NON-RADIOACTIVE WASTE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviated name	Full name
BM-KvVM	Issued by the Minister of Interior - Minister of Environment and Water
EKD	Preliminary Consultation Documentation
ERBE	MVM ERBE POWER ENGINEERING & CONSULTING Plc.
EüM	Ministry of Health
FTV Rt.	FTV Geotechnical Engineering, Geodesy and Environmental Protection Plc.
Waste Act	Act CLXXXV of 2012 on waste
EIS	Environmental Impact Study
Paks II.	Nuclear power plant units planned at the Paks site
VM	Ministry of Rural Development

17 NON-RADIOACTIVE WASTE

17.1 LEGISLATION

Laws

Act CLXXXV of 2012 on waste

Act CXXIX of 2007 on the protection of arable land

Act LXXVIII of 1997 on the shaping and the protection of the built environment

Act LIII of 1995 on the general rules of environmental protection

Government Decrees

Government Decree 246/2014 (IX. 29.) on the rules of constructing and operating certain waste management facilities

Government Decree 314/2005 (XII. 25.) on the environmental impact assessment and the standard environment use licensing procedure

Government Decree 98/2001 (VI. 15.) on the requirements for activities related to hazardous waste

Government Decree 440/2012 (XII. 29.) on the registration and data supply obligations related to waste

Government Decree 191/2009 (IX. 15.) on construction industry contracting activities

Ministerial Decrees

VM Decree 72/2013 (VIII. 27.) on the list of waste

BM-KvVM Joint Decree 45/2004 (VII. 26.) on the detailed rules of construction and demolition waste treatment

17.2 GENERAL CHARACTERISTICS OF WASTE COLLECTION, STORAGE, TRANSPORT AND TREATMENT

17.2.1 GENERAL STATUTORY RULES ON WASTE

Act CLXXXV of 2012 on Waste (Waste Act) lays down the following general rules on waste in terms of the protection of the environment and human health:

Any and all activities must be planned and executed so that

- it affects the environment to the least possible extent, or reduces the load and use of the environment,
- it does not cause an environmental hazard or environment pollution,
- it ensures the prevention of waste generation,
- it reduces the quantity and hazard level of the waste generated,
- waste recovery,
- and environmentally sound disposal.

Waste management activities must be carried out without risking human health and damaging the environment so that

- it does not pose a risk to environmental elements,
- it does not generate noise or stench (in excess of the threshold level) disturbing the public,
- it has no adverse effect on the landscape, or protected natural or cultural values.

To prevent waste generation, to reduce the volume and hazard level of waste generated, preference must be given to the the following:

a) the application of material and energy saving, low waste technologies,
b) keep the material in the production-consumption cycle,
c) produce products that generate waste of the least weight and volume, the least amount of contaminants, and less load on the environment,
d) replacement of materials that pose a risk as waste.

In the course of waste management, the sequence of the following activities must be pursued (waste hierarchy):

- prevent the generation of waste,
- prepare waste for reuse,
- waste recycling,
- other waste recovery, therefore, particularly recovering energy from waste, and
- waste disposal.

The activity ensuring the best overall environmental results, and facilitating the implementation of the recovery and disposal objectives under the *Waste Act* must be selected from the above activities.

17.2.1.1 General Statutory Rules on Waste Collection

Waste management must be attended by the entity whose activity produces such waste (holder of waste).

Without a waste management licence, producers of waste may carry out preliminary selection, preliminary storage and collection within the property for not more than one year.

Holders of waste collect waste separately at the site to be removed for treatment, as far as it can be executed technically as well as in terms of environmental protection and economy. Waste collected separately may not be mixed with other waste or other materials with different characteristics.

The holder of waste may be obliged to collect waste by specific materials - therefore, particularly paper, metal, plastic, glass, biodegradable - or waste types, apply packaging and markings appropriate for the type of waste, and hand over the waste preselected in this manner to the collector, public service operator or waste treatment organisation.

The holder of waste may attend waste treatment as follows:

a) pre-treatment, recovery or disposal process carried out in the waste treatment facility of with the waste treatment equipment operated by the holder of waste,
b) delivery of waste to a waste treatment organisation,
c) delivery of waste to a carrier,
d) delivery of waste to a waste collector,
e) delivery of waste to a mediator,
f) delivery of waste to a dealer,
g) delivery of waste to a public service operator - including delivery at waste drop-off points or waste collection yards -, or
h) delivery at waste reception points or hand over to the organisation obliged to receive waste.

The disposal obligation of the holder of waste is considered completed if the collector, dealer, waste treatment entity or public service operator assumes ownership of the waste delivered.

If the holder of waste delivers waste to another party, it is required to ensure that the recipient possesses a waste management licence for the transport, mediation, trade or treatment of the given waste, or is registered in the applicable registry required for pursuing specific waste management activities.

Waste management licences may be issued for a definite period, but up to 5 years. The environmental authority registers dealers, mediators and mediating organisations for a definite period, but up to 5 years on the basis of a notification.

17.2.1.2 General Statutory Rules on Individual Types of Waste

17.2.1.2.1 Production Waste

Business associations pursuing waste management operations involving production waste are required to endeavour to select the individual waste management activities according to the waste hierarchy that involve the most efficient material, energy consumption, and facilitates, the realisation of prevention, recovery and disposal targets.

Production waste must be collected separately.

It must be endeavoured that production waste is delivered to a recovery or disposal facility in the most economical way and within the shortest possible time from the place it is produced.

17.2.1.2.2 Hazardous Waste

Waste shall be considered hazardous if it possesses at least one of the hazard features specified in Annex 1 to the *Waste Act* and it is listed in the list of waste laid down in the ministerial decree on the list of waste as hazardous waste.

Hazardous waste may not be mixed or diluted with other waste or material in default of a waste management licence.

Hazardous waste may not be diluted or mixed to reduce the original concentration of hazardous materials under the threshold level qualifying such waste as hazardous waste.

The business association obliged to regular data supply

a) is required to prepare a material balance of its production activities that generate hazardous waste,
b) is required to register and verify with a document the generation, collection, delivery and receipt, transport and treatment of hazardous waste,
c) is required to supply data on its operations to the environmental authority.

In the course of collection, transport and storage, hazardous material must be packed and labelled in line with international agreements and Community law, and in compliance with effective legislative regulations.

A form must be issued - also possibly completed electronically - must be enclosed to hazardous waste for transport. Such form must include the data specified in Regulation (EC) No. 1013/2006 of the European Parliament and of the Council.

Hazardous waste to be recycled or disposed may be stored for up to 1 year following collection.

17.2.1 DETAILED RULES ON WASTE

Accordingly, the most important action is to prevent waste production, minimise the amount of generated waste as much as possible and aspire to have the least possible amount of the waste generated taken to the landfill.

A (selective) collection system for waste separated by type must be constructed to establish the highest possible rate of waste recycling. In addition to its environmental benefits, increased level of waste recovery also has positive effects in terms of economy, because it reduces the expenditure side of environmental protection activities by way of selling recyclable or recoverable waste.

Waste collection must be attended using methods excluding environmental pollution, in compliance with statutory regulations.

An adequate number of collecting containers for the various types of waste collected must be provided in the work site and at workplaces. The waste collecting containers must be provided with labels featuring the name and identification code of the waste type stored in the containers as stipulated by *VM Decree 72/2013 (VIII. 27.) on the list of waste*.

The provisions of *Act LIII of 1995 on the general rules of environmental protection, Act CLXXXV of 2012 on waste*, and *Government Decree 246/2014 (IX. 29.) on the rules of constructing and operating certain waste management facilities* must be considered with respect to the storage of the part of waste that is stored at the site for a prolonged period prior to removal.

Organisations holding a waste management licence issued by the environmental authority may perform waste removal, recovery and disposal.

The producer of waste is required to keep a record of and carry out data reporting on the waste generated and delivered to the waste management company according to the provisions of *Government Decree 440/2012 (XII. 29.) on the obligations for the registration of and data reporting on waste*.

The scope of obligations of the producer of waste cover the activities up to the delivery of waste to the waste recovery or disposal organisation, therefore, the assessment of the impacts of non-radioactive waste produced is within this scope.

Any effects that occur at the site of waste management organisations are not anymore associated with the producer of waste.

The following table provides an overview of the special waste management characteristics of various waste groups.

17.2.1.1 Construction-Demolition (Inert) Waste

BM-KvVM Joint Decree 45/2004 (VII. 26.) on the detailed rules of construction and demolition waste treatment deals with the legal regulations of waste groups. The list of waste types subject to the decree is shown in Table 17.2.1-1.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Excavated soil	17 05 04 17 05 06	soil and stones (not containing dangerous substances); dredging spoil (not containing dangerous substances);
concrete debris	17 01 01	concrete
Asphalt debris	17 03 02	Bituminous mixture (not containing coal tar)
Wood waste	17 02 01	wood
Metal waste	17 04 01 17 04 02 17 04 03 17 04 04 17 04 05 17 04 06 17 04 07 17 04 11	copper, brass; aluminium; lead; zinc; iron and steel; tin; mixed metals; cable (not containing any oil, coal tar and other dangerous substances)
Plastic waste	17 02 03	plastic
Miscellaneous construction and demolition waste	17 09 04	mixed construction and demolition waste (not containing mercury, PCB or other dangerous substances)
Mineral construction waste	17 01 02 17 01 03 17 01 07 17 02 02 17 06 04 17 08 02	bricks; tiles and ceramics; mixture of, or separate fractions of concrete, bricks, tiles and ceramics (not containing dangerous substances); glass; insulation materials (not containing dangerous substances); gypsum-based construction material (not containing dangerous substances);

Table 17.2.1-1: List of construction-demolition waste types regulated by BM-KvVM Joint Decree 45/2004. (VII. 26.).

No hazardous waste may be included among inert waste.

A separate are must be provided to collect any large amounts of construction and demolition waste generated, while minor quantities of waste must be put in containers.

Recyclable parts of construction and demolition waste (metals, plastic, glass, wood, etc.) must be removed to processing plants suitable for the recycling of the waste types generated. Construction and demolition waste not subjected to recycling must be deposited in inert landfills.

The domestic processing capacity of such waste is expected to increase in the near future, consequently, concrete, brick, tile waste processed by machine grinding and the fractions separated to various aggregate sizes are expected to be marketable for construction operations or used as base layers for road construction.

Pursuant to the provisions of *BM-KvVM Joint Decree 45/2004 (VII. 26.)* and *Government Decree 191/2009 (IX. 15.) on construction industry contracting activities*, the building contractor is required to keep a permanent record of the types and quantities of construction and demolition waste in the construction log. Following the completion of the activity, the contractor is obliged to prepare and deliver to the developer the construction and demolition waste record sheet presenting the wastes actually generated during the activity.

It is fundamentally the responsibility of the building contractors at construction operations to attend any and all waste management duties.

17.2.1.2 Excavated soil from construction sites

Excavated soil is generated as a major component of construction and demolition (inert) waste, therefore, we deal with analysing its definition by law and the opportunities of treatment.

Excavated contaminated soil

Based on *Article 30(3) Act LIII of 1995 on the general rules of environmental protection*, the rules on the treatment of waste (recycling, disposal) are applicable to contaminated soil. Contaminated soils excavated during construction are to be treated as hazardous waste.

