.5E+00	5.8E-02	8.6E+00	8.7E+00
^{3}H (HTO)	0.0E+00	2.1E+01	2.1E+01	0.0E+00	2.1E+01	2.1E+01
^{14}C	0.0E+00	1.6E+01	1.6E+01	0.0E+00	1.6E+01	1.6E+01
^{131}I	9.2E-05	3.9E-01	3.9E-01	1.5E-04	9.1E-02	9.1E-02
^{132}I	3.2E-05	8.3E-05	1.1E-04	5.5E-05	3.3E-05	8.8E-05
^{133}I	4.5E-05	1.1E-02	1.1E-02	7.6E-05	2.9E-03	3.0E-03
^{134}I	2.3E-05	1.6E-05	3.8E-05	3.9E-05	7.7E-06	4.6E-05
^{135}I	3.9E-05	5.4E-04	5.8E-04	6.6E-05	1.8E-04	2.5E-04
^{54}Mn	1.2E-04	2.5E-04	3.6E-04	1.2E-04	2.6E-04	3.8E-04
^{89}Sr	3.4E-06	1.6E-03	1.6E-03	3.4E-06	5.8E-04	5.8E-04
^{90}Sr	7.4E-07	7.2E-05	7.2E-04	7.4E-07	6.3E-05	6.3E-05
Total	**1.1E-01**	**4.0E+01**	**4.1E+01**	**1.1E-01**	**5.4E+01**	**5.4E+01**

Table 1: Annual doses of the age groups 1-2 years old and adult population living in the area of the Serbian border originating from the liquid discharges (nSv/year)

Doses observed here can naturally not be compared to the dose limits, you can only say that the liquid discharges from the two units result a mere 17 minutes addition to the world average of the annual natural background radiation (2.4 mSv/year). Therefore, a neutral impact can be expected for those living at the Serbian border with respect to the transboundary impacts arising from liquid discharges.

2.3 The impacts of airborne radioactive air pollutants from Paks II

Modelling of the migration of radioactive airborne air pollutants emitted from the new nuclear power plant units proposed for the Paks site were also carried out for the territory of the neighbouring countries using the TREX Euler model on a regular grid covering Central Europe, using the hourly meteorological database from the year of 2011.

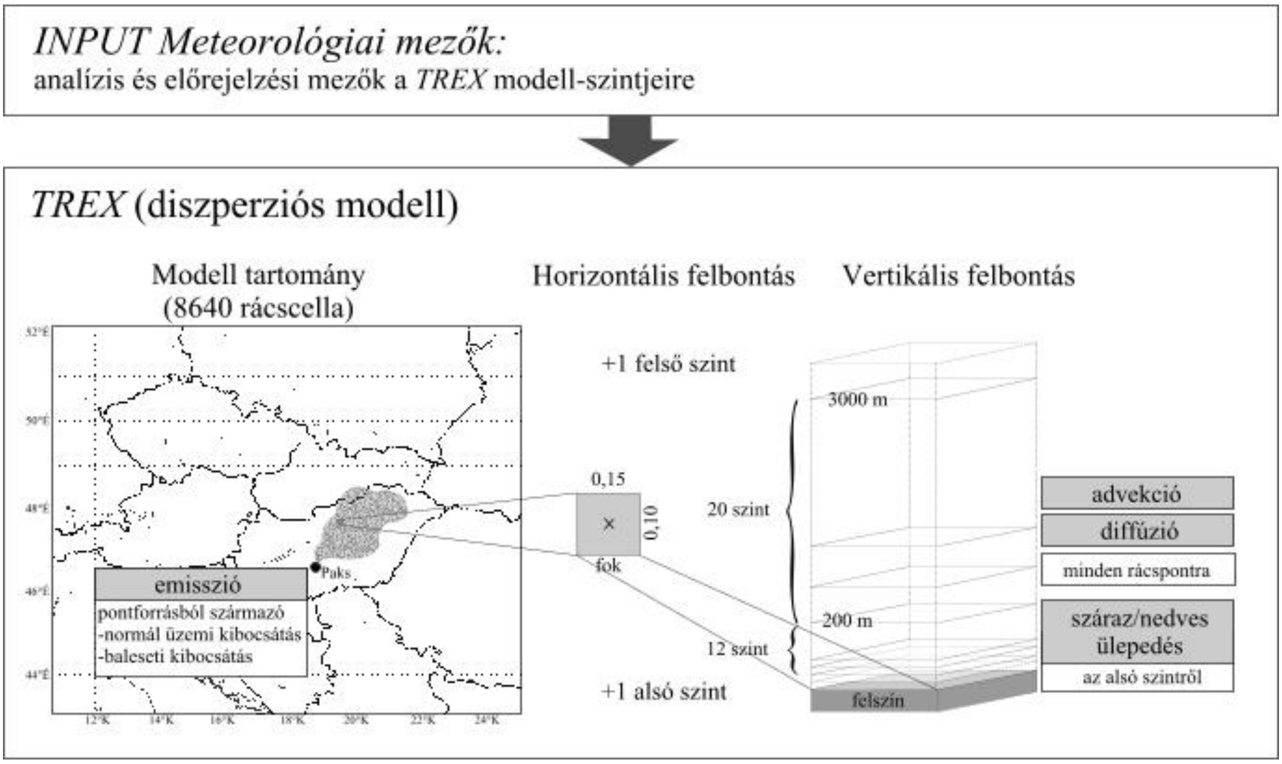
During the calculations the integrated activity concentration fields and inhalation (originating from breathing) doses were determined.

For the simulations models taking various approaches for migration simulation and dose counting were used. The software programmes used are validated and hold references from the nuclear industry as well, a part of them is currently operated at Paks Nuclear Power Plant as an operational tool.

2.3.1 TREX Euler model

The Gaussian models do not provide appropriate results on a regional or larger scale because they are not able to handle the great diversity of meteorological fields in terms of time and space. Therefore the application of such a modelling procedure is necessary where the more complex meteorological factors appearing on the larger scales can also be managed. For this task the Euler-type model of the TREX model family was used. The Euler-type models cover a defined area of the atmosphere by a grid and the system of equations describing the physical processes are solved for the points of this grid so that the solution be obtained for each constant or variable time step. The TREX-Euler model calculates dispersion of the various pollutants on a grid covering Central Europe.

The flow chart of the model is seen on the figure below.



INPUT Meteorológiai mezők - INPUT: Meteorological features
analízis és előrejelzési mezők a TREX modell szintjeire - Analysis and prediction fields for the levels of the TREX model
TREX (diszperziós modell) - TREX (dispersion model)
Modell tartomány (8640 rácscella) - Model range (8640 grid cells)
Horizontális felbontás - horizontal resolution
Vertikális felbontás - vertical resolution
emisszió - emission
pontforrásból származó normál üzemi kibocsátás és baleseti kibocsátás - point sources of standard operational discharges and accidental release
+1 felső szint - +1 upper level
+ 1 alsó szint - + 1 lower level
felszín - surface
advekció - advection
diffúzió - diffusion
minden rácspontra - for all grid point
száraz / nedves ülepedés - dry / wet settlement
az alsó szintről - from lower level

Figure 2: Flow chart of the TREX-Euler type model used

In the transport equations used for the description of the migration the model takes into account the following:

- advection (horizontal flow),
- vertical and horizontal diffusion,
- settling,
- chemical reactions and
- the emission.

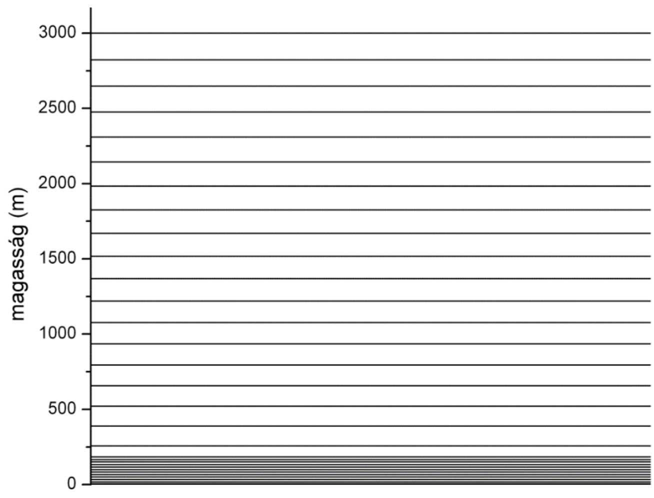
$$\frac{\partial \bar{c}}{\partial t} = -\bar{\boldsymbol{V}}\nabla\bar{c} + \nabla\boldsymbol{K}\nabla\bar{c} - (k_d + k_w) + R + E$$

<u>where</u>:

$\bar{c}$	average concentration of the material concerned [mass unit/m^3],
$\bar{\boldsymbol{V}} = (\bar{u}, \bar{v}, \bar{w})$	average three dimensional wind field [m/s],
k_d	dry settling coefficient [1/s],
k_w	wet settling coefficient [1/s],
$\boldsymbol{K} = (K_x, K_y, K_z)$	vector of the turbulent diffusion coefficients, the components of which include the horizontal and vertical diffusion coefficients [m^2/s],
R	the speed of concentration change occurring as a result of chemical processes [mass unit/(m^{3}s)],
E	emission level of the material concerned [mass unit/volume].

The model is quasi three dimensional as most models are which are used in current practices. The assessed part of the atmosphere is broken down to layers in vertical direction and the changes of the concentration are described in each layer by separate 2 dimensional models while vertical material transport in between the layers are calculated on the basis of the appropriate physical model. In order to achieve an exact description of the vertical mixing 32 different elevations were distinguished.

Up to a height of approximately 200 metres from the ground 12 levels could be placed, and an additional 20 levels were positions between 200 and 3 000 metres so that differential pressure would be equal in the hydrostatic atmosphere between each level (197 and 1514 Pa, respectively). This was carried out by embedding two coordinate systems into each other as presented on the figure below.



magasság - altitude

Figure 3: Vertical stratification in the model

The selection of the time steps and the resolution of the grid is of paramount importance for the purposes of accuracy of the solution obtained, and besides it may result in numeric errors, convergence and stability issues originating from the finite resolution. Stable outcome is obtained for diffusion calculations when the following correlation exists among the K turbulent diffusion constant, Δt time step and Δx grid resolution:

$$\frac{2K \cdot \Delta t}{\Delta x^2} \leq 1$$

Stable outcome is obtained for advection calculations when the following correlation exists among the $\mathbf{V}$ size of the velocity vector, Δt time step and Δx grid resolution:

$$\frac{|\mathbf{V}| \cdot \Delta t}{\Delta x} \leq 1$$

It can be seen that the stability of the solution can be enhanced by reducing the time steps and increased in the resolution accuracy of the grid when the diffusion constant and wind speed are given. However, if a rough grid resolution is used, the emission will be averaged on a large area instantly which levels out the steep gradient and causes a high level of numeric diffusion. As a consequence, maximum concentration is underestimated in the plume and the width of the plume is overestimated. With the reduction of the time step – and with low levels of grid resolution – the calculation time is increased significantly. A compromise between the time and grid resolution must be found by taking these into account simultaneously. The model developed by us calculated the concentration and settling of contaminants originating from a single point source with a 10 seconds time step and 0.15 × 0.1 degrees (~10 km × ~10 km) spatial resolution.

THE ARCHITECTURE OF THE EULER MODEL USED

The programme code consists of several parts.

The main programme carries out the reading of the data, call of the different functions and finally display of the results.

The first sub module provides horizontal and vertical boundary conditions. At the edge of the range 'no-flux' boundary condition was used, in other words it was assumed that no material flow exists at the boundary line. Separate routines carry out the calculations for vertical and horizontal diffusion and the determination of elevation levels. The Monin–Obukhov-length (L) and the vertical turbulent diffusion coefficient (Kz) necessary for the calculations are computed by separate functions. Description of the various material transport modes (advection, diffusion), and separate calculation of the chemical reactions and settling are made possible by the operator slicing method described later on.

