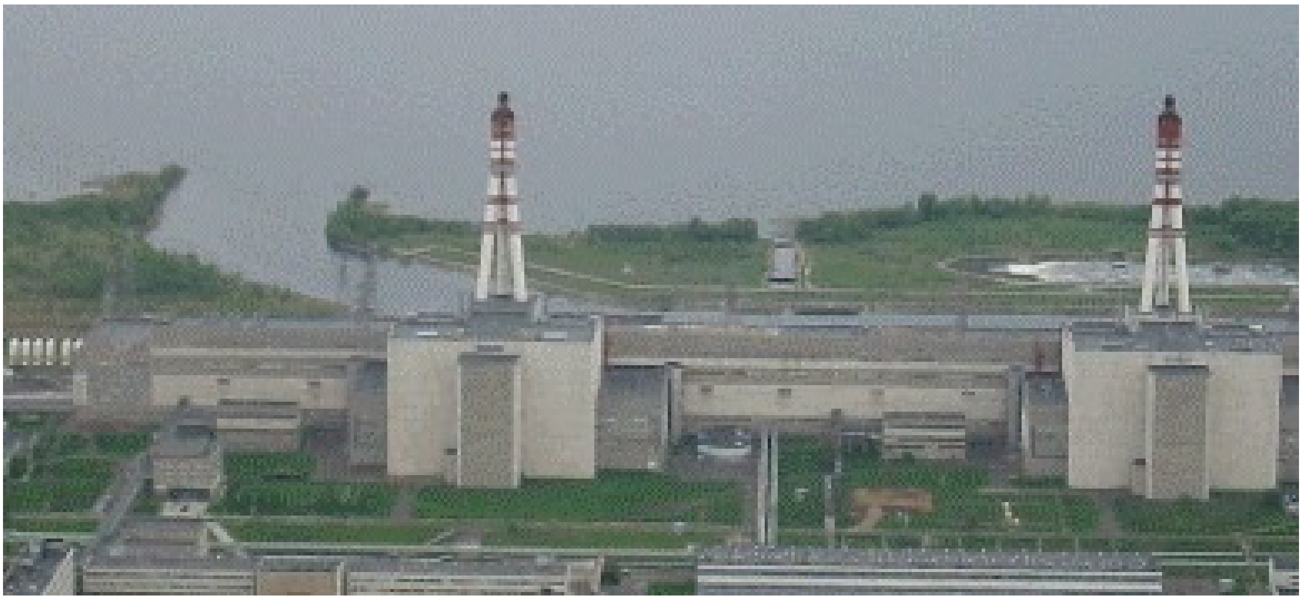
INPP BUILDING 117/1 DECONTAMINATION AND DISMANTLING PROJECT DEVELOPMENT

P0019-10016 005

Environmental Impact Assessment Report

Ignalina NPP Building 117/1 Equipment Decontamination and Dismantling



Organizer of the Proposed Economic Activity	**State Enterprise Ignalina Nuclear Power Plant**
Developer of the EIA Report	**VT Nuclear Services Ltd**
	Lithuanian Energy Institute Nuclear Engineering Laboratory

2009

NUKEM LEI VT Nuclear Services

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TABLE OF REVISIONS

Revision	Date	Description
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0, issue 3	February 15, 2008	Updated and further developed Revision 0, issue 2. For internal review.
0, issue 4	March 31, 2008	Updated and further developed Revision 0, issue 3. For internal review.
1	April 25, 2008	Revised and updated Revision 0, issue 4. For Employer review.
2	July 25, 2008	Updated Revision 1 in accordance with Employer comments. For Employer review and approval.
3	September 19, 2008	Updated Revision 2 in accordance with Employer comments. For Employer review and approval.
4	April 21, 2009	Updated Revision 3 in accordance with results of public and authorities review. For competent authority review.
5	July 24, 2009	Updated Revision 4 in accordance with results of competent authority review.

ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
CEC	Commission of the European Communities
D&D	Decontamination and Dismantling
DP	Decommissioning Project
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECCS	Emergency Core Cooling System
ECCS PT	Emergency Core Cooling System Pressurized Tank
EIA	Environmental Impact Assessment
EOTC	Electric Overhead Travelling Crane
EU	European Union
FRMF	Free Release Measurement Facility
HEPA	High Efficiency Particulate Air, used in the context of HEPA Filter(s)
I&C	Instrumentation and Control
IAEA	International Atomic Energy Agency
INPP	Ignalina Nuclear Power Plant
ISO	International Organisation for Standardisation
Landfill facility (Landfill)	A repository for a short-lived very low level radioactive waste
LEI	Lithuanian Energy Institute
LLW-SL	Short-Lived Low Level Waste
MADA	Multi Attribute Decision Analysis
MFU	Mobile Filtration Unit
RBMK	Water-cooled, graphite-moderated, pressure-tube-type boiling-water power reactor (Russian abbreviation of “Reactor Bolshoy Moshchnosty Kanalny”)

PPE	Personal Protective Equipment
RPE	Respiratory Protective Equipment
SPZ	Sanitary Protection Zone
TS	Technical Specification
VATESI	The Lithuanian State Nuclear Power Safety Inspectorate
VLLW	Very Low Level Waste
WAC	Waste Acceptance Criteria

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INTRODUCTION

The only one nuclear power plant in Lithuania, i.e. Ignalina Nuclear Power Plant (INPP) is situated in the Northeastern part of Lithuania close to the borders with Latvia and Belarus and on the shore of Lake Druksiai. It is approximately one hundred and twenty kilometers away from the capital city Vilnius. The power plant possesses two RBMK-type water cooled graphite-moderated pressure-tube reactors each of a design capacity of 1500 MW(e). They were commissioned (first grid connection) in 1983 and 1987, respectively.