Excavated uncontaminated soil used for construction

Article 1(3) e) of the Waste Act provides that the scope of the act does not cover uncontaminated soil or other material in its natural form, which is excavated during construction and used in its natural form for the construction activity. Consequently, the part of excavated uncontaminated soil used for construction activities may not be considered waste.

Article 16 of Act LIII of 1995 on the general rules of environmental protection, the appropriate removal of tilth and utilisation as topsoil must be ensured in line with the guidelines set forth in *Act CXXIV of 2007 on the protection of arable land* prior to beginning or continuing any investment (construction, mining) projects.

Excavated uncontaminated soil removed from the construction site

Pursuant to the definition in *Article 2(1) 10 of the Waste Act* construction and demolition waste is waste derived from construction activities under *Act LXXVIII of 1997 on the shaping and the protection of the built environment*. *Annex 1 to the BM-KvVM Joint Decree 45/2004 (VII. 26.) on the detailed rules of construction and demolition waste treatment* lists the types of waste generated during construction activities. Excavated soil is included in said list in the following breakdown:

- Identification code: 17 05 04; - soil and stones other than those mentioned in 17 05 03
- Identification code: 17 05 06; - dredging spoil other than those mentioned in 17 05 05

Accordingly, excavated uncontaminated soil used outside the construction site is considered waste pursuant to the applicable statutory regulations.

Designation of a temporary storage area

A separate area must be designated for the storage of excavated uncontaminated soil until the refill of the soil in the construction site, or if removal for utilisation in external locations or for disposal is not viable immediately.

Utilisation opportunities for excavated soil

Excavated soil may be used for "*R10 Land treatment resulting in benefit to agriculture or ecological improvement*" from the recovery operations specified on the basis of *Annex 3 to the Waste Act*.

Activities resulting in benefit to agriculture are specified in *Article 49(1) of Act CXXIV of 2007 on the protection of arable land*, of which excavated soil from construction sites may be used for the following purposes:

a) soil improvement,

b) landscape restoration for agricultural purposes,

c) soil protection technical actions specified in Article 36(2) c),

f) use of non-hazardous waste of non-agricultural origin on arable land.

The prerequisite to the above activities is to prepare a soil protection plan for the intended use, then obtain a permit from the soil protection authority on the basis thereof.

Excavated soil may result in benefit to ecology if used in:

- hydraulic engineering,
- road construction,
- or the re-cultivation of borrow pits.

In this case, the contractor is required to obtain the required permits and licences from the water, building and transport authority.

Excavated soil disposal

If the soil excavated from the construction site cannot be used, it must be disposed in a landfill, where it may be used for landscaping and covering purposes.

17.2.1.3 Non-hazardous industrial waste

Non-hazardous industrial waste – particularly recyclable and resalable waste – must be collected by excluding contaminating materials that would prevent further use, therefore, such waste may not contain municipal waste, hazardous waste or construction debris.

Recyclable non-hazardous industrial waste includes:

- diverse metal waste,
- cable waste,
- wood waste,
- paper waste,
- plastic packaging waste.

An appropriate number of rooms must be designated to store resalable industrial waste.

Such waste must be removed to waste recycling plants after storage.

17.2.1.4 Hazardous waste

Materials with at least one of the hazard characteristics specified in *Annex 1 to the Waste Act*, and having a potential immediate or delayed damaging effect on human life, health or wildlife by virtue of themselves or any of their degradation products in this respect are considered hazardous waste.

Hazardous waste must be prevented during collection and storage to cause environmental pollution by entering the soil, surface and subsurface waters or the atmosphere.

Hazardous waste must be stored in closed vessels (container, barrel) preventing environmental pollution at the construction site waste collection points at the place of generation, separated by type. Spent oil may also be stored in tanks with appropriate protection, while certain solid waste (e.g. oily rags) may also be collected in plastic bags. Municipal sewage sludge is collected in the sludge desiccation basin of the waste treatment plant following thickening.

Hazardous waste collected may be stored in the hazardous waste site storage established at the plant until disposal, but up to 1 year from the date of generation. The plant collection point must be established to prevent pollution of or damage to the environment.

The structure of workplace and plant collection points must, in addition to general environmental and waste management requirements, comply with the requirements of *Government Decree 98/2001 (VI.15.) on the conditions for engaging in activities associated with hazardous waste*.

Oily waste (spent oil, oily rag, empty oil vessels), accumulators and dry batteries may be recycled. Part of the other hazardous waste may be recovered by thermal procedures (e.g. sewage sludge). Minor quantities of hazardous waste that cannot be recovered thermally must be disposed in hazardous waste dumps.

Government Decree 98/2001 (VI.15.) also specifies the transport requirements for hazardous waste; carriers may deliver hazardous waste shipments to the waste treatment entities indicated on the so-called "SZ" accompanying document completed by the producer of waste. The carrier and the waste treatment entity must document the delivery of waste, because this document must be accounted for and retained.

17.2.1.5 Mixed municipal waste

An appropriate number of collection vessels (conventional waste bins and containers) must be provided to collect mixed municipal waste. No specially established storage area is required, waste is removed by the replacement of containers. Mixed municipal waste is practically removed to the closest municipal waste dumps for disposal by way of landfilling.

Metal, glass, paper, plastic and organic waste must be collected separately. Separately collected waste must be delivered to processing plants and recycling organisations for waste recycling or recovery.

17.3 PAKS II. CONSTRUCTION IMPACTS

17.3.1 BASIC CONDITION OF THE AREA

17.3.1.1 Rehabilitated construction debris landfill in the Paks II staging area

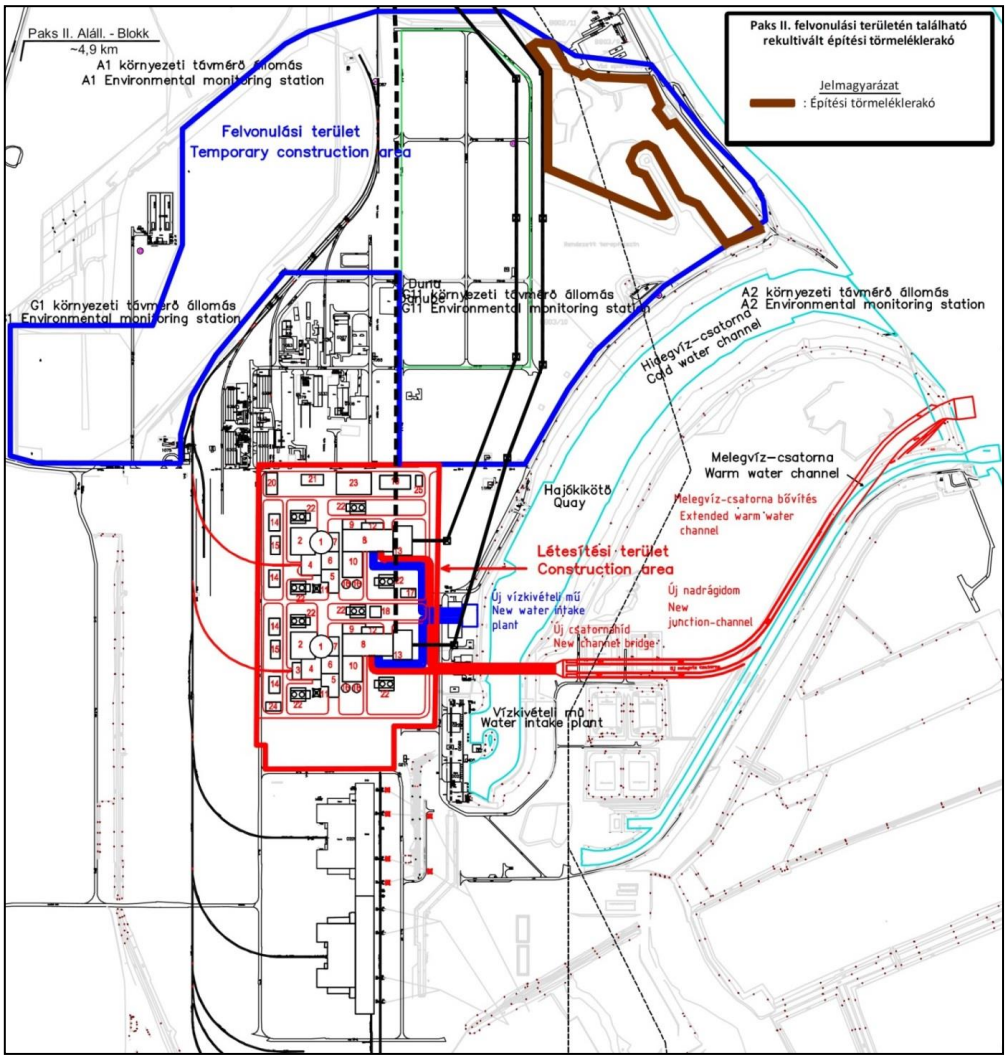
The NW area of the future mobilisation area of Paks II is undeveloped, grassland and grove. A part of it originally had lower terrain elevation, which was filled up with the excavated soil and construction debris from the construction of the Paks Nuclear Power Plant.

The environmental review of the construction landfill was completed by FTV Rt. in 2002.The key findings of the environmental review are summarised below:

- No waste has been deposited in the area since December 2001.
- The results of the explorations show that 95-96% of the waste underground is construction debris and soil, granular material (50-50%), and 4-5% organic material (e.g. wood waste, block, cuttings) in the landfill.
  The landfill contains no hazardous waste.
  The total volume of the landfill is some 80-100 thousand m^3.
  The volume of the waste laid on the surface (typically reinforced concrete pieces and concrete debris) is approximately 1,670 m^3.
- The analytical tests showed no contamination in the deposited debris and the geological medium-type binder.

The construction waste dump is sealed, the rehabilitation of the not recyclable concrete components unloaded onto the surface was attended by mulching. [17-1]

The path of the 400 kV unit line to be constructed may go across the rehabilitated construction debris landfill, delineated by a brown line on Figure 17.3.1-1.



Paks II. felvonulási területén található rekultivált építési törmeléklerakó - Recultivated construction debris landfill in the Paks II: temporary construction site
Jelmagyarázat - Legend
Építési törmeléklerakó - Construction debris landfill

Figure 17.3.1-1: Location of the rehabilitated construction debris landfill in the Paks II. staging area [17-1]

17.3.2 WASTE GENERATED DURING THE CONSTRUCTION OF PAKS II.

The construction process of the new nuclear power plant units involves the production of significant amounts of conventional (non-radioactive), typically construction, hazardous and non-hazardous industrial waste, and municipal waste.