The horizontal diffusion coefficient was taken in the model as a constant. Vertical turbulent diffusion is calculated on the basis of the K-theory and is taken into account with the elevation dependent Kz diffusion coefficient. In order to shorten the time necessary for the model run the calculation of the Kz value was made by the random stochastic method. Vertical distribution of individual material types (profile) is specified by the vertical diffusion equation:

$$\frac{\partial c}{\partial t} = \frac{\partial}{\partial z}\left(K_z(z)\frac{\partial c}{\partial z}\right)$$

The vertical turbulent diffusion coefficient was given parameters with the use of the Monin–Obukhov similarity theory in the following way:

According to this the turbulent diffusion coefficient at a given z level can be plotted as a function of the altitude of the mixing layer (H_z) the friction velocity (u^*), the stability function (Ψ), the Kármán-constant (κ) and the Monin–Obukhov length (L).

For the calculation of dry settling conditions a constant settling coefficient was taken into account. Wet settling was calculated when relative humidity was above 80 %. Additionally, it was assumed that only the first, near surface layer can settle.

The programme calculates advection in each time step for each level once the data are retrieved, the elevation levels, initial and boundary conditions are set, and subsequently defines vertical mixing, the turbulent diffusion coefficient and the associated necessary Monin–Obukhov length for each air column. Finally settling in the near ground or in other words near surface layer was determined. In the next step the process described above is reiterated again from the beginning.

<u>Numeric solution</u>

Those 3D models which have an acceptable level of accuracy, need a huge computational performance and sophisticated numeric solution techniques. In the TREX-Euler model the equations are solved with the use of the operator slicing method, in other words the members included in the partial differential equations were solved one by one. Spatial transport members were discretised by finite differential schemes. Only the advection member (advection effect) was taken into account in the first step and c^{adv} concentration was defined this way (i.e. the new concentration distribution formed as a result of advection) from the former c^{old} concentration value:

$$c^{adv} = c^{old} + A^{adv}\Delta t$$

In the next step using the c^{adv} concentration level obtained previously the c^{diff} concentration formed as a result of the diffusion impact was determined (calculating separately for vertical and horizontal diffusion):

$$c^{diff} = c^{adv} + A^{diff}\Delta t$$

Finally the impact of chemical reactions, dry and wet settling was calculated from the concentration level calculated in the previous two steps using the following equation:

$$c^{chem} = c^{diff} + A^{chem}\Delta t$$

This way the c^{new} concentration parameters contained the impact of all three factors after the Δt time step specified. In the equations A^{adv} stands for the advection operator, A^{diff} for the diffusion operator, while A^{chem} are the operators describing the chemical reaction and settling. Different methods were used for solving them.

One of the effective methods of solving partial differential equations is the so called „method of lines" technique. The point in the method is the integration of the common system of differential equations generated after the spatial discretising of the transport members over time by the application of the appropriate initial and boundary conditions. For the purposes of spatial discretisation of advection the so called "second upwind" method, for the calculation of the vertical diffusion the "first upwind" method were used. The first and second upwind methods are schemes providing stability to the advection and diffusion solutions. In the event of chemical reactions, dry and wet settling no spatial derivative is applied, only the integration over time had to be complete there. The explicit Euler scheme was used for integrating the discretised members over time.

2.3.2 The meteorological databases used

<u>AVERAGE METEOROLOGICAL DATA FOR A CONSERVATIVE ESTIMATE</u>

For the purposes of a conservative estimate the climate data, average and most typical values of the area were taken into account.

The prevailing wind characteristic for the area is the north-west wind, but during the conservative scenario an estimate independent from the direction of the wind was used.

Wind speed levels were set as the average of the measurements made at the Paks metering tower on elevations 20 and 120 metres in the years between 2002 and 2011.

No temperature figures are available from the tower measurements, therefore the climatic average of the temperature was taken into consideration which is 10.7 °C for the area.

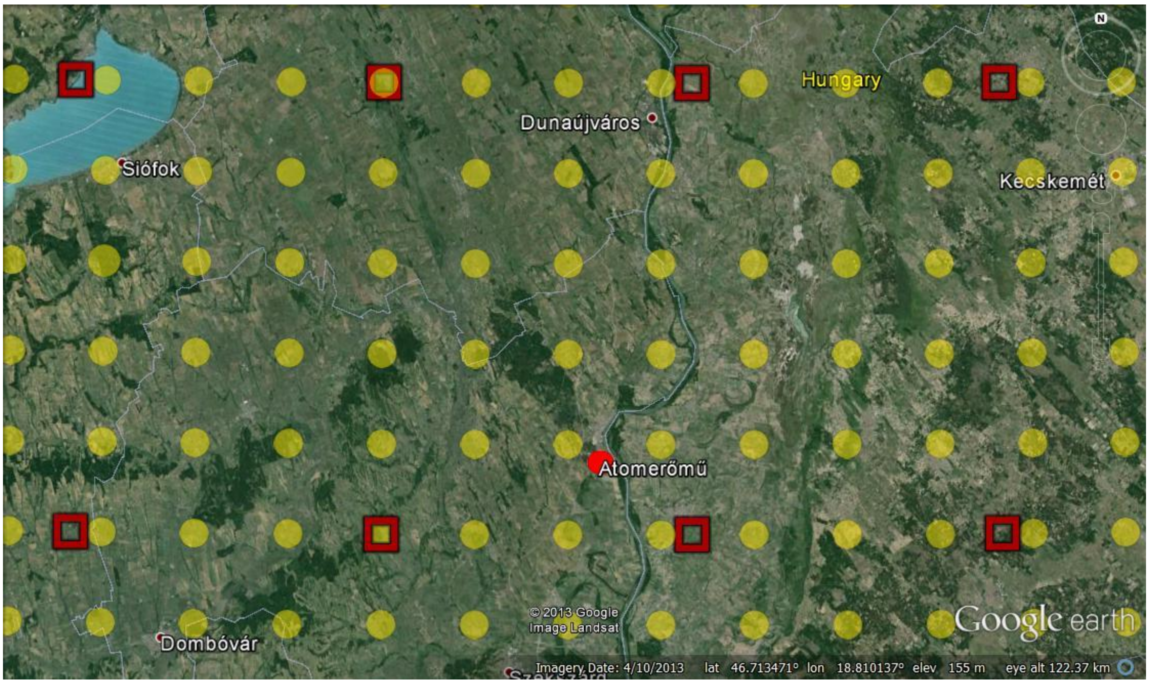
Assuming dry adiabatic temperature stratification the temperature was 4.7 °C and –3.3 °C at the pressure levels of 925 hPa and 850 hPa, respectively. The geopotential elevations of the 925 hPa pressure level and of the and 850 hPa were defined as 700 metres and 1500 metres, respectively. The height of the boundary layer was set to the lowest level characteristic for the daylight hours (300 m), which is the least favourable condition for the dispersion of airborne contaminants.

The level of cloudiness was taken as 4 oktas (50% overcast), and the value of the sensible heat flow 100 W/m^2, while the roughness parameter was set to 0.25 m.

Beside these typical meteorological situation an unfavourable weather condition was also taken into account in certain simulation runs. In this case the wind speed was assumed to be 1 m/s and 2 m/s in an elevation of 20 and 120 metres, respectively, the height of the boundary layer 100 metres, the vertical temperature stratification isotherm and a strong surface eradiation was calculated with (stable air stratification).

SIMULATIONS WITH REAL METEOROLOGICAL DATABASE

Model simulations were carried out with real meteorological databases for a whole year, taking into account hourly releases. Partly point measurement figures and partly numeric forecast model outputs were used for the simulations. For the purposes of the dispersion simulation made with the Euler model for greater distances the archives of the numeric weather forecast model Global Forecast System (GFS) was used. The meteorological fields have time resolution of three hours. The meteorological data specified for the vertical elevations of the GFS numeric forecast model were converted to the vertical elevations of the model (on a total of 34 levels).



Note:
red squares mean the grid points of the GFS model. The yellow circles represent the grid resolution used for the Euler-type simulation. The value of the meteorological figures was determined for these points by interpolation procedures.
Atomerőmű – Nuclear Power Plant

Figure 4: Comparisonof the GFS numeric forecast model grid and the Euler model grid

CALCULATION OF THE INHALATION DOSE

The conversion of the effective absorbed dose originating from the breathing in (inhalation) can be drawn up in general terms as follows:

$$E = \sum_{j=1}^{n} \left[V \cdot K_j \cdot f_{1,j} \cdot F \cdot \int_{t_1}^{t_2} C_j(P,t) \cdot dt \right]$$

where:

V: breathing intensity [m^3/day],

K_j: the inhalation dose coefficient of the j radionuclide [Sv/Bq],

$f_{1,j}$: the radionuclide retaining capacity of the lungs for radionuclide j.

F: a parameter expressing the ratio between staying indoors in the building and the shadowing impact of the building which was taken as 0.4 for the purposes of calculation,

$$\int_{t_1}^{t_2} C_j(P,t) \cdot dt$$

the integrated activity concentration of the isotopes concerned in point P for the period between t_1 and t_2.

2.3.3 Figures on radioactive releases

The impact of the *very low frequency design breakdown marked TA4 (Government Decree No 118/2011. (VII. 11.) Annex No 10, 163. Operating state: Design base TA4: Incidents within the design base, design breakdown events with very low frequency: 10^{-4} > f > 10^{-6} [1/year])* presented in Chapters 20 and 21, respectively, – even under meteorological conciliations which can be considered to be unfavourable – is neutral for the population and the surrounding wildlife.

Therefore, when the transboundary effects were assessed the starting point was the serious accidental releases the probability of which is lower than 10^{-6} 1/rector year. These incidents are to be classified on the categories of operating troubles beyond the design base events TAK1 (DEC1) or serious accident TAK2 (DEC2). *(Extension of the design base TAK: Operating troubles beyond the design base TAK1, and serious accidents TAK2).*

The characteristic features of the operating troubles beyond the design base events TAK1 (DEC1) are as follows:

Any process beyond the scope of expected operational incidents and the design operational troubles which may only occur as a result of several independent errors and which may entail consequences more serious than the processes within the design base and may cause zone damages not accompanied by a meltdown.

After the expected amendment of the Nuclear Safety Codes (NBSz) the following section will replace the term “Operating trouble beyond the scope of design”:

Complex breakdown (TAK1)

An operating state in the case of the new nuclear power plant units beyond the scope of the expected operational events and design operating troubles, which may only occur as a result of several independent errors and which may entail consequences more serious than the operating states within the design base and may cause fuel element damages not accompanied by a meltdown. In the event of existing facilities it corresponds to the operating trouble beyond the scope of design.

The characteristic features of the serious accidents TAK2 (DEC2) are as follows:

A state of emergency accompanied by the significant damage of the reactor zone and meltdown of zone, entailing external impacts more severe than those encountered with design breakdown and operating trouble beyond the scope of design.

the expected amendment of the Nuclear Safety Codes (NBSz) the following section will replace this definition::

an operating state in the case of Nuclear Power Plant units accompanied by the substantial damage to the nuclear fuel, entailing external impacts more severe than those encountered with design breakdown (TA4) and operating trouble beyond the scope of design (TAK1)."

RELEASES

Releases happen from two sources, the 100 m high smokestack and the lower discharge point (35 m).

The supplier of the reactors provided the emission particulars for each of the accident scenarios in the two heights defined above in various times and periods which are summarised in the tables below.