In accordance with the National Energy Strategy [1] adopted by the Lithuanian Parliament the first unit of INPP was shut down on December 31, 2004. The shutdown of the second unit is scheduled for the end of 2009. The Lithuanian Government by resolution “On State Enterprise Ignalina NPP First Unit Decommissioning Concept” [2] has approved an immediate dismantling concept for the decommissioning of the first power unit of INPP.

According to the INPP Final Decommissioning Plan [3] the INPP decommissioning process is split into several decommissioning projects (DP). Each of these DP is a process covering a particular field of activity, defining scope of works and their specific and providing input for organization of specific activity, safety analysis and environmental impact assessment. In order to ensure that environmental impact assessment (EIA) is based on reliable and detailed information, what becomes available along with the progress in the particular DP, the EIA Program of INPP decommissioning [4] provides to develop EIA reports separately for each DP. Every EIA report of a subsequent DP shall take into account results of previous reports. Thus the overall environmental impact due to INPP decommissioning would be assessed and controlled on the basis of the latest information, and environmental impact mitigation measures would be adequate to the real situation.

The proposed economic activity, to which the present Environment Impact Assessment is associated, concerns dismantling and decontamination of redundant equipment located in the INPP Building 117/1. The proposed economic activity is one of separate decommissioning projects performed in accordance with the INPP Final Decommissioning Plan [3]. The development of EIA Report for this proposed economic activity is stipulated by the EIA Program of INPP Decommissioning [4].

The objectives of an EIA are defined by the Article 4 of the Republic of Lithuania Law on the Assessment of the Impact on the Environment of the Proposed Economic Activities [5] and shall be as follows:

- To identify, characterize and assess potential direct and indirect impacts of the proposed economic activity on human beings, fauna and flora; soil, surface and entrails of the earth; air, water, climate, landscape and biodiversity; material assets and the immovable cultural heritage, and interaction among these factors;
- To reduce or avoid negative impacts of the proposed economic activity on human beings and other components of the environment, referred to in the paragraph above; and
- To determine if the proposed economic activity, by virtue of its nature and environmental impacts, may be allowed to be carried out at the chosen site.

The EIA assessment content and structure follows the requirements of the Republic of Lithuania Law on the Assessment of the Impact on the Environment of the Proposed Economic Activities [5] and the Regulations on Preparation of Environment Impact Assessment Program and Report [6].

SUMMARY

The proposed economic activity is named as the "Ignalina NPP Building 117/1 Equipment Decontamination and Dismantling". The proposed economic activity is a part of the Ignalina Nuclear Power Plant (INPP) decommissioning activity.

The Power of Unit 1 of INPP was shutdown on 31 December 2004. After shutdown, the high pressure part of the Emergency Core Cooling System (ECCS) and the Helium Make-up Station, located in the Building 117/1, became redundant and were no longer needed for safety or operational purposes. The Building 117/1 is located in the Ignalina NPP industrial site adjacently to the main building of the Power Unit 1.

The proposed economic activity will decontaminate and dismantle (D&D) the redundant systems located in the Building 117/1 together with the associated auxiliaries according to the most efficient strategy. The strategy to be developed under this proposed economic activity will aim, while complying with the safety goals and the legal Lithuanian requirements, at minimizing the overall cost for Building 117/1 dismantling, including storage/disposal costs.

The total mass of elements to be dismantled is estimated to be about 957 000 kg. It is expected that approximately 98% of the mass of the dismantled elements will be appropriately size reduced and decontaminated to free release conditions, i.e., they will meet the values of the clearance levels as defined in the Republic of Lithuania normative document LAND 34-2008 [1]. These items will be transported to the Free Release Measurement Facility (FRMF) located on INPP site. It is expected that remaining approximately 2% of the mass of dismantled elements cannot be decontaminated to free release condition. These are mainly pipelines and fittings of small diameter where the inner surface is inaccessible for appropriate decontamination or monitoring. These items are categorized as very low level radioactive waste and will be transported to the Buffer Storage of the Landfill Facility located on INPP site.

The Building 117/1 structure can be subdivided into two constructively and functionally separate parts:

- The main building structure which consist of the Main Hall and the Aisle. The main structure houses the ECCS pressurized tanks, associate pipelines and auxiliary equipment;
- Extension for the Helium Make-up Station.

The facilities and systems of the ECCS and Helium Make-up Station are not interconnected. The D&D of the ECCS and Helium Make-up Station can be performed in parallel to each other.