The work processes producing waste in the course of establishing the units (impact factors) are as follows:

- Construction of nuclear power plant units
  - demolition of buildings / structures in the site
  - terrain correction
  - groundwork
  - structural engineering works
  - technological installations and assemblies

- Establishment of the fresh water condenser cooling system
  - cold water canal extension
  - construction of new headworks
  - cooling water supply path construction
  - hot water drainage path construction
  - heat recovery hydroelectric power plant construction
- Installation of the 400 kV unit line and 120 kV power transmission line up to the new substation
  - construction preparation, path layout
  - groundwork
  - assembly of pylons and insulation chains
  - pylon erection
  - laying and configuration of lines

17.3.2.1 Waste types and quantities

17.3.2.1.1 Construction of nuclear power plant units

The construction of the new nuclear power plant units will produce construction and demolition, packaging, and other, mostly **non-hazardous waste** in terms of quantity. The list of such waste is presented in Table 17.3.2-1.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Non-hazardous waste		
demolished concrete, prefabricated and in-situ cast concrete	17 01 01	concrete
bricks (wall)	17 01 02	bricks
ceramic tiles	17 01 03	tiles and ceramics
wood scaffolding	17 02 01	wood
glass waste	17 02 02	glass
polyethylene foil	17 02 03	plastic
steel structures, reinforcing bars, rolled metal material	17 04 05	iron and steel
excavated soil from construction site	17 05 04	soil and stones other than those mentioned in 17 05 03
rockwool slabs (insulation material)	17 06 04	insulation material other than those mentioned in 17 06 01 and 17 06 03
mortar, rendering	17 09 04	mixed construction and demolition waste other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

Table 17.3.2-1: List of non-hazardous waste foreseen to be generated during the construction of Paks II. nuclear power plant units [17-2]

The largest amount of waste is produced during the excavation of the working pit; further construction and demolition waste includes concrete, while a lesser amount of construction auxiliary structures and materials is generated.

Hazardous waste produced is foreseen to include various, primarily oily waste from the operation and maintenance of utility machines used during construction, as well as the empties of paint, solvents and other chemicals, that is packaging materials. This includes municipal sewage sludge produced during the treatment of municipal sewage generated by the workforce attending the construction works at the site.

Contaminated sand, perlite, other absorbent material as well as excavated contaminated soil waste may be generated if any damage events during the operation of utility machines need to be managed.

The list of foreseen hazardous waste generated during the construction of Paks II is shown in Table 17.3.2-2.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Hazardous waste		
lubricating grease	12 01 12*	spent waxes and fats
hydraulic oils	13 01 10*	mineral-based non-chlorinated hydraulic oils
spent oil	13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils
contaminated empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances
oily rags, rags contaminated with lubricating grease	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
used oil filters, air filters	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
used accumulators	16 06 01*	lead batteries
contaminated soil excavated from the construction site, contaminated absorbent material (sand, perlite)	17 05 03*	soil and stones containing dangerous substances
municipal sewage sludge	19 08 11*	sludge containing dangerous substances from biological treatment of industrial waste water

Table 17.3.2-2: List of hazardous waste foreseen to be generated during the construction of Paks II. nuclear power plant units

17.3.2.1.2 Establishment of the fresh water cooling system

Primarily construction and demolition waste is foreseen to be produced in the course of establishing the fresh water cooling system.

This work process will also fundamentally be characterised by large volumes of earthworks.

The main waste types foreseen to be produced are listed in Table 17.3.2-3.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Non-hazardous waste		
concrete waste	17 01 01	concrete
mixed construction waste	17 01 07	mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
wood scaffolding	17 02 01	wood
steel structures, reinforcing bars	17 04 05	iron and steel
excavated soil from construction site	17 05 04	soil and stones other than those mentioned in 17 05 03
sludge and bed material excavated from the construction site	17 05 06	dredging spoil other than those mentioned in 17 05 05
mortar, rendering	17 09 04	mixed construction and demolition waste other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

Table 17.3.2-3: Main waste types foreseen to be generated during the construction of the fresh water cooling system

17.3.2.1.3 Installation of the 400 kV unit line and 120 kV power transmission line up to the new substation

The 400 kV unit line and 120 kV power transmission line up to the new substation may be divided into two sections: a section in the area of the power plant to be constructed, that is a section running through an industrial area, and a section running outside the site, in an agricultural and forest area. This may influence the treatment of the excavated soil.

We calculated the waste quantities foreseen to be produced during terrain formation, groundworks and assembly works in view of the number of pylons on the transmission line path and dimensions of the bases.

The site section of the transmission line also runs through the part of the site used as construction debris landfill in previous years, therefore, earthworks will also produce construction debris, which is to be removed to the inert landfill. The calculated quantity of waste generated is shown in Table 17.3.2-4.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity	
			[m³]	[t]
SITE SECTION				
Non-hazardous waste				
paper packaging residue	15 01 01	paper and cardboard packaging		0.05
wood packaging residue	15 01 03	wooden packaging waste		0.1
metallic packaging residue	15 01 04	metallic packaging waste		0.05
excavated soil from construction site	17 05 04	soil and stones other than those mentioned in 17 05 03	150	270
Hazardous waste				
paint empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances		0.01
paint and chemical contaminated rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances		0.01
OUT-OF-SITE SECTION				
Non-hazardous waste				
paper packaging residue	15 01 01	paper and cardboard packaging		0.2
wood packaging residue	15 01 03	wooden packaging waste		0.4
metallic packaging residue	15 01 04	metallic packaging waste		0.2
excavated soil from construction site	17 05 04	soil and stones other than those mentioned in 17 05 03	650	1 170
Hazardous waste				
paint empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances		0.05
paint and chemical contaminated rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances		0.05

Table 17.3.2-4: Main waste types and calculated quantities generated during the construction of power transmission lines

17.3.2.1.4 Soil volume excavated from the construction sites

The largest amount of waste produced during the construction of Paks II is soil excavated from the construction site, consequently, this component of the total waste will be the most instrumental in the environmental impact caused by the generated non-radioactive waste.

The estimated quantities of soil to be excavated are presented in Table 17.3.2-5. We carried out the calculations in m^3 units, then converted the results to tons using a factors of 1.8, because experience shows that the specific weight of compact soil is 1.8 t/m^3.

Paks II. construction phases	Quantity	
	[m³]	[t]
Construction of nuclear power plant units	820 000	1 476 000
Establishment of the condenser fresh water cooling system	570 000	1 026 000
Transmission grid		
construction of the site section	150	270
construction of the out-of-site section	650	1170
total:	1 390 800*	2 503 440*

Note:
The quantities of excavated soil include the amounts refilled during the construction works.

Table 17.3.2-5: Estimated soil volume excavated from the construction site during the construction of Paks II.

Part of the soil – approximately 66,000 m³ - 118,800 t – excavated during the construction of the cooling water supply path and hot water drainage path will be refilled. Part of the soil excavated during the construction of the nuclear power plant units will also be refilled around the concrete. The volume of refill will be specified at a later phase of the design process. Part of the soil excavated during the construction of the transmission line pylons bases will also be refilled around the concrete bases.

17.3.2.1.5 Mixed municipal waste

The amount of municipal waste during the construction of the nuclear power plant will depend on the current headcount of workers at the site. The amount of municipal waste generated will vary due to the different scheduling of partial tasks and the diverse labour requirements thereof.

17.3.3 IMPACTS AND IMPACT AREAS OF PAKS II CONSTRUCTION

In terms of non-radioactive waste, the construction period of Paks II will have the greatest impact on the environment. The reasons thereto are partly the large amount of waste generated during construction works, and partly because said environmental impacts will occur concentrated during the 5-5 years of the construction of the individual units.

Foreseen construction period of the units of Paks II.:

1st unit 2020-2025

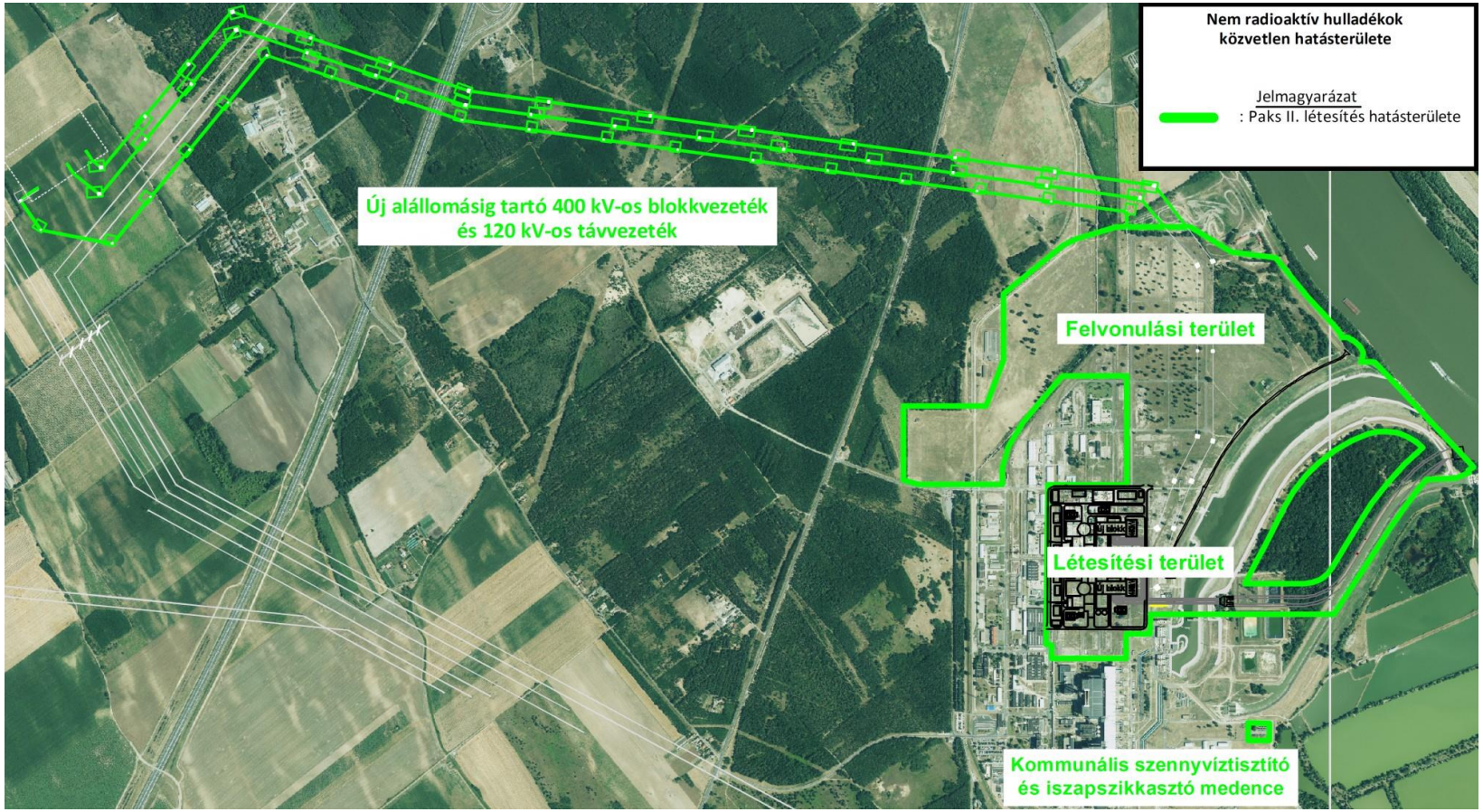
2nd unit 2025-2030

Fundamentally the building contractors are responsible to attend any arising waste management duties at the construction sites, however, experience shows that it is more practical to organise waste management centrally.

17.3.3.1 Direct impacts

Non-radioactive waste production during the establishment period has its impacts on the construction site and the locations where waste is deposited or stored until removal, including the existing municipal waste water treatment plant with the sludge desiccation basin. Non-radioactive waste is stored as the temporary use of the area as waste storage locations, and may change the condition of the geological medium. The impacts may be mitigated through the application of technologies and raw materials facilitating the reduction of waste generation. The impacts remain acceptable.

The scope of the direct impact area extends to the establishment and mobilisation area, the waste storage location as well as the paths of the 400 kV unit line and the 120 kV power transmission line up to the new substation (Figure 17.3.3-1).