Isotope	Lower discharge point (35 m)			Smokestack (100 m)		
	1 day	10 days	30 days	1 day	10 days	30 days
	activity (Bq)					
Elemental iodine						
I-131	2.3E+11	2.4E+11	2.4E+11	1.1E+08	5.9E+08	8.7E+08
I-132	2.5E+11	2.5E+11	2.5E+11	3.4E+07	3.4E+07	3.4E+07
I-133	3.4E+11	3.4E+11	3.4E+11	1.2E+08	2.0E+08	2.0E+08
I-134	2.7E+11	2.7E+11	2.7E+11	2.3E+07	2.3E+07	2.3E+07
I-135	2.3E+11	2.3E+11	2.3E+11	5.3E+07	5.6E+07	5.6E+07
Organic iodine						
I-131	1.8E+09	1.2E+10	2.0E+10	2.5E+09	1.7E+10	2.8E+10
I-132	2.8E+08	2.8E+08	2.8E+08	4.0E+08	4.0E+08	4.0E+08
I-133	1.8E+09	3.3E+09	3.3E+09	2.6E+09	4.7E+09	4.7E+09
I-134	1.0E+08	1.0E+08	1.0E+08	1.4E+08	1.4E+08	1.4E+08
I-135	6.7E+08	7.3E+08	7.3E+08	9.5E+08	1.0E+09	1.0E+09
Inert gases						
Kr-85m	3.6E+10	3.6E+10	3.6E+10	4.9E+11	5.0E+11	5.0E+11
Kr-87	8.5E+10	8.5E+10	8.5E+10	3.5E+11	3.5E+11	3.5E+11
Kr-88	1.2E+11	1.2E+11	1.2E+11	1.1E+12	1.1E+12	1.1E+12
Xe-133	8.2E+11	2.0E+12	2.4E+12	3.2E+13	1.9E+14	2.6E+14
Xe-135	3.6E+10	3.7E+10	3.7E+10	8.1E+11	9.8E+11	9.8E+11
Xe-138	1.9E+11	1.9E+11	1.9E+11	1.1E+11	1.1E+11	1.1E+11
Aerosols						
Cs-134	1.4E+08	1.4E+08	1.4E+08	6.2E+05	6.2E+05	6.2E+05
Cs-137	7.2E+07	7.2E+07	7.2E+07	3.2E+05	3.2E+05	3.2E+05

Table 2: Emission particulars of an accident in the category of TAK1 (DEC1)

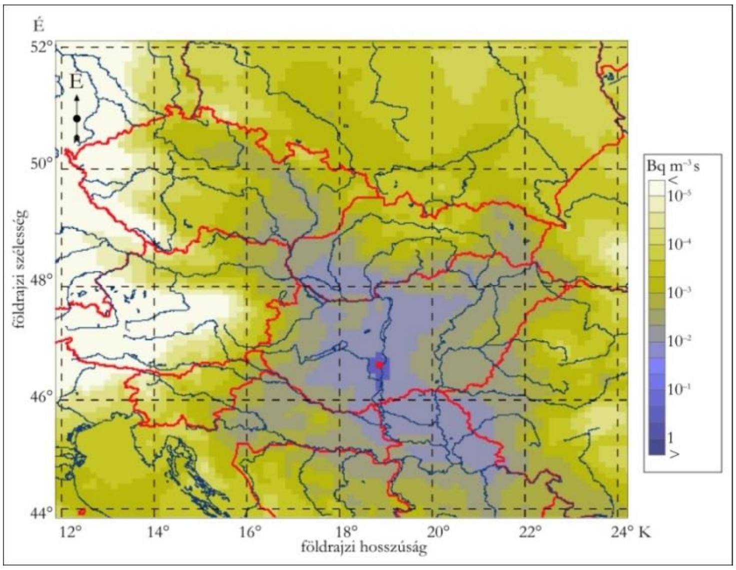
Isotope	Lower discharge (35 m)			Smokestack (100m)	
	0 – 1 days	1 – 7 days	7-30 days	1 – 7 days	7 – 30 days
	activity (Bq)				
Elemental iodine					
I-131	9.4E+12	4.1E+11		3.5E+11	
I-132	7.9E+11	5.2E+09		2.8E+09	
I-133	1.3E+13	3.1E+11		2.9E+11	
I-134	2.6E+11	-		-	
I-135	5.1E+12	7.8E+10		7.7E+10	
Organic iodine					
I-131	1.8E+12	8.4E+11	4.7E+11	4.5E+12	4.7E+12
I-132	3.7E+11	3.1E+10	-	1.6E+11	-
I-133	2.4E+12	2.9E+11	5.9E+08	1.8E+12	5.9E+09
I-134	3.0E+10	-	-	-	-
I-135	8.9E+11	2.4E+10	-	1.8E+11	-
Inert gases					
Kr-85m	3.9E+13	4.3E+11	-	3.6E+13	-
Kr-87	1.1E+13	-	-		-
Kr-88	6.2E+13	1.3E+11	-	1.1E+13	-
Xe-133	2.4E+15	1.1E+15	2.0E+14	5.7E+16	2.0E+16
Xe-135	6.2E+14	4.7E+13	-	2.9E+15	-
Xe-138	7.8E+11	-	-	-	-
Aerosol					
I-131	4.5E+13	6.8E+12	-	6.2E+11	-
I-132	3.5E+13	7.9E+10	-	5.3E+09	-
I-133	7.5E+13	5.7E+12	-	5.6E+11	-
I-134	5.8E+12	-	-	-	-
I-135	4.5E+13	9.2E+11	-	9.2E+10	-
Cs-134	1.1E+13	1.6E+12	2.5E+11	1.5E+11	2.5E+10
Cs-137	5.2E+12	8.1E+11	1.6E+11	7.3E+10	1.6E+10

Table 3: Emission particulars of an accident in the category of TAK2 (DEC2)

2.3.4 In the event of standard operational releases

ACTIVITY CONCENTRATION LEVELS

The activity concentration field in standard operational releases is shown on the figure below:

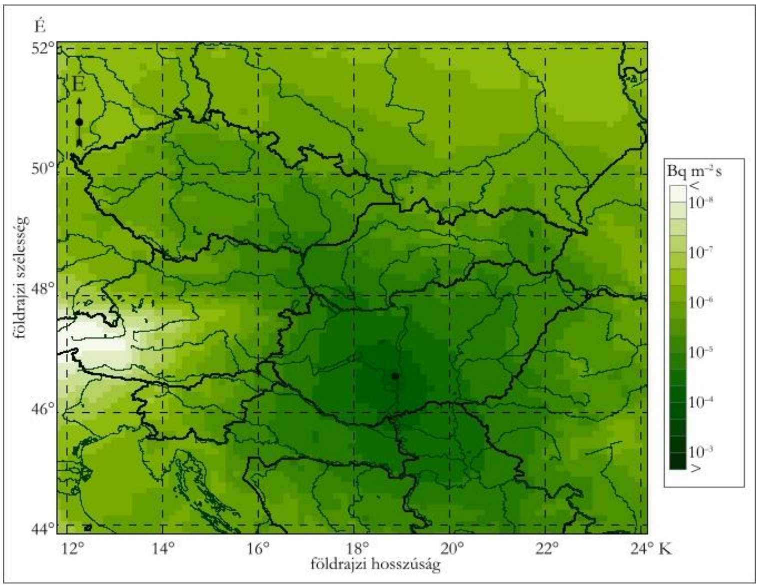


földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 5: The integrated activity concentration field for the whole year of 2011 in the environment of the proposed nucelar power plant units in the near ground layer (0–2 m) under standard operational release levels

SETTLING FIELD LEVELS

The settling field in standard operational release is shown on the figure below:



földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 6: The integrated settling field for the whole year of 2011 in the environment of the proposed nucelar power plant units under standard operational release levels

INHALATION DOSES

Settlement	Model coordinates		Inhalation dose (adult) nSv/year	Inhalation dose (child) nSv/year
	width	length		
Graz	15.50	47.1	1.420E-02	1.428E-02
Zagreb	15.95	45.8	3.560E-01	3.581E-01
Vienna	16.40	48.2	3.741E-01	3.762E-01
Bratislava	17.15	48.2	6.750E-01	6.790E-01
Novi Sad	19.85	45.3	9.892E-01	9.951E-01
Beograd	20.45	44.8	8.876E-01	8.928E-01
Arad	21.35	46.2	6.228E-01	6.265E-01
Kosice	21.35	48.7	4.156E-01	4.180E-01
Oradea	21.95	47.0	1.808E-01	1.819E-01
Uzhgorod	22.25	48.6	2.515E-01	2.530E-01

Table 4: Calculated annual inhalation doses originating from standard operational releases (adult and children)

2.3.5 In the event of releases exceeding the design base

In the event of releases exceeding the design base the radiation exposure of the population at the site can best be presented by the specification of the inhalation (breathing in) dose since the other doses causing radiation exposure are values lower by several orders of magnitude.

Activity concentrations of the radioactive isotopes at the location concerned are needed in order to determine the inhalation dose.

During the simulation process the average and maximum activity concentration values were determined for during event beyond the design state were determined in the event of TAK1 (DEC1) and TAK2 (DEC2) releases both for early and late releases. (*The average activity concentration is the average value of the activity concentrations simulated for the grid point in question over a year. The maximum activity concentration is the highest of the activity concentrations simulated for the grid point in question over a year.)*

Later on expected early and late inhalation dose values were determined in the case of both events for adults and children. (*The meaning of early in the case of TAK1 is the activity concentration or dose calculated for a 7 days period of release (0-7 days), in the case of TAK2 for a 10 days period of release (0-10 days). The phrase late concerns the activity concentration or dose calculated on the basis of 30 (0-30 days) days release periods.)*

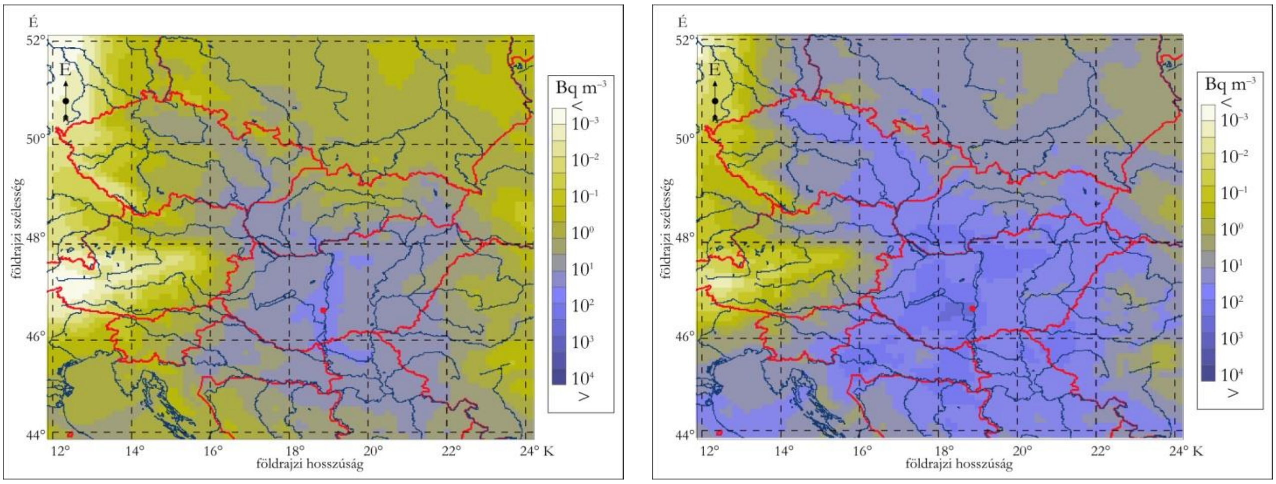
For the early dose calculations the initial data were considered to be the release figures of days 1 to 10 (Table 2) and 0 to 7 (Table 3) in the event of TAK1 (DEC1) complex operating troubles and TAK2 (DEC2) severe accidents, respectively.

For the late dose calculations the initial data were considered to be the release figures of 30 days (Table 2) and 7 to 30 days (Table 3) in the event of TAK1 (DEC1) complex operating troubles and TAK2 (DEC2) severe accidents, respectively.

The figures obtained are shown on the tables below in the case of major towns situated close to the national border, based on the grid point values of the model found the closest to the respective cities.