Nem radioaktív hulladékok hatásterülete - Direct impact area of non-radioactive wastes
Jelmagyarázat - Legend
Paks II. létesítés hatásterülete - Paks II. Construction impact area
Új alállomásig tartó 400 kV-os blokkvezeték és 120 kV-os távvezeték - 400 kV unit line and 120 kV power transmission line up to the new substation
Felvonulási terület - Temporary construction site
Létesítési terület - Construction site
Kommunális szennyvíztisztító és iszapszikkasztó medence - Municipal sewage treatment plant and sludge desiccation basin

Figure 17.3.3-1: Impact area of Paks II. construction direct impacts - non-radioactive waste

17.3.3.2 Indirect impacts

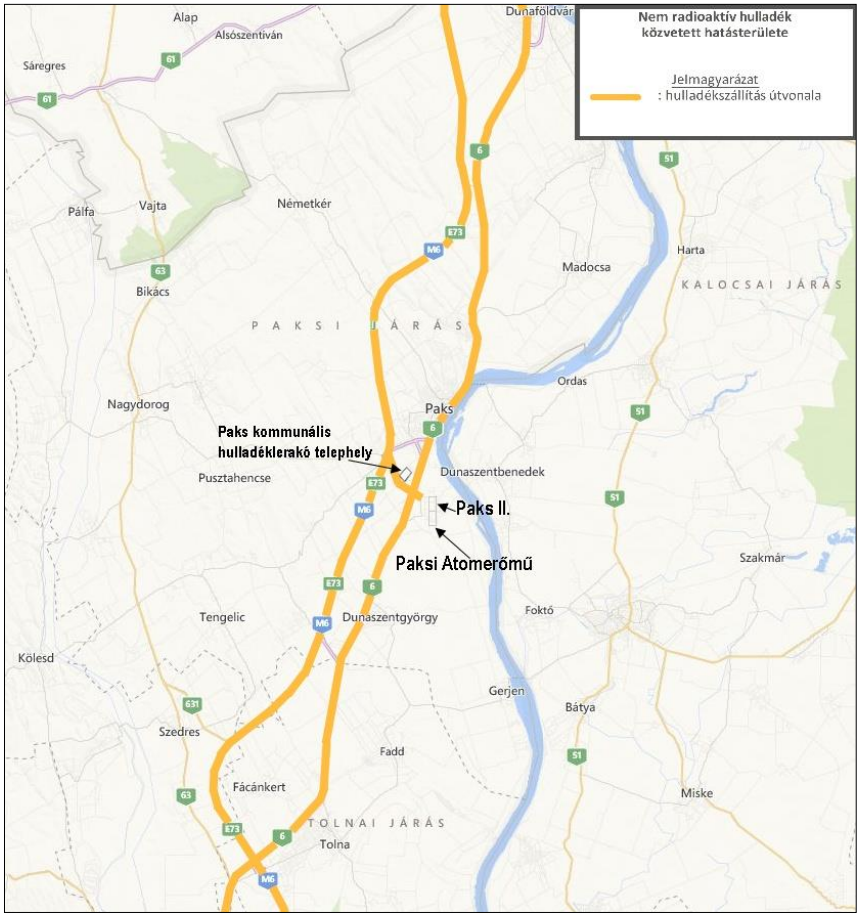
A carrier with a valid licence must be engaged for waste transport, who transfers the waste received to an organisation holding a valid licence for waste recycling or disposal.

The removal of non-radioactive waste from the site may potentially affect the vicinity of transport routes. Potential impacts on air quality may occur within a not more than 50-100 m zone along the roads used for waste transport. The noise load caused by waste transport during the establishment period is one of the components of noise annoyance increase caused by all the operations of the power plant associated with road traffic.

The removal of waste to nearby sites may reduce the environmental risk and potential impact of deliveries. Compliance with the applicable requirements for waste transport may minimise the potential environmental impacts.

The route for the removal of mixed municipal waste is the section stretching between the northern entrance of the power plant and the municipal waste dump of the town of Paks. The exact transport routes for the other construction and demolition, hazardous and non-hazardous waste generated are not known at this moment, however, potential routes include Road No. 6 and the involved sections of M6 Motorway. The frequency of waste transports will be subject to the rate of waste production.

The indirect impact area will remain within a zone of 50-100 m of the road used for waste transport (Figure 17.3.3-2).



Nem radioaktív hulladék közvetett hatásterülete - Indirect impact area of non-radioactive wastes
Jelmagyarázat - Legend
hulladékszállítás útvonala - Waste transport route
Paks kommunális hulladéklerakó telephely - Paks municipal waste landfill site
Paksi Atomerőmű - Paks Nuclear Power Plant

Figure 17.3.3-2: Potential impact area of Paks II. construction indirect impacts - non-radioactive waste transport

17.3.3.3 Transboundary environmental impacts

The impacts of the non-radioactive waste produced during the establishment of Paks II remain local in all cases and there will be no transboundary environmental impacts.

17.4 FORESEEN IMPACTS OF PAKS II. OPERATIONS

17.4.1 WASTE GENERATED DURING THE OPERATION OF PAKS II.

17.4.1.1 Waste types and quantities

The operation of the new nuclear power plant units does not basically result in the production of waste types different from the currently operating power plant. The difference will be experienced in the lower amount of waste due to the operation of modern equipment, less maintenance needs and in the need of less workforce.

During the operation of Paks II., construction, hazardous and non-hazardous industrial waste, and municipal waste is foreseen to be produced. Diverse waste types may be produced in both the controlled and monitored zones. Waste produced in the controlled zone, but already released for removal in compliance with the requirements may remain to be stored and treated in the future together with waste generated in the monitored zone.

Part of the waste during the operation of the units is produced regularly with the operation, while the other part is generated occasionally during maintenance and the construction works during remodelling.

The supplier's preliminary data supply we had available when preparing the EIS does not contain information on the type and quantity of waste produced during the operation of the new nuclear power plant units, consequently, we determined the missing information after processing the data obtained from some documentation pertaining to the topic.

The types and quantities of waste were determined based on the following data sources:

- Waste types produced during the operation of the Paks Nuclear Power Plant and the average quantities thereof.
- Information gathered from the environmental impact study of the nuclear power plant to be constructed in Pyhäjoki, Finland.

All underlying documents typically present the waste management data of the facilities basically divided into hazardous waste and non-hazardous waste breakdowns, accordingly, we describe the baseline conditions in the following in conformity to the structure of the source materials used.

17.4.1.1.1 Non-radioactive waste generated during the operation of Paks Nuclear Power Plant

We took the Environmental Protection Reports of the Paks Nuclear Power Plant (2004-2013.) [17-4] an the sustainability reports of the MVM Group (2004-2013.) [17-5] as baseline data to describe the operation of the Paks Nuclear Power Plant..

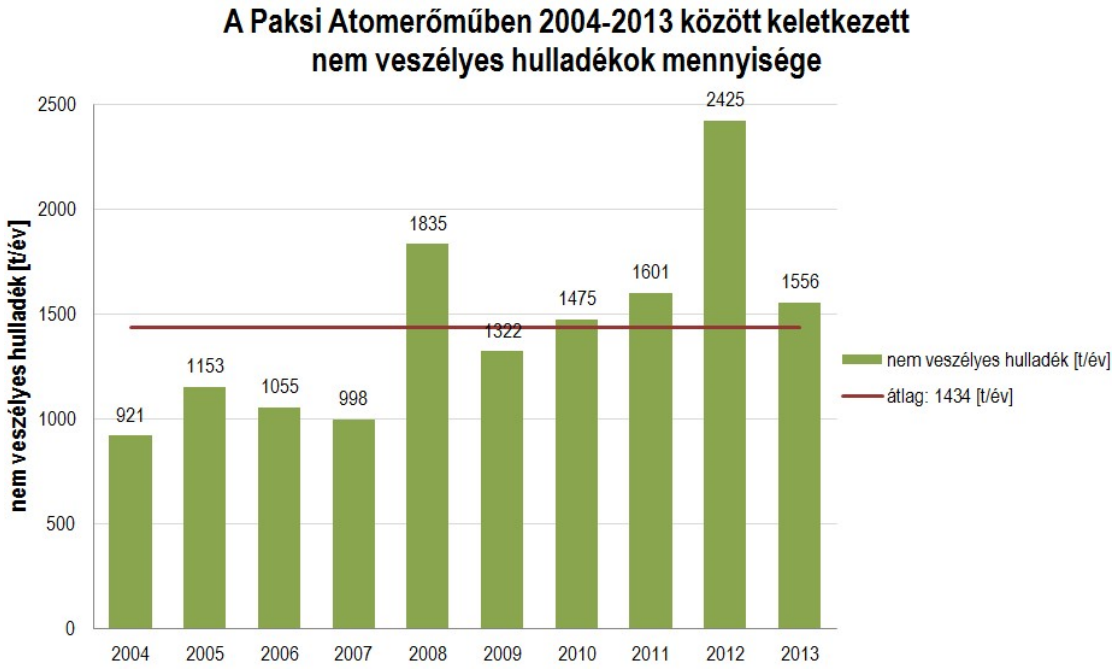
We examined the waste management data of the Paks Nuclear Power Plant producing a total nominal electric output of 2000 MW in the span of 10 years between 2004-2013.

- non-hazardous waste: 1434 t/year/2000 MW,
- hazardous waste: 276 t/year/2000 MW.

The significant fluctuation of annual waste quantities results from the difference in annual planned maintenance and overhauls, which are greatly influenced by the projects launched on account of safety enhancement measures, operating time extensions and targeted security reviews.

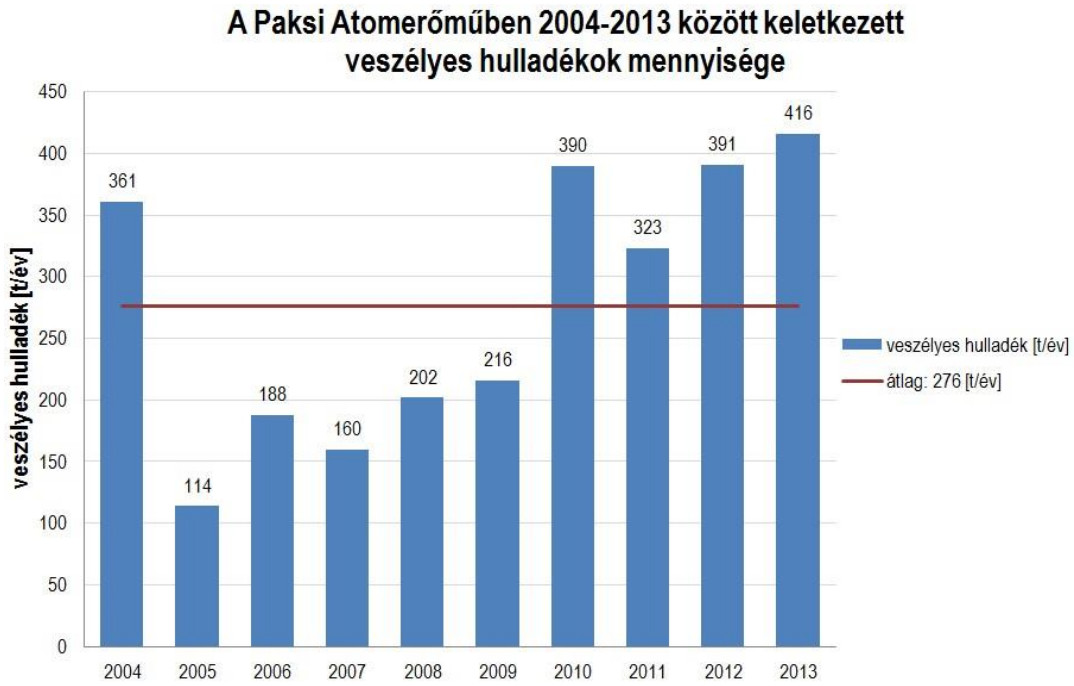
For that reason, we only reckon with the average quantity data by considering that the future nuclear power plant operations of a similar scale in terms of total output should produce considerably less average waste annually by virtue of the modern nuclear power plant units.