<u>ACTIVITY CONCENTRATION LEVELS</u>

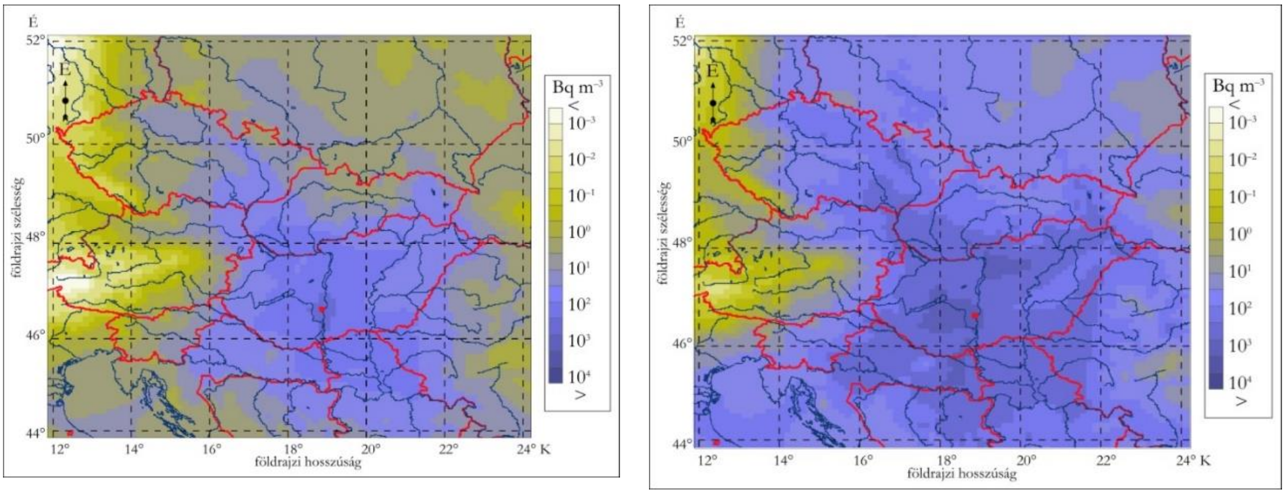
Average and maximum activity concentration fields expected in the case of events beyond the design state are illustrated on the figures below for the cases of TAK1 (DEC1) and TAK2 (DEC2) incidental releases.



a,) early b,) late

földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 7: Early and late activity concentration fields in the event of a TAK1 (DEC1) incident



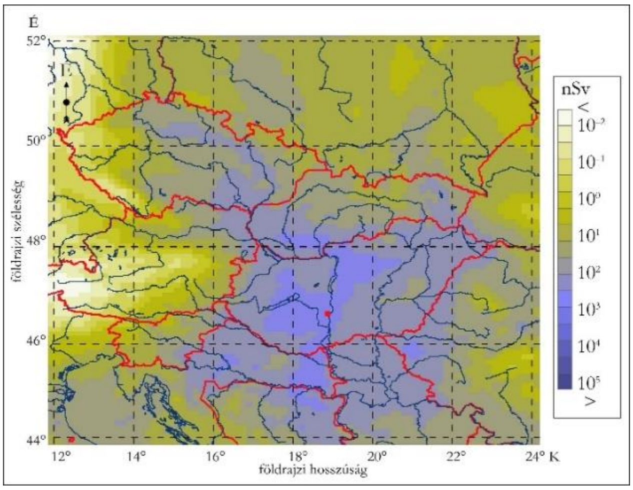
a,) early b,) late

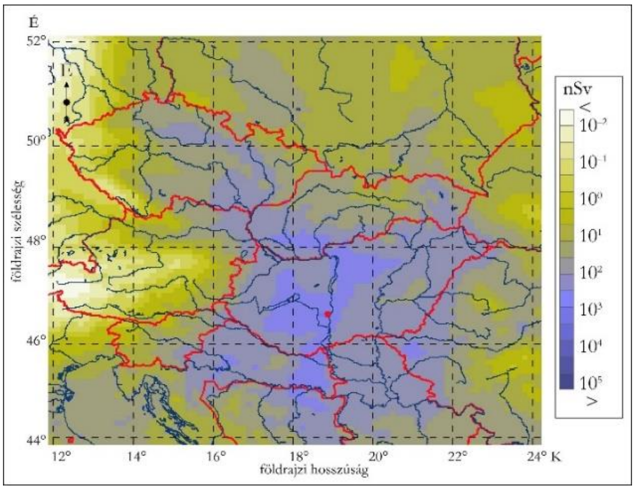
földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 8: : Early and late activity concentration fields in the event of a TAK2 (DEC2) incident

INHALATION DOSES

Average and maximum inhalation dose levels expected for adults and children in the case of events beyond the design state are illustrated on the figures below for the cases of TAK1 (DEC1) and TAK2 (DEC2) incidental releases.





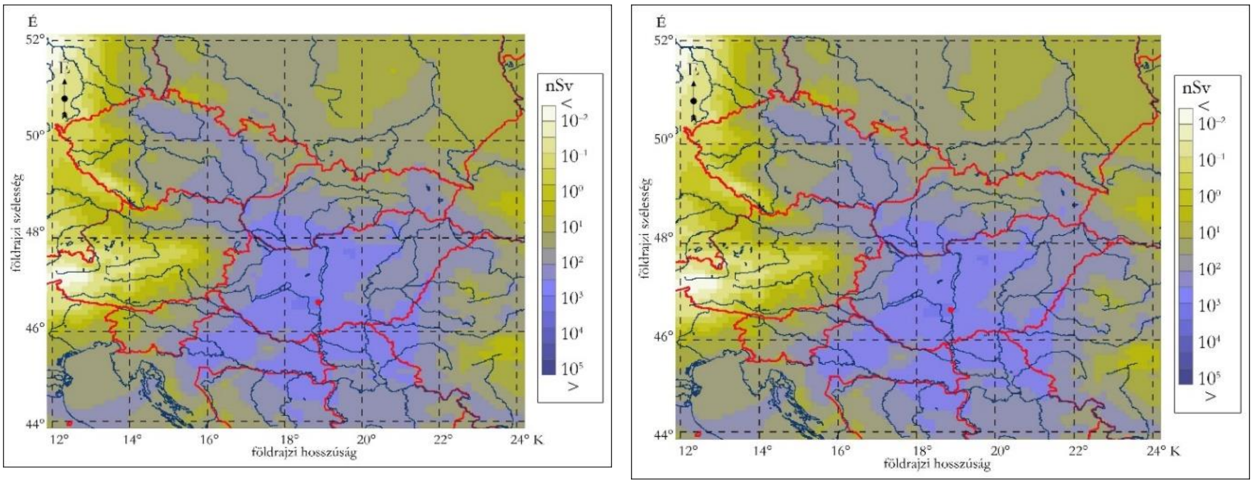
a,) early b,) late

földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 9: Early and late inhalation doses of adults in areas in a distance of more than 30 kilometres in the event of TAK1 (DEC1) *releases*

Settlement	Model coordinates		Inhalation effective dose nSv	
	Width	Length	TAK1 (DEC1) - early	TAK1 (DEC1) - late
Graz	15.50	47.1	1.970E+00	1.998E+00
Zagreb	15.95	45.8	6.775E+01	6.849E+01
Vienna	16.40	48.2	3.324E+01	3.388E+01
Bratislava	17.15	48.2	6.108E+01	6.232E+01
Novi Sad	19.85	45.3	6.607E+01	6.766E+01
Beograd	20.45	44.8	4.905E+01	5.048E+01
Arad	21.35	46.2	**7.369E+01**	**7.474E+01**
Kosice	21.35	48.7	4.117E+01	4.171E+01
Oradea	21.95	47.0	3.357E+01	3.391E+01
Uzhgorod	22.25	48.6	2.247E+01	2.280E+01

Table 5: Calculated annual inhalation dose rates for adults originating from TAK1 (DEC1) releases



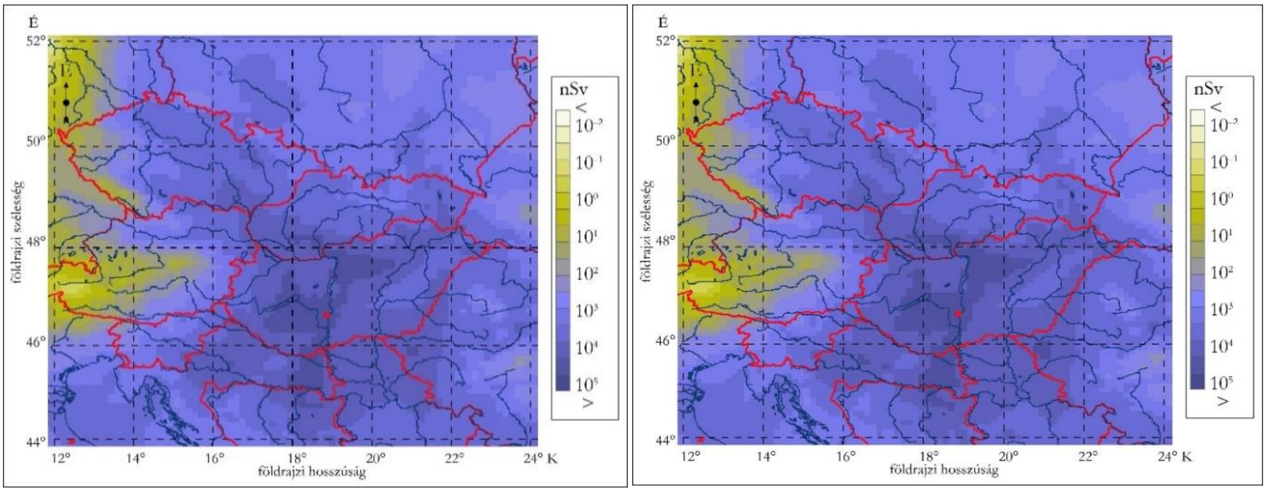
a,) early b,) late

földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 10: Early and late inhalation doses of children in areas in a distance of more than 30 kilometres in the event of TAK1 (DEC1) releases

Settlement	**Model coordinates**		**Inhalation effective dose nSv**	
	Width	Length	TAK1 (DEC1) - early	TAK1 (DEC1) - late
Graz	15.50	47.1	3.296E+00	3.343E+00
Zagreb	15.95	45.8	1.133E+02	1.146E+02
Vienna	16.40	48.2	5.559E+01	5.669E+01
Bratislava	17.15	48.2	1.022E+02	1.043E+02
Novi Sad	19.85	45.3	1.105E+02	1.132E+02
Beograd	20.45	44.8	8.203E+01	8.448E+01
Arad	21.35	46.2	**1.232E+02**	**1.250E+02**
Kosice	21.35	48.7	6.886E+01	6.979E+01
Oradea	21.95	47.0	5.615E+01	5.673E+01
Uzhgorod	22.25	48.6	3.758E+01	3.815E+01

Table 6: Calculated annual inhalation dose rates for children originating from TAK1 (DEC1) releases



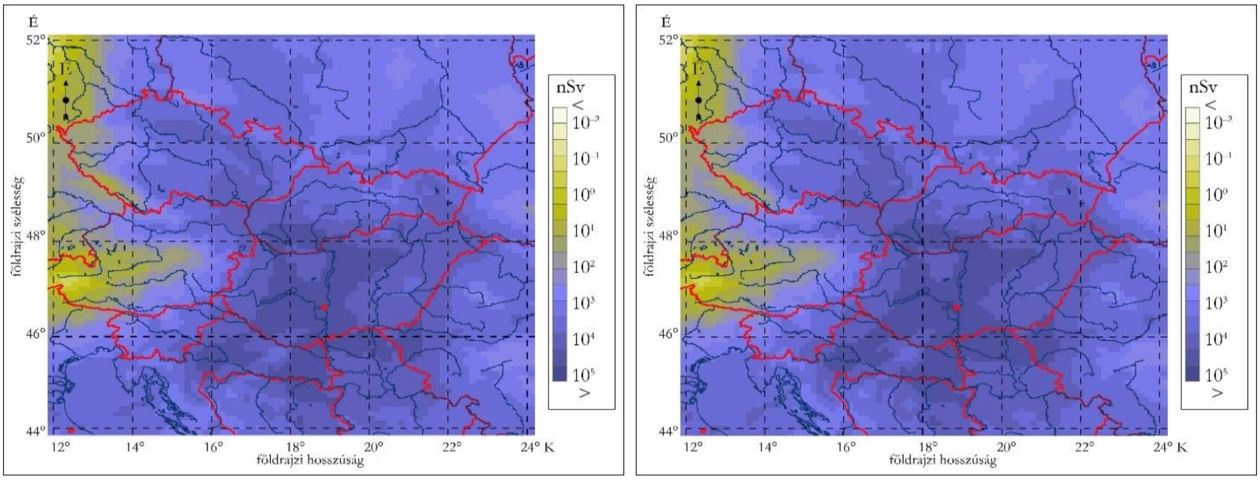
a,) early b,) late

földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 11: Early and late inhalation doses of adults in areas in a distance of more than 30 kilometres in the event of TAK2 (DEC2) releases