The annual quantities of non-hazardous and hazardous waste generated at the Paks Nuclear Power Plant between 2003-2014 are presented in Figure 17.4.1-1 and Figure 17.4.1-2, respectively.



A Paksi Atomerőműben 2004-2013 között keletkezett nem veszélyes hulladékok mennyisége - Non-hazardous waste produced in the Paks Nuclear Power Plant between 2004-2013
nem veszélyes hulladék [t/év] - non-hazardous waste [t/year]
átlag: 1434 [t/év] - average: 1434 [t/year]

Figure 17.4.1-1: Annual quantities of non-hazardous waste generated in the Paks Nuclear Power Plant between 2004-2013



A Paksi Atomerőműben 2004-2013 között keletkezett veszélyes hulladékok mennyisége - Hazardous waste produced in the Paks Nuclear Power Plant between 2004-2013
veszélyes hulladék [t/év] hazardous waste [t/year]
átlag: 276 [t/év] - average: 276 [t/year]

Figure 17.4.1-2: Annual quantities of hazardous waste generated in the Paks Nuclear Power Plant between 2004-2013

The detailed list and quantities of waste produced in 2013 are presented in the following tables, where non-hazardous waste is shown in Table 17.4.1-1 and hazardous waste is shown in Table 17.4.1-2.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity [kg/year]
Non-hazardous waste			
iron chips	12 01 01	ferrous metal filings and turnings	670
wooden packaging waste	15 01 03	wooden packaging waste	99 362
glass waste	20 01 02	glass	6 060
plastic demolition waste	17 02 03	plastic	16 060
copper, bronze, brass waste	17 04 01	copper, bronze, brass	1 270
aluminium waste	17 04 02	aluminium	15 193
lead waste	17 04 03	lead	550
iron and steel waste	17 04 05	iron and steel	491 257
cables	17 04 11	cables other than those mentioned in 17 04 10	22 195
rockwool waste	17 06 04	insulation material other than those mentioned in 17 06 01 and 17 06 03	78 760
paper and cardboard waste	20 01 01	paper and cardboard	28 226
paper packaging waste	15 01 01	paper and cardboard packaging waste	22 660
heat exchanger waste water	19 09 99	wastes not otherwise specified from the preparation of water intended for human consumption or water for industrial use	3 800
spillway sludge	19 09 99	wastes not otherwise specified from the preparation of water intended for human consumption or water for industrial use	31 110
biodegradable waste	20 02 01	biodegradable waste	107 760
tile and ceramic waste	17 01 03	tiles and ceramics	22 680
concrete debris	17 01 01	concrete	159 500
bricks	17 01 02	bricks	1 320
mixed construction waste	17 01 07	mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	122 660
excavated soil	17 05 04	soil and stones other than those mentioned in 17 05 03	61 400
plastic packaging waste	15 01 02	plastic packaging waste	4 640
mixed waste, bulky waste	20 03 07	bulky waste	860
vacuumed waste water	20 03 04	septic tank sludge	258 000
total:			***1 555 993***

Table 17.4.1-1: List of non-hazardous waste generated in the Paks Nuclear Power Plant in 2013 [17-6]

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity [kg/year]
Hazardous waste			
acids	06 01 06*	other acids	1
liquid waste containing mercury	06 04 04*	waste containing mercury	700
printing waste	08 03 12*	waste ink containing dangerous substances	2 360
office technology waste	08 03 17*	waste printing toner containing dangerous substances	102
waste servicing materials	08 04 09*	waste adhesives and sealants containing organic solvents or other dangerous substances	3 622
spent oil	13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils	16 843
transformer oil	13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils	140
oily sludge	13 05 02*	sludges from oil/water separators	27 960
spent oil containing water	13 08 02*	other emulsions	26 700
oily metal empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances	565
oily plastic bottle	15 01 10*	packaging containing residues of or contaminated by dangerous substances	167

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity [kg/year]
empties with chemical residues	15 01 10*	packaging containing residues of or contaminated by dangerous substances	4 522
paint empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances	21 897
pressure container waste	15 01 11*	metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers	961
oily rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	25 770
chemical absorbent	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	1 528
air filter cartridge (textile)	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	3 860
active carbon	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	1 545
aqueous washing liquid	07 01 01*	aqueous washing liquids and mother liquors	2 047
waste refrigerators	16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC	1 041
electronic waste	16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12	3 455
fine chemicals	16 05 06*	laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals	3 822
photo chemicals	16 05 07*	discarded inorganic chemicals consisting of or containing dangerous substances	530
own process chemicals	16 05 07*	discarded inorganic chemicals consisting of or containing dangerous substances	32 843
used accumulators	16 06 01*	lead batteries	80 636
dry battery waste	16 06 02*	Ni-Cd batteries	800
railway sleepers	17 02 04*	glass, plastic and wood containing or contaminated with dangerous substances	9 560
demolished roof insulation	17 03 01*	bituminous mixtures containing coal tar	11 620
oily soil, stones	17 05 03*	soil and stones containing dangerous substances	38 220
soil containing chemicals	17 05 03*	soil and stones containing dangerous substances	54 650
insulation materials containing asbestos	17 06 01*	insulation material containing asbestos	1 685
demolition waste containing dangerous substances	17 09 03*	other construction and demolition wastes (including mixed wastes) containing dangerous substances	4 400
examination materials from physician's office	18 01 06*	chemicals consisting of or containing dangerous substances	220
expired medicines	18 01 08*	cytotoxic and cytostatic medicines	420
borax waste	19 02 11*	other waste containing dangerous substances	6 950
municipal sewage sludge	19 08 11*	sludges containing dangerous substances from biological treatment of industrial waste water	4 880
ion exchange resin	19 08 06*	saturated or spent ion exchange resins	15 910
fluorescent tube	20 01 21*	fluorescent tubes and other mercury-containing waste	3 207
total:			***416 139***

Table 17.4.1-2: List of hazardous waste generated in the Paks Nuclear Power Plant in 2013 [17-6]

17.4.1.1.2 Data used from the environmental impact assessment of the nuclear power plant constructed in Finland

Fennovoima Ltd. is planning to establish a nuclear power plant based on an AES-2006 unit with a nominal electric output of 1200 MW in Pyhäjoki on the Hanhikivi peninsula, Finland.

AES-2006 is one of the potential Russian units that may be selected to be installed for operation at the Paks II. site, therefore, the estimated waste quantities in the environmental impact study of the planned Finnish power plant may provide an appropriate baseline for comparison to determine the waste quantities foreseen to be produced at the planned Paks facility.

In addition, the impact study [17-7] also contains the aggregate quantities of estimated hazardous and non-hazardous wastes produced during normal operations:

- non-hazardous waste: 400 t/year/1200 MW,
- hazardous waste: 50 t/year/1200 MW.

17.4.1.1.3 Foreseen types and quantities of waste generated during the operation of Paks II.

The comparison of the averaged waste quantities produced during the operation of the Paks Nuclear Power Plant and the estimated waste quantities produced during the operation of the planned nuclear power plant of Fennovoima Ltd. planned in Finland shows that the estimated value of the planned Finnish nuclear power plant converted to 2400 MW is approximately half the quantity of the average annual waste produced in the currently operational Paks Nuclear Power Plant (Table 17.4.1-3).

Total nominal electric output	Non-hazardous waste	Hazardous waste
	[t/year]	[t/year]
Paks Nuclear Power Plant 2000 MW	1434	276
Fennovoima Ltd. Hanhikivi 1200 MW	400	50
Fennovoima Ltd. Hanhikivi converted to 2400 MW	*800*	*100*

Table 17.4.1-3: Estimated waste quantities generated during the operation of the Paks Nuclear Power Plant and the nuclear power plant of Fennovoima Ltd.

We calculated with double the estimated waste quantities from the environmental impact study of the Finnish nuclear power plant with an designed power output of 1200 MW when estimating the waste quantities produced during the operation of Paks II planned for the Paks site with a total power output of 2400 MW.

We relied on the waste management data of the Paks Nuclear Power Plant to identify the list of presumed waste types generated during regular operation. The characteristics of non-hazardous and hazardous wastes are presented in Table 17.4.1-4 and Table 17.4.1-5, respectively.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity [t/year]
Non-hazardous waste			
paper packaging waste	15 01 01	paper and cardboard packaging waste	
plastic packaging waste	15 01 02	plastic packaging waste	
textile protective clothing	15 02 03	absorbents, filtering materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	
heat exchanger waste water	19 09 99	wastes not otherwise specified from the preparation of water intended for human consumption or water for industrial use	
glass waste	20 01 02	glass	
biodegradable wastes	20 02 01	biodegradable waste	
mixed municipal waste	20 03 01	other municipal wastes, including mixed municipal waste	
		total:	***800***

Table 17.4.1-4: Foreseen list and estimated quantities of non-hazardous waste generated during the operation of Paks II.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)	Quantity [t/year]
Hazardous waste			
aqueous washing liquid	07 01 01*	aqueous washing liquids and mother liquors	
spent oil	13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils	
transformer oil	13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils	
oily sludge	13 05 02*	sludges from oil/water separators	
oily rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	
air filter cartridge (textile)	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	
active carbon	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	
electronic waste	16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12	
technological chemical residues	16 05 07*	discarded inorganic chemicals consisting of or containing dangerous substances	
used accumulators	16 06 01*	lead batteries	
ion exchange resin	19 08 06*	saturated or spent ion exchange resins	
municipal sewage sludge	19 08 11*	sludges containing dangerous substances from biological treatment of industrial waste water	
		total:	***100***

Table 17.4.1-5: Foreseen list and estimated quantities of hazardous waste generated during the operation of Paks II.

We also used data from the Paks Nuclear Power Plant to identify the list of wastes expected to be produced on an ad hoc basis during maintenance and transformation construction works, obviously without any estimated quantities.

Table 17.4.1-6 and Table 17.4.1-7 present the non-hazardous and hazardous waste types, respectively.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Non-hazardous waste		
wood packaging residue	15 01 03	wooden packaging waste
concrete debris	17 01 01	concrete
demolished bricks	17 01 02	bricks
mixed construction waste	17 01 07	mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
glass waste	17 02 02	glass
demolished asphalt	17 03 02	bituminous mixture other than those mentioned in 17 03 01
iron and steel waste	17 04 05	iron and steel
cables	17 04 11	cables other than those mentioned in 17 04 10
excavated soil	17 05 04	soil and stones other than those mentioned in 17 05 03
insulation waste	17 06 04	insulation material other than those mentioned in 17 06 01 and 17 06 03
mixed construction waste	17 09 04	mixed construction and demolition waste other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

Table 17.4.1-6: List of foreseen randomly generated non-hazardous waste during the operation of Paks II.

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Hazardous waste		
paint empties	15 01 10*	packaging containing residues of or contaminated by dangerous substances
empties with chemical residues	15 01 10*	packaging containing residues of or contaminated by dangerous substances
oily rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
oily soil, stones	17 05 03*	soil and stones containing dangerous substances
contaminated equipment	17 04 09*	metal waste contaminated with dangerous substances
demolition waste containing dangerous substances	17 09 03*	other construction and demolition wastes (including mixed wastes) containing dangerous substances

Table 17.4.1-7: List of foreseen randomly generated hazardous waste during the operation of Paks II.

Mixed municipal waste

Municipal waste is produced at all organisational units and workplaces (offices, workshops, staff facilities, canteens, laboratories, etc.) during the operation of the new nuclear power plant. The quantity of the wastes generated primarily depends on the headcount of operation personnel.

Taking the earlier analysis prepared by ERBE as a baseline, altogether 680 persons are envisaged to be present simultaneously at the site during the operation of the new nuclear power plant to be established. This headcount may double during major overhauls [17-3]. On the basis thereof, approximately 700 kg of municipal waste is foreseen to be generated daily during the operation of Paks II., except for the period of major overhauls, because the double headcount will produce approximately 1400 kg of municipal waste at the site daily.

Selectively collected metal, glass, paper, plastic and organic wastes will be handed over to the appropriate processing plants and recycling organisations for waste recycling.

Mixed municipal waste produced may be removed to the closest municipal waste dumps of the town of Paks for disposal by way of landfilling. The licence of the operator, Paksi Hulladékgazdálkodási Kft., is valid until 31 January 2044, after which date the existing landfill is abandoned and rehabilitated [17-8].

The town of Paks will probably open a new waste dump site to attend further waste management public services from February 2044, where the municipal waste quantity produced by Paks II can very likely be dumped in the future. If it were not the case, another site licensed for disposal must be sought in the region.

17.4.1.1.4 Waste storage locations

Hazardous waste must be stored in closed vessels (container, barrel) at the workplace waste collection points at the place of generation, separated by type.

Any and all hazardous waste collected may be stored at the plant's hazardous waste collection point until disposal.

The in-plant collection points for storing various wastes generated during the operation of Paks II. until the removal thereof will be established - according to the present assumptions - at the existing waste collection points of the Paks Nuclear Power Plant. These are as follows:

- industrial waste material storage,
- hazardous and industrial waste plant collection point,
- sludge desiccation basin of the municipal sewage treatment plant.

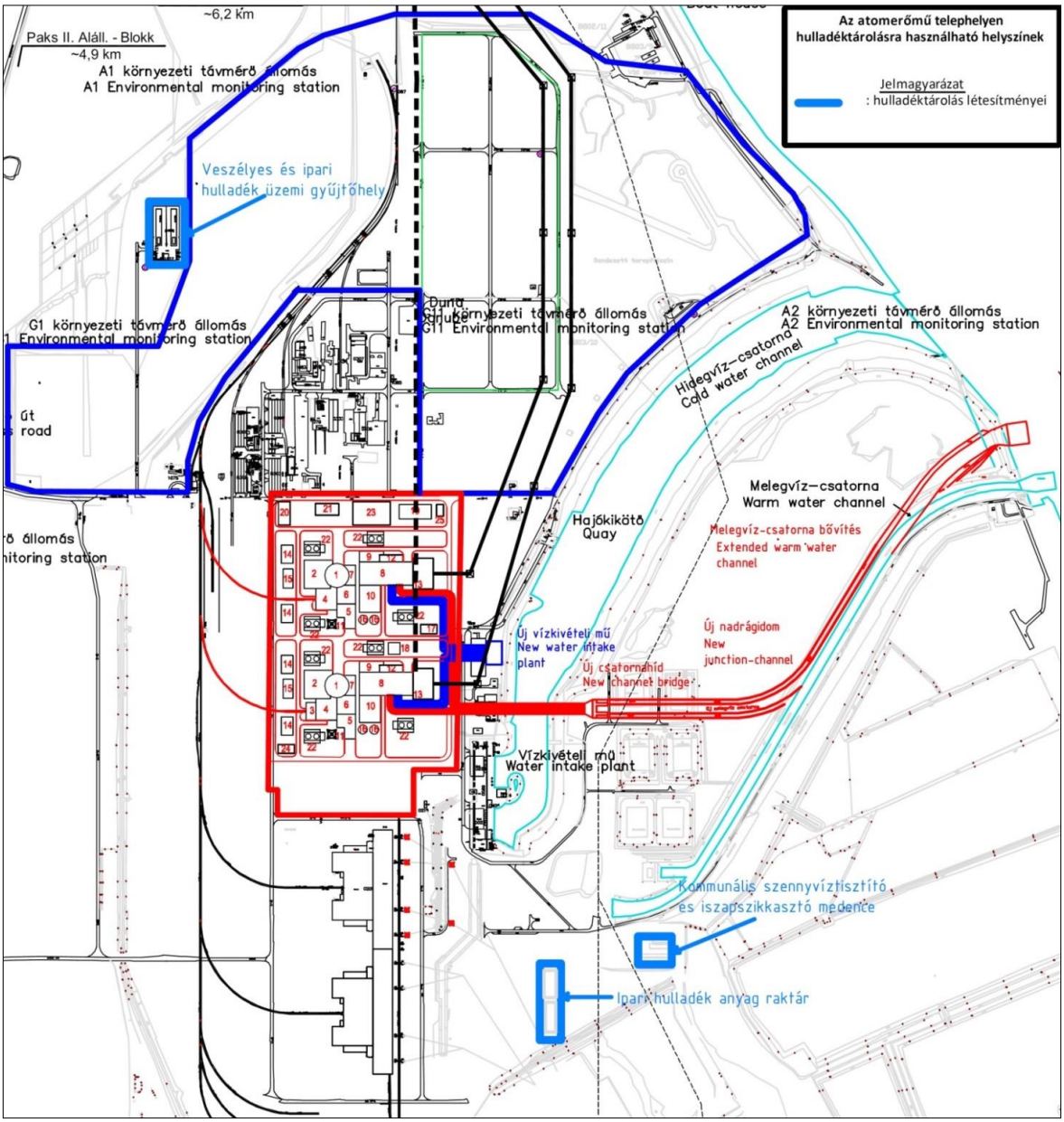
The in-plant waste collection points must meet the requirements of *Government Decree 246/2014 (IX. 29.) on the rules of constructing and operating certain waste management facilities*, which will possibly require transformations.

Current plans foresee the industrial waste material storage of the Paks Nuclear Power Plant to store marketable industrial wastes, however, the extension of the existing storage or the establishment of a new storage may be required in the future.

A separate collection point must be allocated for unmarketable industrial wastes.

The existing in-plant hazardous and industrial waste collection point is foreseen to be available for the wastes produced by Paks II, but may need to be extended in the future as required.

The locations are presented in Figure 17.4.1-3.



Az atomerőmű telephelyen hulladéktárolásra használható helyszínek - Potential locations to be used for waste storage at the nuclear power plant site
Jelmagyarázat - Legend
hulladéktárolás létesítményei - waste storage facilities
Veszélyes és ipari hulladék üzemi gyűjtőhely - In-plant hazardous and industrial waste storage point
Kommunális szennyvíztisztító és iszapszikkasztó medence - Municipal sewage treatment plant and sludge desiccation basin
Ipari hulladék anyag raktár - Industrial waste material storage

Figure 17.4.1-3: Potential locations to be used for non-radioactive waste storage

17.4.2 IMPACTS AND IMPACT AREAS OF PAKS II. OPERATIONS

In terms of the non-radioactive wastes, the operation of Paks II will have less impact on the environment than the establishment period thereof, because waste will not be produced in large amounts, but in amounts and quality in conformity to regular operating conditions, therefore, the load of the collection and treatment system will decrease compared to the previous period.

The impacts of the operations of Paks II will occur during the foreseen periods of the units' operation:

1st unit 2025-2085

2nd unit 2030-2090

17.4.2.1 Direct impacts

Areas affected by the regular and occasional production of non-radioactive wastes during the operating period of Paks II:

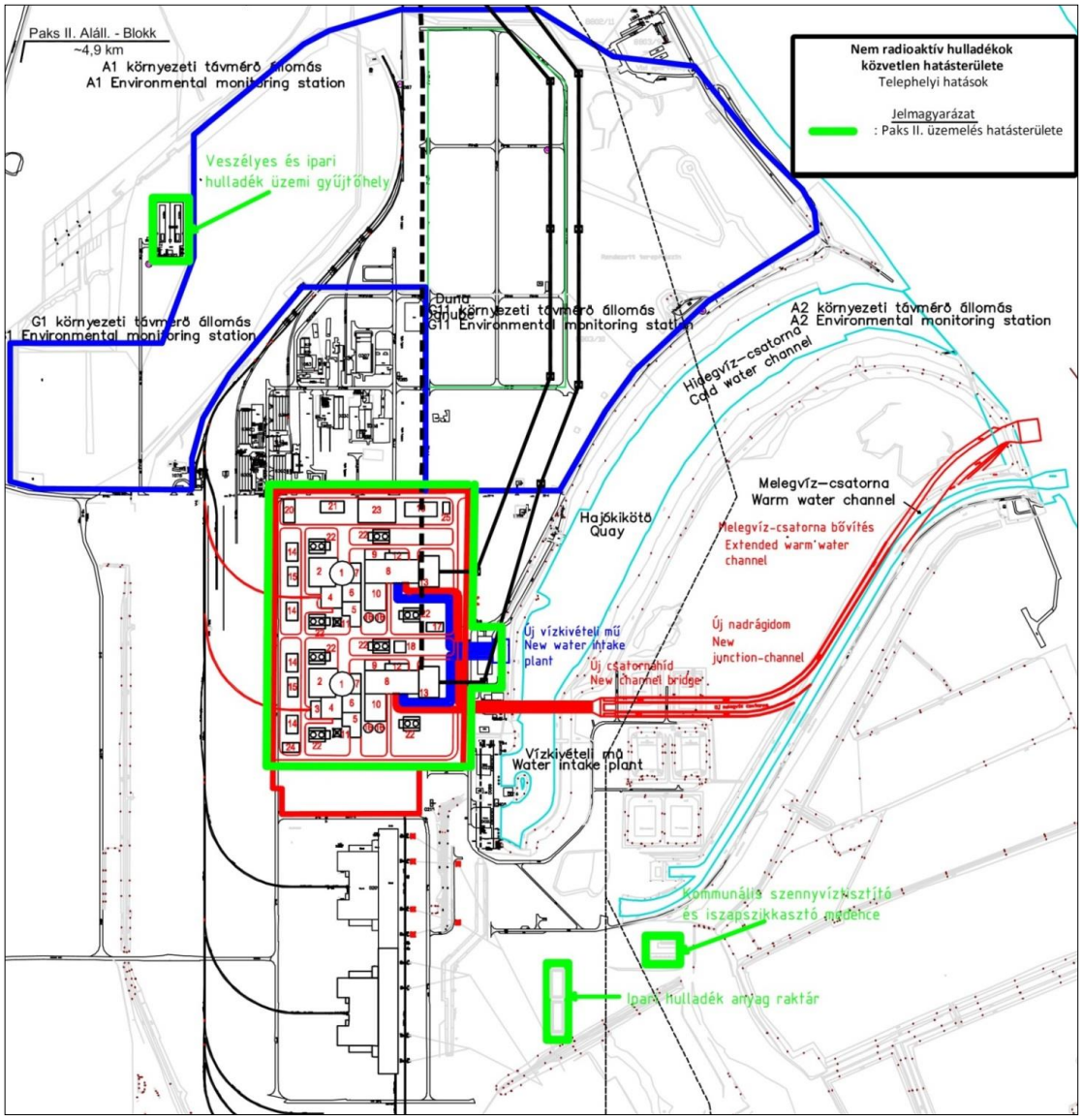
- plant area of the new nuclear power plant,
- in-plant collection point for hazardous waste,
- direct environment of non-hazardous industrial waste collection points,
- municipal sewage treatment plant with the sludge desiccation basin.