Settlement	**Model coordinates**		**Effective inhalation dose nSv**	
	Width	Length	TAK2 (DEC2) - early	TAK2 (DEC2) - late
Graz	15.50	47.1	1.788E+02	1.921E+02
Zagreb	15.95	45.8	6.156E+03	6.520E+03
Vienna	16.40	48.2	3.022E+03	3.312E+03
Bratislava	17.15	48.2	5.551E+03	6.127E+03
Novi Sad	19.85	45.3	6.004E+03	6.592E+03
Beograd	20.45	44.8	4.452E+03	4.975E+03
Arad	21.35	46.2	**6.693E+03**	**7.114E+03**
Kosice	21.35	48.7	3.736E+03	3.982E+03
Oradea	21.95	47.0	3.053E+03	3.206E+03
Uzhgorod	22.25	48.6	2.037E+03	2.183E+03

Table 7: Calculated annual inhalation dose rates for adults originating from TAK2 (DEC2) releases



a,) early b,) late

földrajzi szélesség – latitude, földrajzi hosszúság – longitude

Figure 12: Early and late inhalation doses of children in areas in a distance of more than 30 kilometres in the event of TAK2 (DEC2) releases

Settlement	**Model coordinates**		**Effective inhalation dose nSv**	
	Width	Length	TAK2 (DEC2) - early	TAK2 (DEC2) - late
Graz	15.50	47.1	2.474E+02	2.679E+02
Zagreb	15.95	45.8	8.517E+03	9.072E+03
Vienna	16.40	48.2	4.181E+03	4.625E+03
Bratislava	17.15	48.2	7.681E+03	8.559E+03
Novi Sad	19.85	45.3	8.307E+03	9.208E+03
Beograd	20.45	44.8	6.160E+03	6.969E+03
Arad	21.35	46.2	**9.260E+03**	**9.906E+03**
Kosice	21.35	48.7	5.170E+03	5.551E+03
Oradea	21.95	47.0	4.225E+03	4.456E+03
Uzhgorod	22.25	48.6	2.819E+03	3.046E+03

Table 8: Calculated annual inhalation dose rates for children originating from TAK2 (DEC2) releases

Based on the aforementioned details it can be concluded that in all cases the figures calculated for the city of Arad were the highest both in the case of adults and children, but in no cases did they reach the radiological impact threshold level of 90 μSv, in other words the dose limit constraint. Thus it can be stated that the summarised radiological impacts across the border are kept below the dose limit constraint defined by the authority even in the case of releases beyond the design base, in other words the impact is neutral.

3 The management of the comments received in response to the Preliminary Consultation Document

3.1 Background

Pursuant to Government Decree 314/2005 (of 25.12.) on Environmental Impact Assessment and the Uniform Environment Usage Permission Procedure MVM Paks II. Zrt. submitted a preliminary consultation request to the competent environmental authority, the South Transdanubian Environmental Protection, Nature Conservation and Water Management Inspectorate (DDKTVF) on 10 November 2012.

The preliminary consultation request was transmitted to the neighbouring countries of Hungary, to the European Union Member States and Switzerland pursuant to the Espoo Convention (a total of 30 different countries). Ten of the notified nations indicated their intention to participate in the Environmental Impact Assessment procedure, 8 of them providing itemised comments on the preliminary consultation document [1], and the Environmental Impact Study to be prepared.

During the preparation of the Environmental Impact Study [2] the comments received were processed and the Environmental Impact Assessment was conducted with a view to the relevant observations.

This document intends to handle the observations received from the notified countries and the description of the answers provided to the questions which were not covered by the scope of the Environmental Impact Assessment.

3.2 Description of the documents providing the background

Document originating from the individual countries and containing the processed comments are contained in the table below.

Country	Document
Czech Republic	Ministerstvo Životního Prostředí, 33029/ENV/13, dated on 17 May 2013 (27 position statements from the organisations concerned as an attachment)
Romania	Ministry of Environment and Climate Change, 900/RP/09.04.2013.
Malta	Environment Protection Directorate, email sent on 5 April 2013
Croatia	Ministry of Environmental and Nature Protection, 517-06-02-1-13-3, 2013. 2 April
Slovakia	Ministerstvo Životného Prostredia Slovenskej Republiky, 4337/2013-3.4/hp, dated on 3 April 2013 (19 position statements from the organisations concerned as an attachment)
Greece	Ministry of Environment, Energy & Climate Change, dated on 2 April 2013 facsimile message received with the reference number of 18725/SES/Ypeka
Austria	Federal Ministry of Agriculture, Forestry, Environment and Water Management, BMLFUW-UW.1.4.2/0023-V/1/2013, 2013.04.15. (474 paper based hard copy and 228 electronic letters from private persons and civil organisations, furthermore the document prepared by Umweltbundesamt entitled “KKW Paks II Fachstellungnahme zu, Entwurf einer Umweltverträglichkeitserklärung im Rahmen der Umweltverträglichkeitsprüfung” as an attachment)
Germany	Bayerisches Staatsministerium für Umwelt und Gesundheit, 81-U8806.50-2013/1-10, 16 April, 2012 (77 paper based hard copy and 15221 electronic letters and 1 signatory sheet with 154 signatures from private persons and civil organisations)

Table 9: Presentation of the documents originating from the individual countries and containing the processed comments

3.3 Methodology of processing the comments

In the course of processing the comments all observations were read and recorded by country as a first step. During this work it was observed that the majority of the paper based hard copy and electronic comments sent by Austria and Germany and originating from private persons most of the time were of identical contents. Therefore, these comments were handled as a single observation since they are numerous in their numbers but identical in their contents.

In the next step recorded comments were again reviewed for their contents and the observations received from various countries with the same or similar contents were pooled. Subsequently the comments were categorised according to their respective topics as follows:

- National Energy Strategy, the energy situation of Hungary
- Serious accidents and operating troubles;
- Nuclear safety;
- Nuclear liability;
- Fuel cycle;
- Radioactive waste;
- Joint impact of the two power plants;
- comments on the contents of the Environmental Impact Study;
- Economic issues;
- Issues and questions not included in any of the aforementioned topics. (For instance, questions concerning the tendering procedure, licensing, or general regulatory issues)

The most part of the comments was related to issues within the scope of the Environmental Impact Assessment (for instance, comments on the contents of the Environmental Impact Study, management of radioactive waste, the use of the Danube etc.). These concerns were mostly taken into account and answered during the compilation of the Environmental Impact Study.

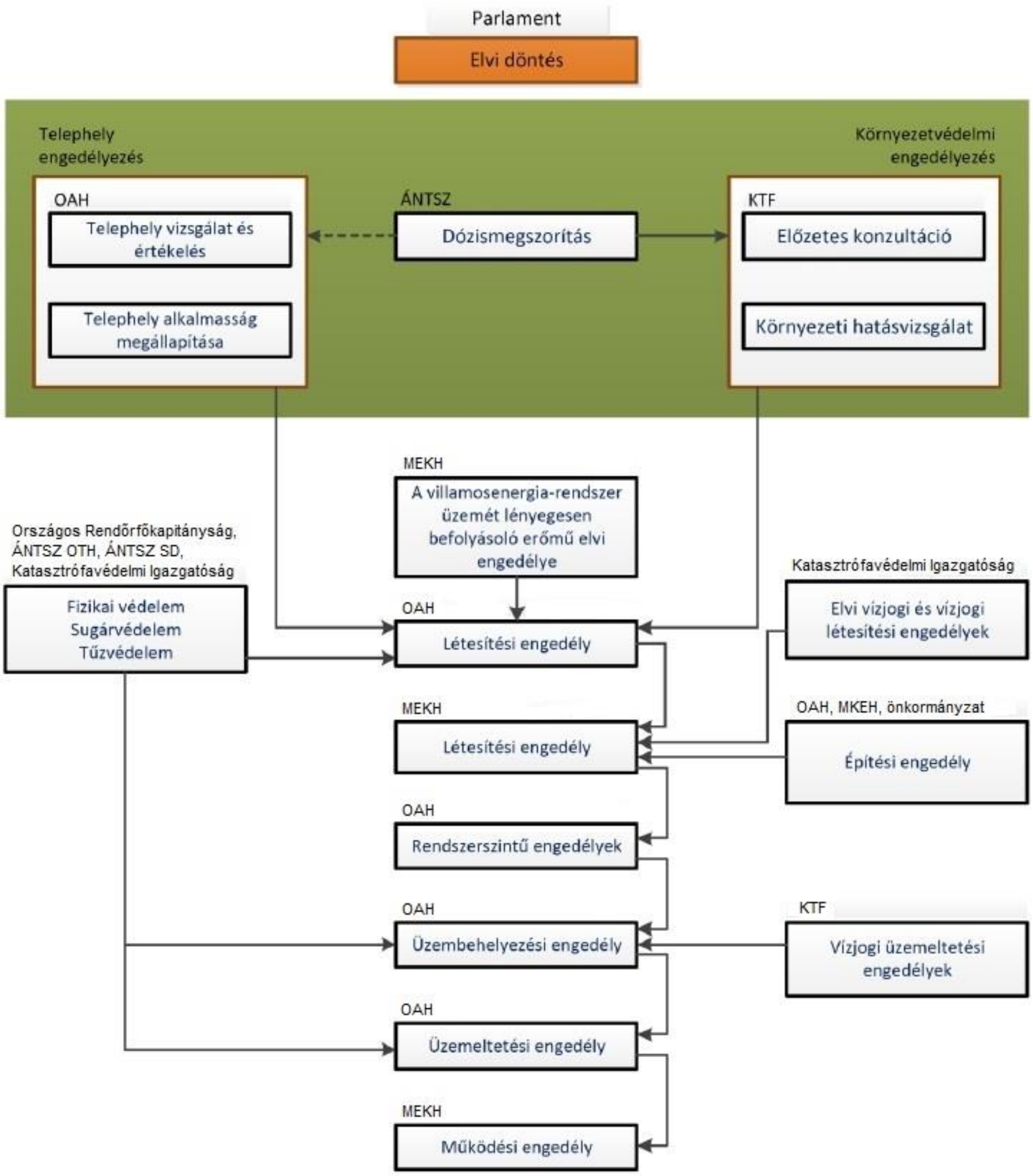
However, there were a number of comments which do not constitute a part of the Environmental Impact Assessment and therefore it was not possible to taken them into account or to answer them in the Environmental Impact Study. These issues, concerns and comments are answered in this document according to our best knowledge and information available at the time being.

3.4 General comments on the proposed project, licensing procedure and the completion of the Environmental Impact Assessment

3.4.1 On the establishment licensing procedure of a nuclear power plant in general

Quite a number of the answers given to the comments received is connected to the establishment licensing procedure and processes of the new nuclear power plant, therefore it seemed to be appropriate not to answer them one by one, but to describe the processes themselves shortly and to present the requirements to be met for the purposes of obtaining the various permits and licenses. Furnishing evidence of compliance with these requirements will be possible during the licensing procedure concerned.

The process of licensing the implementation of a new nuclear power plant is very complex, encompassing a number of specialist fields. Permits in the number of thousands need to be secured from the preparations up to the commencement of commercial operations, which are issued by a number of acting authorities and several others contribute as specialist authorities. A part of the licensing procedures is conducted in parallel, there are however licensing procedures connected serially, where the procedure can only be started once the previous procedures have been duly completed as a condition precedent. The connections between the key licensing procedures are presented on the figure below.