The impacts of operation differ from that of construction in that more types of wastes with environmentally higher hazard levels are to be expected.

During operation, the impacts will occur due to the long-term land use of the waste storage areas. The geological medium may be affected, while the impacts on surface and underground waters can be excluded.

Environmental impacts may be reduced by selecting low-waste technologies and the highest possible use of recyclable materials. The treatment, storage and disposal of waste produced must be attended in compliance with regulations. The establishment and operation of the collection points in compliance with effective regulations may minimise the impacts, resulting in moderate impacts at most.

The range of the direct impact area includes the location of waste collection points and storages and the environment thereof within a few metres, consequently, it will certainly remain within the perimeter of the site (Figure 17.4.2-1).



Nem radioaktív hulladékok közvetlen hatásterülete / Telephelyi hatások - Direct impact area of non-radioactive waste / In-site impacts
Jelmagyarázat - Legend
Paks II. üzemelés hatásterülete - Paks II. operation impact area
Veszélyes és ipari hulladék üzemi gyűjtőhely - In-plant hazardous and industrial waste storage point
Kommunális szennyvíztisztító és iszapszikkasztó medence - Municipal sewage treatment plant and sludge desiccation basin
Ipari hulladék anyag raktár - Industrial waste material storage

Figure 17.4.2-1: Impact area of Paks II. operation direct impacts - non-radioactive waste, site impacts

17.4.2.2 Indirect impacts

The transportation of non-radioactive wastes during operation from the site to the waste treatment facilities may cause a potential load on the environment of the transport routes.

Mixed municipal waste is removed on the short section of the route stretching between the northern entrance of the power plant and the municipal waste dump of the town of Paks. Additional wastes generated are removed on the relevant section of Road No. 6 and M6 Motorway. The exact transport routes are not known at this point. Shipments will be occasional subject to the quantity of waste produced.

Potential impacts on air quality may occur within a not more than 50-100 m zone along the roads used as waste transport routes. The noise load caused by waste transport during the operation period will be one of the components of noise annoyance increase caused by all the operations of the nuclear power plant associated with road traffic.

Wastes may only be transported by carriers holding a relevant valid licence. The carrier must forward the wastes received to the waste treatment company holding a waste management licence. The environmental risk and potential impacts may be reduced by removal to a nearby location. The provisions of the applicable regulations must be observed during the waste transport processes, thereby the impacts may be minimised.

The indirect impact area will remain within a 50–100 m zone along the public road waste transport routes, and its range corresponds to the area illustrated in the section *Impacts and impact areas of Paks II construction* (Figure 17.3.3-2).

17.4.2.3 Transboundary environmental impacts

The impacts of the non-radioactive waste produced during the operation of Paks II remain local in all cases and transboundary environmental impacts are not applicable.

17.4.3 JOINT OPERATION OF PAKS II. AND THE PAKS NUCLEAR POWER PLANT

17.4.3.1 Duration of joint operation

The joint operation of Paks II. and the Paks Nuclear Power Plant with extended operating time will be between 2025-2037 (Table 17.4.3-1).

The collective environmental impact of the two facilities will be combined during said period, but will differ in intensity due to the fact that the Paks II. units will start operation and the units of the Paks Nuclear Power Plant will be shut down finally at various points in time.

Phases of Paks II. and the Paks Nuclear Power Plant operation	year
Paks Nuclear Power Plant Units 1-4 end of extended operation time	2032 - 2037
Paks II. operation of Unit 1	2025-2085
Paks II. operation of Unit 2	2030-2090
Joint operation of Paks II and the Paks Nuclear Power Plant	*2025-2037*

Table 17.4.3-1: Duration of Paks II. and the Paks Nuclear Power Plant joint operation

17.4.3.2 Types and quantities of waste generated during joint operation

The simultaneous operation of Paks II and the Paks Nuclear Power Plant will also involve the production of hazardous and non-hazardous industrial wastes, municipal waste, and occasional production of construction and demolition wastes. Wastes will be generated in the monitored zone in this case as well, and also waste removed from the controlled zone during the release procedure will also appear. The waste types produced in both nuclear power plants will be similar for the most part, and the quantities of waste generated during the operation of the two nuclear power plants will add up. The peak amount of waste is expected to be generated during the combined operation of the six units between 2030-2032 (Table 17.4.3-2).

	Non-hazardous waste [t/year]	Hazardous waste [t/year]
Paks Nuclear Power Plant	1 400*	280*
Paks II.	800	100
total:	*~2 200*	*~380*

Note:
* Rounding the average annual waste quantities generated during a period of 10 years between 2004 and 2013 in the Paks Nuclear Power Plant

Table 17.4.3-2: Estimated quantity of waste generated during the joint operation of Paks II. and the Paks Nuclear Power Plant

Proportionally less waste will be produced in the subsequent joint operation phases of the two nuclear power plants, when the units of the Paks Nuclear Power Plant will undergo a scheduled shut down.

The intensity of aggregate quantities, however, will fluctuate annually within the period of simultaneous operation. This is partly due to the fluctuation of annual waste production and partly due to the fact that the units of Paks II will start operation and the units of the Paks Nuclear Power Plant will be shut down finally at various points in time.

According to the current state of planning, the two power plants will use the existing waste collection points (Figure 17.4.1-3):

Since the waste quantities generated will be added up, the capacity of currently existing facilities will probably have to be expanded or new waste collection points must be established in the future.

17.4.3.3 Impacts and impact areas of joint operation

17.4.3.3.1 Direct impacts

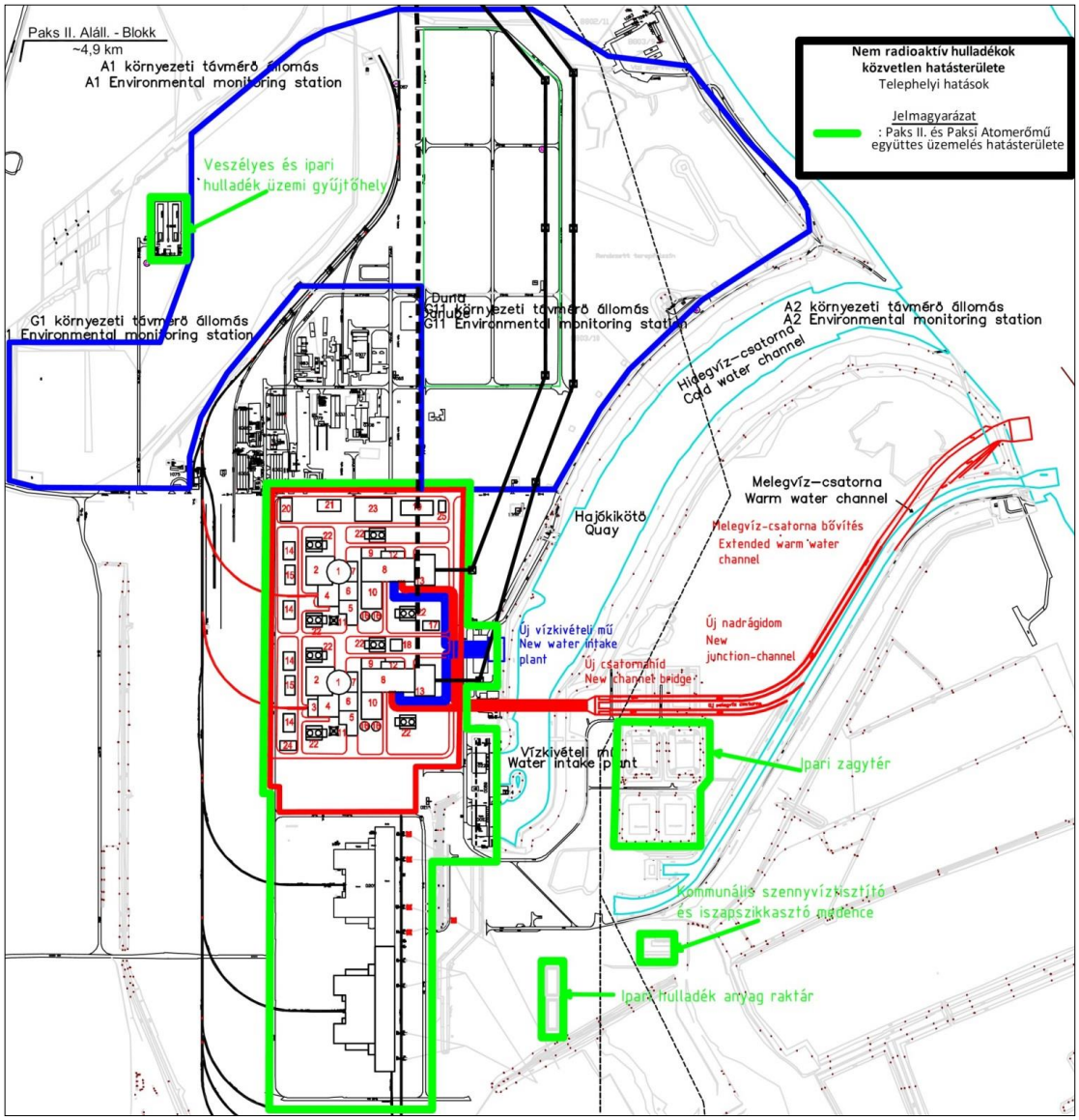
The impacts during during the joint operation of Paks II and the Paks Nuclear Power Plant will be added up.

In addition to the workplace waste collection points of the current nuclear power plant, the workplace waste collection points of the new nuclear power plant, the direct environment of the in-plant collection points for hazardous waste and non-hazardous industrial waste collection points, as well as the municipal sewage treatment plant with the sludge desiccation basin and the industrial sludge ponds used by the Paks Nuclear Power Plant will also be affected. According to the information available to us at the moment, Paks II will use the in-plant hazardous waste collection point of the Paks Nuclear Power Plant to store waste instead of the non-hazardous industrial waste collection points; the expansion of the existing collection points or the establishment of new ones has to be completed as required. In addition, the municipal sewage from Paks II will be treated at the municipal sewage treatment plant of the Paks Nuclear Power Plant, consequently, part of the sewage sludge stored in the sludge desiccation basin will come from the operation of Paks II.

The nature of impacts from joint operation will not differ from the direct impacts discussed in the section 17.4.2 *Impacts and impact areas of Paks II operations*; the difference will occur in the increase of affected locations (primarily workplace waste collection sites).

The impacts of the non-radioactive wastes produced during the joint operation of Paks II and the Paks Nuclear Power Plant will be moderate.