Parlament–Parliament
Elvi döntés–Preliminary decision
Telephely engedélyezés–Site permit
Környezetvédelmi engedélyezés–Environmental licence
OAH - Telephely vizsgálat és értékelés– OAH Site inspection and assessment
Dózismegszorítás–Dosage limit
KTF Előzetes konzultáció– KTF Preliminary consultation
Telephely alkalmasság megállapítása–Implementation of site suitability
Környezeti hatásvizsgálat–Environmental Impact Assessment
Országos Rendőrfőkapitányság–National Police Headquarters
ÁNTSZ OTH, ÁNTSZ SD,
Katasztrófavédelmi Igazgatóság–Disaster Control Directorate
MEKH Villamosenergia-rendszer üzemét lényegesen befolyásoló erőmű elvi engedélye–MEKH Preliminary licence for power plants having a significant impact on the operation of the power system
Katasztrófavédelmi Igazgatóság–Disaster Control Directorate
Elvi vízjogi és vízjogi létesítési engedélyek–Preliminary water rights licence and water rights implementation permit
Fizikai védelem, sugárvédelem, tűzvédelem–Physical protection, radiation protection, fire protection
MEKH Létesítési engedély–MEKH Implementation permit
OAH, MKEH, önkormányzat– OAH, MKEH, municipalities
Építési engedély– Building permit
OAH rendszerszintű engedélyek–OAH system level permits/licences
OAH üzembehelyezési engedély–OAH commissioning licence
KTF vízjogi üzemeltetési engedélyek–Water rights operating licences
OAH üzemeltetési engedély– OAH management licence
MEKH működési engedély–MEKH operating licence

Figure 13: The relationship of the major licensing procedures [2]

Licenses and permits to be obtained with respect to each of the specialist fields are summarised below, indicating the connection points to other specialist fields.

Nuclear safety licenses

Act No CXVI of 1996 on nuclear energy lays down the requirements related to the peaceful use of nuclear power and defines the authorisations and liabilities of the stakeholders in the application of nuclear energy.

Under the Nuclear Energy Act the conceptual endorsement of the Parliament is required in order to start the preparatory activities of the implementation of a new nuclear power plant. The Hungarian Parliament provided such approval to the new units to be erected at the Paks site in the Parliamentary Decision No 25/2009. (IV.2.).

The enforcement of nuclear safety requirements in the course of the implementation of a Nuclear Power Plant is effectuated through the licenses and permits issued by the Hungarian Atomic Energy Authority (hereinafter referred to as: OAH).

In the site assessment and evaluation permit to be obtained as the first step in the nuclear safety licensing procedure the OAH approves the assessment program for the site which provides the basis for conducting the studies generating the body of data necessary for the licensing of the site. The site assessment and evaluation licensing procedure is currently underway.

In the course of the site licensing procedure presenting the assessment of the site and the findings of the studies the OAH approves the eligibility of the proposed site and the compliance of the baseline data related to the site with the appropriate requirements.

In the course of the establishment licensing procedure the OAH evaluates whether or not the nuclear power plant to be erected complies with all nuclear safety requirements. In addition to the establishment license, system and construction level permits need to be obtained for the constructions, building structures, systems and system elements of the nuclear power plant influencing nuclear safety. Once holding these permits, the construction and occupancy/commissioning, production or procurement erection and commissioning of any given system component can be started. Since a nuclear power plant consists of a multitude of constructions and systems, you can talk about thousands of permits to be obtained at the construction and system level.

Implementation of the commissioning program of a completed and installed nuclear power plant can be commenced on the basis of the commissioning permit. Following the successful commissioning procedure the operation license can be applied for which provides authorisation for the operation of the nuclear power plant.

Environmental permits and endorsements

The purpose of the Environmental Impact Assessment procedure to obtain the environmental licence, and the procedure is conducted by the regionally competent South Transdanubian Environmental Protection, Nature Conservation and Water Management Inspectorate (DDKTVF). Once the legally binding environmental permit has been obtained, the condition precedent for the commencement of the construction works and the issue of the nuclear establishment licence is met. Following the issue of the environmental permit the environmental authority still joins the licensing procedure at a number of phases. Among others, it acts as a specialist authority in the facility level in the efforts aiming at the nuclear safety licensing procedure. At the same time this authority provides standalone licensing and endorsement functions as well, permitting design emission levels, and approving release and environmental monitoring codes of practices, approves emission limits and their verification by various measurements.

Also, the environmental permits and endorsement for the installation of the facilities indispensable for the purposes of the erection and operation of a nuclear power plant (for instance, installation of the electric power network, establishment of an access road, etc.) need to be obtained from the competent environmental authority.

Water rights permits

Under the Water Management Act (Act No LVII of 1995) water rights permits are required for the completion of any water works, the construction and commissioning of water facilities and for the use of water sources. A number of water facilities need to be set up in connection with the new nuclear power plant (for instance, fresh water extraction, the installation of monitoring wells, the construction of a waste water treatment plant etc.), for which water rights establishment permits and following implementation water rights operation permits/licenses need to be procured from the regionally competent Disaster Management Directorate of County Fejér.

Radiation protection

Dose limit constraint values need to be requested for in the preparatory phase of the establishment procedure from the National Service for Public Health and Medical Officers (NSPHMO) Office of the National Chief Medical Officer (hereinafter referred to as: ÁNTSZ OTH), which takes into account and ensured the enforcement of the dose constraints provided for by the law – Ministerial Decree No 16/2000. (VI. 8.) EüM Annex No 2 – in the course of the design process for both the general public and the employees. The MVM Paks II. Zrt. obtained the dose limit constraint resolution for the general public on 15 October 2012.

Pursuant to the Chapter entitled "Licensing and inspection" of the Ministerial Decree No 16/2000. (VI. 8.) EüM on the implementation of certain provisions in the Nuclear Energy Act the following activities are conducted by ÁNTSZ OTH in the first instance in the case of a priority facility, which is the case with the nuclear power plant to be established:

- approves the manufacture, production, and marketing of nuclear substances,
- endorses the Workplace Radiation Protection Code (with a view to the expert opinion issued by OSSKI, the "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene),
- classifies the equipment or the prototype of the equipment emitting ionising radiation or containing a radioactive radiation source from the perspective of radiation protection based on the expert opinion issued by OSSKI,
- accomplishes the geographic scope of the permits issued by the regionally competent Radiohygienic Decentre of the Public Health Administration Body of the Government Agency in Tolna County (hereinafter referred to as: SD),
- releases radioactive substances from official supervision.

The regionally competent SD will licence on the first instance the following activities:

- operations conducted with the involvement of radioactive substances and the establishment, operation, reconstruction, conversion or the discontinuation of operation of non-nuclear facilities serving these activities,
- operation and discontinuation of operation of any equipment generating ionising radiation; the establishment, operation, reconstruction, conversion or the discontinuation of operation of facilities serving these activities,
- transfer of ownership of such equipment and facility,
- storage necessary for the purposes of delivering equipment containing confined radioactive radiation sources and the delivery of radiation sources,
- the delivery of radioactive substances and the use of the vehicle transporting it.

Permits in the electricity industry

Act No LXXXVI of 2007 on electric power regulates the issues related to the security of electric power supply and defines the tasks of the operators of the electric power system, laying down the activities which can be carried out in the possession of a permit only. Permits in the electricity industry are issued by the Hungarian Energy and Public Utility Regulatory Authority (MEKH).

Prior to the implementation of any power plant with a rated output exceeding 500 MW a conceptual permit need to be requested for the power plant influencing the operation of the electricity system considerably. The nuclear establishment licensing procedure can only be started in possession of such a conceptual permit.

The erection of the power plant (in addition to the issue of the nuclear establishment licence) can only be commenced when holding the establishment licence issued by the MEKH.

As a closure of the establishment procedure the MEKH is to issue a generator operation license which is the basis for feeding the electric power generated onto the national grid. Production/generation operation licenses can be applied for following the procurement of the nuclear operation license.

Building permits

Facilities and constructions not within the scope of nuclear safety must be licensed by the building authority under the provisions of Act No LXXVIII of 1997 on the shaping and protection of the built environment. Licensing functions for the permits of special constructions which are not covered by the scope of authority of nuclear safety (for instance, construction for the protection of pressure vessels, facility to store hazardous liquids, etc.) are provided by the Hungarian Trade Licensing Office (MKEH) under Government Decree No 320/2010. (XII. 27.). Obtaining of these permits will take place in the implementation phase in parallel with the procurement of the relevant nuclear safety permits.

Other permits and approvals

In addition to those described above, obtaining a number of other permits and official approvals is necessary before a nuclear power plant gets from the design phase up to commercial operation.

A selected number of such additional permits are specified in the list below:

- The permit of the heritage protection authority
- Permits necessary for the installation of the infrastructure (construction of an access road and installation of the public utility connection lines).
- Permits needed for the set-up of the electric power network.
- Permits needed for the set-up of the physical protection facilities.
- Delivery and transport permits.
- Fire protection permit.

3.4.2 General remarks on the investment project, and the completion of the Environmental Impact Assessment

Hungary is a member of several international organisations founded in order to control the peaceful use of atomic energy and of the European Union. Hungary signed the international conventions listed below and intends to fully comply with them:

- treaty on the non-proliferation of nuclear weapons [3]

- the convention concluded on the application of the securities pursuant to the treaty on the non-proliferation of nuclear weapons [4]
- Vienna convention on nuclear liability [5]
- joint protocol on the application of the Vienna convention on civil liability for nuclear damage and of the Paris convention on nuclear third party liability [6]
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons on the Sea-bed and the Ocean Floor and in the Subsoil Thereof [7]
- Comprehensive nuclear test ban treaty [8]
- convention on the physical protection of nuclear substances (International Atomic Energy Agency (IAEA)) [9]
- the convention on assistance in case of a nuclear accident or radiological emergency [10]
- convention on nuclear safety [11]
- the Vienna Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [12]
- Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [13]
- the foundation charter of the International Atomic Energy Agency (IAEA) [14]
- convention on the privileges and immunities of the International Atomic Energy Agency (IAEA) [15]
- revised additional agreement on the provision of technical assistance by the International Atomic Energy Agency (IAEA) [16]
- Espoo Convention [17]

The requirements formulated in the conventions and treaties listed above appear in the Hungarian legislation as well. Compliance with the legal requirements of nuclear power generation is controlled by the OAH. Review of the Hungarian nuclear legislation is an on-going process thus ensuring that the international recommendations and experiences be incorporated in the domestic regulations.

Hungary makes all efforts to implement a safe and reliably operating nuclear power plant.

It is important to note that the preliminary consultation process still concerned five potential units, but since then the selection of the approved Supplier has taken place under Act No II of 2014 on the proclamation of the convention between the Government of Hungary and the Government of the Russian Federation on the cooperation to be conducted in the field of peaceful use of nuclear energy, and accordingly, the Environmental Impact Assessment was prepared with a view to the parameters and particulars of this Russian type unit, and evaluates the potential environmental impacts of this single type of unit. Correspondingly, no tendering procedure will be conducted anymore and the comments on the selection of the type are not relevant any more in the light of Act No II of 2014.

It is also important to note that the discussion and answering of any kind of economic or financial issues does not constitute a subject matter or a function of the Environmental Impact Study. With reference to item c) Section 7 of Annex No 6 to Government Decree No 314/2005 (XII.25.) it can be stated that this part of the Environmental Impact Study does not contain any data which would be classified as state or service secret or business confidential with regard to MVM Paks II. Zrt., and answering economic issues is not found relevant under this current procedure.

We need to highlight furthermore that the effective national legislation refer the issues related to nuclear safety and the nuclear safety licensing procedure to the authority of the OAH. Correspondingly, compliance with the requirements concerning nuclear safety and meeting the respective standards must be verified in the course of the OAH procedures. In the light of the aforementioned considerations the Environmental Impact Assessment must not have the goal to investigate the various aspects of nuclear safety, it only have to identify and evaluate the potential environmental impacts of the facility. However, taking into account the wide ranging interest related to severe nuclear incidents this topic is covered in details in the international chapter.

The Nuclear Energy Act – getting prepared to all possibilities – deals with the liability issues emerging in relation to the application of nuclear energy and the compensation for such damages in line with the respective international conventions [5,6]. Government Decree No 227/1997. (XII.10.) on the nature of the insurance cover or any other kind of financial security concerning nuclear liability regulated the issues related to the insurance cover or any other kind of financial security concerning nuclear liability accordingly.

Pursuant to paragraph (4) Article 11/A of the Nuclear Energy Act during the licensing procedure the OAH will organise public hearings where the public will have the opportunity to get familiar with the procedure and may put questions to the representatives of both the authority and the project sponsor.

3.5 Discussion of the comments in each of the themes

Comments received from the countries listed earlier on (indicated by grey background) and the answers provided to them (indicated in italics) are set forth herein in the breakdown according to the respective topics described earlier, with respect of which information was provided as part of the general remarks (these include economic, other, and nuclear liability issues).