The range of the direct impact area includes the location of waste collection points and the environment thereof within a few metres, consequently, it will certainly remain within the perimeter of the two nuclear power plant sites (Figure 17.4.3-1).



Nem radioaktív hulladékok közvetlen hatásterülete / Telephelyi hatások - Direct impact area of non-radioactive waste / In-site impacts
Jelmagyarázat - Legend
Paks II. és Paksi Atomerőmű együttes üzemelés hatásterülete - Paks II. and Paks Nuclear Power Plant joint operation impact area
Veszélyes és ipari hulladék üzemi gyűjtőhely - In-plant hazardous and industrial waste storage point
Kommunális szennyvíztisztító és iszapszikkasztó medence - Municipal sewage treatment plant and sludge desiccation basin
Ipari zagytér - Industrial sludge pond
Ipari hulladék anyag raktár - Industrial waste material storage

Figure 17.4.3-1: Impact area of Paks II. and Paks Nuclear Power Plant joint operation direct impacts - non-radioactive waste, site impacts

17.4.3.3.2 Indirect impacts

The potential impacts caused by the removal of non-radioactive wastes from the site during the joint operation of Paks II. and the Paks Nuclear Power Plant will occur in the vicinity of the transport routes.

The route for the removal of mixed municipal waste will be the section stretching between the northern entrance of the power plant and the municipal waste dump of the town of Paks. The rest of the waste will be transported on the sections of Road No. 6 and M6 Motorway included in waste transport. The scheduling of waste transport will depend on the quantity of waste produced.

The nature of indirect impacts from joint operation will be the same as the indirect impacts discussed in the section 17.4.2 *Impacts and impact areas of Paks II. operations*; the difference will occur in the frequency of waste removal due

to the combination of the waste quantities produced in the two power plants and the resulting increased frequency of waste removals.

The indirect impact area will remain within a 50–100 m zone along the public road waste transport routes, and its range corresponds to the area illustrated in the section *Impacts and impact areas of Paks II construction* (Figure 17.3.3-2).

17.4.3.3.3 Transboundary environmental impacts

The impacts of the non-radioactive waste produced during the joint operation of Paks II. and the Paks Nuclear Power Plant remain local in all cases and there will be no transboundary environmental impacts.

17.5 PAKS II. DECOMMISSIONING IMPACTS

The possible scenarios for the dismantling of the nuclear power plants are presented in the following list:

- immediate dismantling,
- delayed dismantling with the protected conservation of the reactor,
- delayed dismantling with the protected conservation of the complete primary coolant circuit.

According to the currently available information, the preferred strategy for Paks II is *immediate dismantling*, which is estimated to last approximately 10 years, however, the exact duration will be specified in the dismantling plan of the power plant to be developed in the future.

17.5.1 WASTE GENERATED DURING THE DECOMMISSIONING OF PAKS II.

17.5.1.1 Waste types and quantities

According to the currently available information, the decommissioning of the Paks II units will be effected in the period following the 60-year planned operating time. It is not possible to determine the future waste management characteristics of decommissioning accurately for such a long time horizon, *inter alia*, due to the fact that we have no information at the moment on the legislative environment in effect in the distant future of decommissioning, or the waste management approach, technologies to be developed in the future and the efficiency thereof in this context. In the spirit of the above statements, the waste management characteristics and environmental impacts of decommissioning can only be estimated with a high level of uncertainty. The dismantling plan to be developed subsequently and the environmental impact study of decommissioning will provide more extensive and accurate information in this respect.

One of the major environmental impacts related to the decommissioning of Paks II will be the amount of non-radioactive wastes produced. The future facilitation of dismantling processes and the reduction of the amount of wastes to be produced is already a priority during the design of the currently modern nuclear power plant units and the raw materials to be used for the construction thereof. Primarily demolition wastes, hazardous wastes and a minor amount of municipal waste are expected.

The wastes produced during decommissioning will result from the following activities:

- disassembly of inactive process equipment,
- disassembly of process equipment inactivated as a consequence of decontamination,
- demolition of inactive building structures,
- demolition of buildings inactivated as a consequence of decontamination.

We compiled the list of the key non-radioactive wastes generated upon the decommissioning of Paks II. with consideration of the data from Even though two different generations of units will be used in the two nuclear power plants, the types of waste produced upon decommissioning are not expected to differ significantly (Table 17.5.1-1).

Waste name according to material	ID Code	Waste type name according to VM Decree 72/2013. (VIII.27.)
Non-hazardous waste		
Recyclable metal wastes		
colour metals (aluminium and copper cables, pipes, etc.)	17 04 02 17 04 01	aluminium; copper, bronze, brass
iron and steel (pipes, plates, covers, equipment parts, doors, water pipes, steel wires, etc.)	17 04 05	iron and steel
steel structures of buildings	17 04 05	iron and steel
reinforcing bars (from reinforced concrete processing)	17 04 05	iron and steel
Recyclable building materials		
concrete, reinforced concrete	17 01 01	concrete
precast concrete elements	17 01 01	concrete
walls (bricks, plasterboard)	17 01 02	bricks
	17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
Other wastes		
wood products	17 02 01	wood
glass, fibreglass from the thermal insulation of equipment	17 02 02	glass
ceramic materials	17 01 03	tiles and ceramics
roofing and insulation materials (bituminous, PVC)	17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
various plastics (from floors, covers)	17 02 03	plastic
rubber waste (rubber floor, sealing, etc.)	19 12 04	plastic and rubber
mixed demolition waste	17 09 04	mixed construction and demolition waste other than those mentioned in 17 09 01, 17 09 02 and 17 09 03
Hazardous waste		
equipment contaminated with dangerous substances	17 04 09*	metal waste contaminated with dangerous substances
demolition waste contaminated with dangerous substances	17 09 03*	other construction and demolition wastes (including mixed wastes) containing dangerous substances
spent oil	13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils
oily sludge	13 05 02*	sludges from oil/water separators
oily rags	15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
used accumulators	16 06 01*	lead batteries
electronic waste	16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
technological chemical residues	16 05 07*	discarded inorganic chemicals consisting of or containing dangerous substances
oily soil, stones	17 05 03*	soil and stones containing dangerous substances
ion exchange resin	19 08 06*	saturated or spent ion exchange resins

Table 17.5.1-1: Non-radioactive waste types foreseen to be generated upon the decommissioning of Paks II. [17-9]

Determining the quantities of waste that will be produced in the decommissioning period will involve a great extent of uncertainty in a time horizon of over 60 years. Nevertheless, we may presume that we have to expect an immense amount of non-radioactive wastes. The greatest part thereof will come from the bulk of inactive concrete waste from the demolition of buildings.

17.5.2 IMPACTS AND IMPACT AREAS OF PAKS II. DECOMMISSIONING

The decommissioning operations of Paks II will be almost identical in magnitude to the establishment operations. Reckoning with the *immediate dismantling* scenario, the assumed duration of decommissioning of the the units of Paks II will be as follows:

1st unit 2085 - ~2095

2st unit 2090 - ~2100

The environmental impacts will occur with varying intensity during the decommissioning period by virtue of the scheduling of the work processes.

17.5.2.1 Direct impacts

The area of the nuclear power plant and its associated facilities where demolition will take place, as well as the work site waste collection zones will be affected by the impacts the production of non-radioactive causes during the decommissioning period. The impacts will be caused by the temporary land use of the waste collection points, where the geological medium will be affected.

The environmental impacts may be reduced if the requirements of effective legislation are observed in the course of all partial tasks of the waste management duties, thereby mitigating the impacts to an acceptable level.

The range of the direct impact area includes the demolition area, the waste storage locations and the environment thereof within a few metres, consequently, it will certainly remain within the perimeter of the site.

17.5.2.2 Indirect impacts

The removal of non-radioactive waste from the site may potentially affect the vicinity of transport routes during the decommissioning period of Paks II.

The impact of waste transport is expected to be similar to the environmental impacts of the establishment phase, however, its intensity will be lower due to the prolonged duration of dismantling.

The public road transport routes will include the relevant sections of Road No. 6 and the M6 Motorway. Demolished inactive metal structures, however, will probably be removed to foundries for recycling as secondary raw material. This will probably be effected by means of railway transport from the nuclear power plant site via the northbound railway line [17-9].

Potential impacts on air quality may occur within a not more than 50-100 m zone along the roads used for waste transport and non-electrified sections of the railway line.

The noise load caused by waste transport during the decommissioning period will be one of the components of noise annoyance increase caused by all the operations of the power plant associated with road and railway traffic.

Potential environmental impacts may be mitigated by transporting the wastes to nearby sites and full compliance with the transport requirements. A carrier with a valid licence must be engaged for the removal of wastes for recycling or disposal.

The indirect impact area will presumably remain within a zone of 50-100 m of the road and railway used for waste transport.

17.5.2.3 Transboundary environmental impacts

The impacts of the non-radioactive waste produced during the decommissioning of Paks II remain local at most and there will be no transboundary environmental impacts.

17.6 ENVIRONMENTAL EMERGENCIES, ACCIDENTS

Failure events of the waste management system may potentially occur in each phase in the service life of Paks II., which covers the spilling or leakage of non-radioactive wastes while stored at the workplace and in-plant collection points, or during waste handling.

Leaked dangerous substances (machine oil, fuel) in potential failure events during the operation of utility machines and their storage at the work site in the decommissioning period may load the environment, chiefly the geological medium. Contaminated sand, perlite, other absorbent material as well as excavated contaminated soil waste may be generated if any damage events during the operation of utility machines need to be managed. Such damage events are incidental, the contamination sources are fairly easy to localise and eliminate, therefore, the contamination will not spread to wide areas, and the damage recovery of the geological medium may begin instantly.

Waste may spill or leak on the sections of public roads used for waste removal from the site if a transport vehicle has an accident. Such events may change the condition of the geological medium by virtue of the contaminating effect of wastes.

Modern technologies and the guidelines of the increasingly stricter legislative environment also markedly reduce the probability of occurrence, risk and hazard level of such events. The collection, transport, recycling and recovery of the generated waste must be ensured in compliance with the regulations. The services of companies holding a valid licence for waste transport and treatment activities must be engaged. At the same time, absorbents (such as sand, perlite, etc.) must be stocked and used during the damage recovery operations of any damage events.

On the whole, accidents and failure events occur rather seldom in practice with respect to the production of non-radioactive wastes. Even then, the environmental impacts thereof remains moderate and brief if the requirements are observed properly.

17.7 REFERENCES

[17-1] Comprehensive environmental review of the construction debris landfill of Paksi Atomerőmű Rt., FTV Rt., 2002
[17-2] MIR.1200 Preliminary data and information for safety and environmental licensing, Report, Atomstroyexport, 2010.
[17-3] Analysis to determine the labour requirement of the new nuclear power plant units, MVM ERBE Zrt., 2013.
[17-4] Environmental Protection Report of MVM Paksi Atomerőmű Zrt., 2004-2013.
[17-5] MVM Group sustainability report, 2004-2013.
[17-6] Paksi Atomerőmű Zrt.
[17-7] Hanhikivi NPP in Pyhäjoki, Environmental Impact Assessment Report, Fennovoima Ltd., 2014
[17-8] Custom waste management plan for the Paks site of the Paksi Atomerőmű Zrt., 2010-2015.
[17-9] Paks Nuclear Power Plant service life extension, Environmental Impact Study, ETV ERŐTERV Zrt., 2006.