For comments which were taken into account in the course of the preparation of the Environmental Impact Study, the title for the relevant chapter is provided.

3.5.1 National Energy Strategy

The purpose of the National Energy Strategy 2030 [18] is to ensure long term sustainability, safety and economic competitiveness of the domestic energy supply. The development of the strategy was commenced in August 2010 and nearly 110 key business, scientific, trade and social operators of the market were consulted. The recommendations from the professional consultative committees operating beside the National Ministry of Development and of the International Atomic Energy Agency as well as the energy policy concepts of the European Union were all taken into account.

The document formulates five important pillars in order to achieve the objectives:

1. Enhancement of energy efficiency and energy saving measures
2. Increasing the share of renewable energy resources
3. Integration of the Central European power line transmission grid and the construction of the cross border capacities needed for it
4. Preservation of the current nuclear capacities
5. The environmentally friendly use of domestic coal and lignite resources in electric power generation

Issues related to the National Energy Strategy and the respective answers are summarised herein below grouped per topic:

EXACT DESCRIPTION OF ENERGY EXPORTS AND THE PRESENTATION WHICH IMPACT THE CONSTRUCTION OF THE NEW HIGH VOLTAGE TRANSMISSION NETWORK WILL HAVE ON THE ELECTRIC GRID OF THE NEIGHBOURING COUNTRIES.

The existing nuclear power plant currently operating at the Paks site is connected to the Hungarian electricity system by five 400 kV transmission lines the cumulated transmission capacity of which lines exceeds 10000 MVA. A condition precedent to the integration of the new nuclear power plant units into the Hungarian electricity system is the construction of a new double system 400kV voltage level power line between Paks and Albertirsa in addition to the currently existing 400 and 120 kV transmission capacities. The actual mode of implementation is currently being designed. This transmission line will increase the stability and reliable operation of both the Hungarian and the adjacent national power grids in addition to the connection of the power plant unit into the power system.

DESCRIPTION OF THE PREDICTED DEVELOPMENT OF THE HUNGARIAN POWER PLANT FLEET (CONSTRUCTIONS, SHUT DOWNS) UP TO 2030. WHICH WAY, USING WHAT KIND OF POWER PLANTS AND WHERE HUNGARY THE EVER INCREASING POWER NEEDS DESCRIBED IN THE PRELIMINARY CONSULTATION DOCUMENTATION WANTS TO MEET? HOW THE NEW NUCLEAR POWER PLANT UNITS TO BE INSTALLED AT PAKS WOULD FIT THE HUNGARIAN POWER PLANT FLEET AS A WHOLE (BOTH FROM THE PERSPECTIVE OF OUTPUT AND ANNUAL PRODUCTION RATES)?

The total gross installed capacity of the Hungarian power plants was 10 109 MW in the year of 2011 (8637 MW of them from large power plants). Investigating the medium term and long term changes and predictions of the installed electric capacities it can be stated that the fate of existing domestic power plants, expected shut down will follow the trends of the market on capacities in a way and at a time according to the intentions of the owners. Any new power plant will only be needed in the next two decades only for the purposes of replacing quitting units, and only secondarily for purposes of increased electricity demands. [19,20]

IT WOULD BE EXPEDIENT TO INVESTIGATE IN THE ENVIRONMENTAL IMPACT STUDY WHAT CONSEQUENCES FULL OUTAGES (ALL THE 6 UNITS) WOULD CAUSE IN THE POWER SUPPLY OF BOTH HUNGARY AND THE NEIGHBOURING COUNTRIES.

The total breakdown of all the six power plant units at the same time has a very low level of probability. Assessment of a failure of this scale belongs to the scope of authority of the Hungarian system dispatcher (MAVIR Zrt.) and of the European Network of Transmission System Operators organisation (ENTSO-E). The single most severe but pre-designed situation of the electricity system is the state of total Black-out. Restoration or resetting after the system collapse (Black-start) is a function of the Hungarian system operator (MAVIR Zrt.) for which a pre-arranged system reset plan is available.

ECONOMICALLY AND TECHNICALLY COMPARABLE ALTERNATIVES OF THE PROJECT SHOULD BE DEVELOPED BY THE APPLICATION OF A BALANCED ENERGY CARRIER MIX AND PRESENTED IN THE ENVIRONMENTAL IMPACT STUDY. UPON THE DEVELOPMENT OF THE ALTERNATIVES THE USE OF RENEWABLE ENERGY RESORUCES MUST ALSO BE CONSIDERED BESIDE THE FOSSIL ENERGY RESOURCES. FIRST OF ALL, POTENTIALLY RENEWABLE ENERGY RESOURCES SUCH AS WIND POWER, BIOMASS, BIOGAS AND SOLAR ENERGY AVAILABLE IN HUNGARY MUST BE TAKEN INTO CONSIDERATION IN A CONSISTENT MANNER. IN RELATION TO THIS MODERN, COMBINED CYCLE POWER PLANTS AND DECENTRALISED BIOMASS BASED THERMAL PLANTS NEED TO BE CONSIDERED TO REPLACE EXISTING UNITS.

The ideas formulated by the Hungarian Government on energy policy are contained in the National Energy Strategy, making detailed recommendations to create harmony between energy and climate policy up to 2030 with a view to economic development and sustainable environment to determine the acceptable level of energy demand and the development projects in the field of the energy industry, setting up a road plan up to 2050. Detailed Impact Studies must be available prior to each of the decision milestones to provide as much up to date data and information as possible for the preparation of decision making.

PLEASE DESCRIBE WHICH WAY THE DEVELOPMENT PROJECT IMPLEMENTS THE REDUCTION OF THE DEMAND FOR ELECTRIC POWER IN LINE OF THE ENERGY POLICY OBJECTIVES OF THE EU.

The missing capacity predicted by the forecasts (nearly 6500 MW in 2027) can be covered by renewable energy resources and small power plants partially only, since the exploitation of these potentials in the environments with favourable conditions has happened already. The shortage of capacity at this scale is best reduced by large unit output newly constructed power plants and such a beneficial option is provided by the erection of the new power plant, since the generation of electricity in a nuclear power complies with the decarbonisation efforts formulated in the EU energy policy and allows to create economically efficient, long term and safe provision of electric power supply, while the fuel can be procured from a number of sources in a stable manner and at predictable prices.

NO STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT HAS BEEN CONDUCTED FOR TRANSBOUNDARY CONSIDERATIONS OF THE ENERGY STRATEGY, THEREFORE IT IS NOT AN ACCEPTABLE STARTING POINT FOR MAKING A POLITICAL DECISION.

The strategic Environmental Impact Assessment has not been conducted for transboundary considerations as a result of an energy policy decision, the National Ministry for Development is the competent authority in this issue.

3.5.2 Severe accidents and operating troubles

The general requirements of the contents of the Environmental Impact Study are regulated by Annex No 6 to Government Decree No 314/2005. (XII.25.). Correspondingly, the presentation of the impacts expected in the event of operating troubles within the design base and accidents beyond the control of the design is found partly in the relevant chapter of the Environmental Impact Study and partly in this present international chapter.
The characteristic properties of the design breakdowns and operating troubles beyond them were discussed in line with the definitions of the European Utility Requirements (EUR) in Chapter No 20 Ambient radioactivity - Radiation exposure of the population living within the environment of the site of the Environmental Impact Study. The limit values applicable to the various radioactive discharges and emissions were specified in line with the requirements of the EUR recommendations and of the International Commission on Radiological Protection (ICRP).
The calculations carried out for the cases of serious accidents are described in the international chapter, having regard to their potential regional impacts.
Methods and procedures associated with the performance of the requirements and tasks specified in the legal and technical regulations of nuclear accident management are contained in the guidance documents attached to the National Nuclear Accident Management Action Plan (OBEIT). The contents and the structure of the National Nuclear Accident Management Action Plan follows the recommendations formulated by the International Atomic Energy Agency (IAEA) [21,22,23,24,25], applies their set of concepts, the notions of emergency design zones and the various intervention levels. These are supplemented by the internal regulations and documents of the organisations and institutions contributing to the National Nuclear Accident

Management Action Plan which are prepared and maintained in accordance with their respective quality assurance systems.

It would be necessary to describe all members of the sources of radiation in the case of an eventual meltdown in details (in terms of quantities and qualities) potentially applicable in the case of meltdown accompanying severe accidents and accidents beyond the scope of design, and the provision of the PSA examinations (levels 1,2,3), with particular regard to the discussion of the following:

• The probabilities and frequency of reactor damages (CRF) and accidents accompanied by large releases (LRF or LERF), including probability distribution (fractiles statistics);

• Providing the respective ratios of accidents arising from intrinsic triggering causes, internal and external events, from the operation and decommissioning, and from the holding basin;

• Specification of the most serious accident scenarios, including accidents arising from the holding basins (specifying the necessary manual interventions and the time available for such actions);

• Description of severs accidents and discussion of the measures intended to mitigate the consequences thereof;

• Source members of the key releases including release from the holding basin;

• Trackable description of the migration calculations and the determination of doses received in operating troubles and accidents.

The management of the issues raised in these questions at such a length and details is not the function of the Environmental Impact Study, they will be discussed under the establishment licensing procedure.

Please describe all information related to eventual operating troubles with a special regard to the publication of the history of the operating troubles occurred at the Paks site so far and an independent assessment of the safety of the site. All these details are necessary in order to assess the real risks of the investment project.

The Environmental Impact Study discusses the potential environmental impacts in a depth and scope complying with the relevant applicable law, in other words the quality assurance and quality control and management systems of the integrated systems, the environmental permits and additional licenses issued by the authorities ensure attainment of the appropriate level of safety by which the risks of the new construction can be properly judged.

Independent expert evaluation of the site safety is presented at length in the Site permit application.

3.5.3 Nuclear safety

Nuclear power plants are designed and the technical equipment and safety systems are set up in a way that guarantee the safety of the environment around the power plant even in the case of an accident. Ongoing monitoring and review of the safe operational state and the development of the measures intended to enhance such security levels is a fundamental requirement for the operators. The supervising authority allows the start-up of the reactor or the completion of the various operations to be conducted on the reactor equipment only when it was verified that safe operation of the reactors can be warranted.

Exclusion of the risks representing any hazard to the neighbouring or any other countries from the power plant units to be completed are contained in the international chapter of the Environmental Impact Study presenting the cross border impacts pursuant to Annex No 6 to Government Decree No 314/2005. (XII.25.).

Compliance of the site with geological requirements and the requirements of nuclear safety will be evaluated and evidenced in details in the site licensing procedure to be conducted by the OAH pursuant to the Nuclear Safety Codes (NBSz) constituting the Annexes to Government Decree No 118/2011. (VII.11.) on the nuclear safety of nuclear facilities and the related official activities. Characteristic features of the sites are investigated on the basis of a site assessment programme which programme in this case has been completed by taking into account the most recent international requirements (post-fukushima). The site assessment programme was evaluated by the experts of the International Atomic Energy Agency (IAEA) (NAÜ) under an independent review.

Physical protection of the facility against sabotage and terrorist acts is provided by the complexity of internal regulations, a technical toolbox and manned security services, intended to deter, detect, delay and eliminate unauthorised alienation and sabotage committed against nuclear facilities, nuclear and other radioactive substances as part of the nuclear security measures. The operation of this system and the description of the implementation of the functions associated with the physical protection are contained in the physical protection plan. Exact details thereof – for apparent reasons – are available only for duly authorised persons and does not constitute a part of this impact study. Information in general on physical protection measures is contained in Chapter 6 The characteristic features and basic data of the Paks II Nuclear Power Plant proposed to the Paks site sub-chapter 6.12 Physical protection.

HOW THE OPERATORS OF THE NEW UNITS WILL PROVIDE COOLING WATER SUPPLY IN THE EVENT OF SEVERE ACCIDENTS, IF THE USE OF DANUBE WATER IS NOT POSSIBLE? HOW THE MATERIAL CAN FURNISH EVIDENCE THAT SUFFICIENT WATER SUPPLY WILL BE AVAILABLE IN EMERGENCY SITUATIONS (HAVING REGARD TO THE CLIMATIC CONDITIONS).

In the case the operational heat absorption functions are lost and an incident of operating trouble occurs, the long term cooling of the reactor is possible without operator intervention by the use of the built-in water reserves. Removal of residual heat (the thermal energy left over from the decay of the fission products) is provided by the active failure incident cooling systems (four standalone systems), first of all by four pieces of hydraulic accumulators with a volume capacity of 60 m^3 each. The high pressure nitrogen cushion in the hydraulic accumulators presses 16 g/kg concentration boron water into the reactor directly. Two additional passive systems are also available to remove residual heat which are designed to commence operation in the event of severe accident situations. One of them removes heat from the steam generator, the other one from the containment. Their joint property is that flow of the medium and hence, the operation of the system is ensured by natural circulation in both cases. The volume of the tanks attached to the systems is 4x540 m^3. The operation of the passive systems allows removal of the residual heat for a period of 72 hours and hence, preventing a meltdown. In an accident situation not the climatic conditions dominate with regard to the removal of the heat produced in the reactor.

WHAT IS THE GUARANTEE THAT THE CONTAINMENT BUILDING, REACTOR BUILDING AND THEIR CONCRETE STRUCTURE WAS OF EXCELLENT TECHNICAL CONDITIONS? HOW IT IS ENSURED THAT THE BUILDING WITHSTOOD THE CRASH OF A CIVIL AIRPLANE?

The units to be erected at the Paks site must be protected against the crash of a large civil airplane under the effective law.

Very stringent quality assurance and control criteria apply to the equipment and buildings of the units. Such requirements provide for the minimum level of the European Utility Requirements (EUR). The Supplier of the units undertook to meet these requirements, therefore such *architectural and other technical solutions are applied in the course of the implementation which ensure protection of the facility against the crash of an airplane.*

THE ENVIRONMENTAL IMPACT STUDY MUST DISCUSS IN DETAILS AT WHICH LEVEL EACH OF THE REACTOR TYPES MEET THE EUROPEAN AND INTERNATIONAL STANDARDS AND IN PARTICULAR THE REQUIREMENTS SET BY WENRA AND IAEA. YOU SHOULD ALSO DESCRIBE THE CONSIDERATIONS ARISING FROM THE STRESS TEST OF THE EU

Design of the Russian units was made in accordance with the official Russian legislation, taking into account at the same time the recommendations of the EUR, WENRA, and IAEA, as well as the requirements of the nuclear authority. Additionally, the units to be delivered at Paks must meet the Hungarian expectations and legal requirements alike, which in turn include the most up to date WENRA recommendations and the lessons learnt from Fukushima.

APPROPRIATE TESTING OF THE PASSIVE SAFETY SYSTEMS INCLUDING THE ATTACHMENT OF THE TEST REPORTS. CERTIFICATION OF COOLING IN CASE OF FULL BLACK OUT.

A number of experiments justified appropriate and effective operation of the passive systems in the design phase. Additionally, naturally a number of further tests and measurements will be carried out during the implementation phase and the commissioning procedure of the systems. Data and characteristic curves obtained from them can be compared with the design values. Test results and test reports, protocols of trial runs and measurements – as in the case of any other systems – will be attached to the commissioning documentation. The operation of the passive safety engineering systems does not require any electric power supply because the flow of the cooling medium is ensured by natural circulation and hence, retrieval of the residual heat. These systems are able to ensure removal of the residual heat for a period of 72 hours and hence, preventing a meltdown. .

5.1.1. TESTS AND INVESTIGATIONS NEED TO BE CARRIED OUT IN ORDER TO MAKE SURE THAT THE PIECES OF EQUIPMENT INSTALLED ARE FUNCTIONALLY FIT FOR THEIR INTENDED PURPOSES, IN PARTICULAR IN THE CASE OF THE REACTOR VESSEL.

Before and after installation all systems and system component of the units will be subjected to strict tests and inspections. Their functionality will be warranted by such inspections and also a serious quality assurance and control system. Test results and test reports, protocols of trial runs and measurements – as in the case of any other systems – will be attached to the commissioning documentation.

3.5.4 Full fuel cycle

The nuclear fuel cycle which produces energy with the use of uranium oxide can be broken down into 8 different stages (mining and grinding, conversion, enrichment, production of the fuel elements, generation of electricity, reprocessing of spent fuel elements, removal of low and medium activity waste, disposal of high activity waste). Each stage apply special technology, and each process is carried out in difference locations. However, it is a generally accepted fact that the environmental impacts of standard operational releases from the nuclear fuel cycle are negligible.

WHICH PART OF THE STUDY CONTAINS ANY INFORMATION ON THE ASSESSMENT OF HANDLING, STORAGE AND REMOVAL OF SPENT FUEL ELEMENTS FROM THE COUNTRY? YOU SHOULD CONSIDER THE HANDLING AND MANAGEMENT OF SPENT FUEL ELEMENTS OF THE NEW POWER PLANT AND ENVIRONMENTAL IMPACTS ARISING FROM FUEL ELEMENT MANAGEMENT. IS IT POSSIBLE OR NEEDED TO EXPAND THE TEMPORARY STORAGE FACILITIES OF PAKS IN ORDER TO DISPOSE THE WASTE FROM THE NEW UNITS? PLEASE INCLUDE IN THE MATERIAL THE TIME SPENT BY DEPLETED FUEL IN THE TEMPORARY STORAGE.

The answers provided to these questions and other pieces of information are found in Chapter 19 of the Environmental Impact Study dealing with radioactive waste and spent fuel elements.

3.5.5 Radioactive waste

Evidence on the transient and final disposal of radioactive waste generated in accordance with the international requirements must be furnished in the course of a later stage of the establishment licensing procedure of the nuclear power plant, in the OAH commissioning licensing procedure (Government Decree No 118/2011. (VII.11.) Nuclear Safety Code – 1.2.4.0300 item g)).

The answer to the questions received in this topic but not set forth in details below can be found in Chapter 19 of the Environmental Impact Study dealing with radioactive waste.

ACCORDING TO THE POLLUTER PAYS PRINCIPLE SUFFICIENT PROVISIONS SHOULD BE MADE TO FINANCE THE CONSTRUCTION OF A FINAL DISPOSAL SITE. IT IS RECOMMENDED TO COMPLETE THE ENVIRONMENTAL IMPACT STUDY WITH THIS INFORMATION.

The tasks related to this issue are financed by the Central Financial Fund set up as a set aside government fund in accordance with paragraph (1) Article 62 of the Nuclear Energy Act5 (KNPA, or Fund). During the implementation of the new units the transformation of the KNPA will allow among others to finance the decommissioning of the new units pursuant to the law.

WHAT IS THE HUNGARIAN LEGAL AND INSTITUTIONAL BACKGROUND AND THE CONCORDANCE WITH EUROPEAN UNION REQUIREMENTS WITH RESPECT TO THE MANAGEMENT OF RADIOACTIVE WASTE?

Like in all Member States of the European Union, legal harmonisation is an ongoing process conducted in a procedure according to the general rules applicable to the legislative process. Its purpose is to create harmony between the national legislation and the Community law. The obligation of legal harmonisation is contained in the fundamental treaties – currently the Treaty of Lisbon is in effect – and the legal principles developed by the European Commission (for instance, the priority of the Community law over national legislation, direct applicability and direct or indirect scope), and the entity responsible for it is the Hungarian Government in office from time to time. Directive 2013/59/EURATOM has direct effect in Hungary. OPAH coordinates the legal harmonisation activities domestically with respect to the management of radioactive waste, the preparation of domestic legislation from the professional perspective, reviews the legal rules related to this topic and is represented by the various interdepartmental negotiation meetings to participate in the development of the Hungarian position.

3.5.6 Joint impact of the two power plants

Joint impacts of the two power plants are described by the relevant chapters of the Environmental Impact Study.

PLEASE FURNISH EVIDENCE IN THE MATERIAL THAT THE CONSTRUCTION OF THE NEW POWER PLANT TO BE ERECTED WILL NOT THREATEN SAFE OPERATION OF THE EXISTING NUCLEAR POWER PLANT .

Effective law (Government Decree No 246/2011. (XI.24.)) ensures that before the commencement of any activities to be conducted in the environment of a nuclear plant evidence must be presented that the activity to be conducted will not jeopardise the safety of the existing nuclear power plant. This applies to the construction of any new units as well and during the appropriate licensing procedures evidence must be provided that the erection and commissioning activities as well as the operation will not threaten the safety of the existing nuclear power plant .

3.5.7 Observations concerning the contents of the Environmental Impact Study

The general requirements concerning the contents of the Environmental Impact Study prepared under the environmental licensing procedure are governed by Annex No 6 to Government Decree No 314/2005. (XII.25.). Acting accordingly, the description of the respective impacts can be found in the relevant chapters.

Concepts regarding the decommissioning of the plant are found in the subchapter entitled 6.16 Decommissioning of the new power plant units of Chapter 6. The characteristic features and basic data of the Paks II Nuclear Power Plant proposed to the Paks site. Considering the proposed useful lifetime of the facility (60 years), no exact details can be provided with respect to dismantling. Pursuant to the domestic legislation currently in force, decommissioning of a nuclear power plant is an activity subject to an Environmental Impact Assessment in itself.

PLEASE DESCRIBE THE TRANSPORTATION ROUTES AND MODES OF TRANSPORT OF NUCLEAR FUEL IN THE MATERIAL (HAVING PARTICULAR REGARD TO THE NEIGHBOURING COUNTRIES).

The transportation of nuclear fuel is an activity subject to licensing for the procurement of which the development of a physical protection plan is necessary. The relevant requirements are contained in Annex No 3 to Government Decree No 190/2011. (IX. 19.) on the physical protection related to the application of nuclear energy and the associated licensing, reporting and control system, while the contents thereof are regulated in Annex No 4 thereto. In order to avoid and prevent abuses and terrorist acts the exact information provided therein can only be accessed by persons duly authorised for reviewing and only the competent authorities are properly informed on all events occurring during the transportation process. In general it can be said that when the transport routes are selected, the densely populated urban areas are to be avoided, or, if this is not possible, the time of transport is chosen to avoid peak hours. Additionally, special attention should be paid to each apparent source of risk such as danger of floods, forest fire, or rock fall. Other official requirements in place applicable to the transport of hazardous goods pending on the mode of transport are also taken into account (for instance, ADR, RID, ADN, etc.).

ADR- The European Agreement concerning the International Carriage of Dangerous Goods by Road,

RID- international carriage of dangerous goods by rail,

ADN- The European Agreement concerning the International **Carriage** *of Dangerous Goods by Inland Waterways.*

NO INFORMATION IS AVAILABLE ON ARCHAEOLOGICAL EXPLORATIONS IN THE MATERIAL, AND IT IS NOT SPECIFIED TO WHICH EXTENT THE AFFECTED AREA IS DAMAGED DUE TO THE CONSTRUCTION WORKS IN A PERMANENT MANNER.

The preliminary archaeological exploration of the area has been completed. The documentation compiled on these works (Preliminary Archaeological Documentation) constituted a part of the submission prepared for the Environmental Impact Study.

IT SHOULD BE PRESENTED WHICH OF THE REACTOR TYPES CONSIDERED WAS SUITABLE – IF ANY –, HOW AND TO WHICH EXTENT TO PERFORM LOAD TRACKING OPERATING STATES IN ORDER TO BE ABLE TO BALANCE THE POWER FLUCTUATIONS CAUSED BY THE INCREASING PROPORTION OF RENEWABLE ENERGY RESOURCES PROMOTED BY THE EUROPEAN UNION AND USED IN THE SYSTEM.

Nuclear plants are designed basically to continuous operation at their rated output, since this is the way how they are most efficient in economic terms.

The reactor and the fuel elements in it selected in the course of the Paks capacity maintenance efforts were designed by the Atomenergoprojekt (SPbAEP) design office at Saint Petersburg so that in addition to the system level primary regulation functions the reactor unit could provide so called daily load tracking operating mode as well at an output of 50 to 100% of its rated capacity.

The nuclear power plant unit this way is able to provide a high level regulatory reserve by the application of the load tracking operating mode in the event of changes on the demand or supply side of the energy system and in case of operating troubles. This is how it will be able to balance the output fluctuations caused by the increasing ratio of renewable energy sources in the electric power supply system. [26,27]

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