Deplanting of the Helium Make-up Station will be a relatively straight forward industrial dismantling operation of equipment which is not likely to be significantly contaminated. D&D of equipment and installations within the Aisle and the Main Hall will be more complex. Due to area limitation D&D will be carried out in several consecutive steps. Installation of equipment and systems necessary for startup of deplanting with following partial deplanting and intermediate storage of deplanted items will be performed at first. Afterwards new workshops for size reduction, decontamination, radiological check and packing will be installed in the emptied space. When the new facilities will become serviceable, the intermediately stored items as well as newly deplanted items will be sequentially fed to the workshops. D&D items will be finally packed according to the type, size and transfer destiny. Then D&D material will be loaded into standard 20 foot half height ISO containers and will be transported by trucks to the FRMF or Buffer Storage of Landfill facility. Dismantled materials or other radioactive waste transfer operations performed by this proposed economic activity will take place only within boundaries of the INPP industrial site.

Oxygen-acetylene flame cutting method is selected as the main deplanting technique together with ‘tool box’ of cutting techniques like reciprocating saws, hydraulic shears etc. The levels of dose rate and contamination within premises of Building 117/1 are relatively modest and will readily allow the use of manually deployed techniques, subject to the application of personal protective equipment where appropriate and consideration of the ALARA principle. The decontamination process will be based on the use of dry shot vacuum blasting technology with steel grit as blast material.

The potential environmental impacts arising due to the implementation of the proposed economic activity can be divided into two main groups – radiological impacts and non radiological impacts. Generation of non-radioactive waste is also an important issue, thus it is considered by the EIA. The proposed economic activity will not produce any hazardous non-radioactive waste. Amounts of the resulting non-radioactive waste will be relatively small and will be managed in accordance with the requirements of the waste management legislation in force. The new equipment to be used in D&D activity like cranes, lifting and transport devices, dismantling and size reduction tools etc. will be used in following D&D activities performed on the INPP site.

The potential public health impact sources of conventional (i.e. non radiological) nature could be airborne pollutants resulting from flame cutting operations and on-site transport of dismantled materials. The proposed economic activity will not produce any other significant impacts of conventional nature, which could physically affect environment components or public health. Current ambient air pollutant levels in the environment of INPP will not be significantly enhanced by the planned D&D activities. Ground level concentrations of pollutants in ambient air will be below the limit values for the protection of human health. Appropriate impact mitigation measures are proposed to reduce a potential impact on these environmental components.

Radiological impact under normal operation conditions of the proposed economic activity potentially may result from release of airborne activity and due to increase of direct irradiation from Building 117/1structure and on-site transport of radioactive materials. No release of radioactive liquids into the environment from the proposed economic activity under normal operation conditions is planned.

The radiation exposure of the critical group members of population in the environment of INPP resulting from the potential emission of radioactive material into atmosphere from Building 117/1 is calculated to be below 4×10^{-4} μSv. Annual dose constitutes a very small fraction from the established annual dose constraint, which equals to 200 μSv. The potential radiological impact on the environment components outside the INPP industrial site due to radioactive emissions is evaluated to be extremely low and therefore further is no more considered.

Other identified potential impact sources are estimated to be also of low significance. Therefore it is concluded that implementation of the proposed economic activity will not create impact on public health which should be considered as relevant from radiological safety point of view. The proposed economic activity will not adversely change the existing radiological situation around the INPP site.

The EIA also addresses main aspects influencing personnel safety with purpose to demonstrate that personnel exposure can be handled within permissible radiation safety limits. No significant impact on personnel (both directly involved into the proposed economical activity and other personnel on the INPP site) can be expected during implementation of the proposed economic activity. The detail estimation of personnel exposure for specific working places and operations, optimization of exposure in view of implementation of ALARA principle are tasks for the Basic design and Safety Justification Report.

Two countries, i.e. Belarus and the Latvia Republics, can be considered as being relatively close to the sites of the proposed economic activity. It is foreseen that no direct impact of physical nature on social and economic components of Latvia and Belarus will occur at all during the proposed economic activity under normal operation conditions.

The risks expected under normal operation conditions of the proposed economic activity can be managed by appropriate design and work organization solutions. As the irradiation dose rate and radioactive contamination levels are relatively modest, the general hazards typical for any construction / dismantling activity (work at height, use of hot cutting and mechanical cutting technique etc.) prevails. Particular attention shall be placed on work safety in confined spaces.

In case of accidents potentially most impacted would be the personnel performing D&D activity inside the Building 117/1 and the internal premises of the building. Impact consequences can be mitigated by use of personal protective equipment (PPE) together with appropriate design and work organization means. The upgraded building ventilation system will prevent emission of radioactivity into environment if local Mobile Filtration Units (MFU) fails or in case of accident with direct release of activity into the building environment. Finally, the D&D activity will lead to overall reduction of the risk level due to continuous reduction of the radioactive material in the Building 117/1.

The radioactive waste arising from the proposed economic activity will be either of very low or low activity. Consequences of transport accident with dispersion of activity are classified as limited (simple contamination, localized effects) due to low activity of the waste and limited amount of dispersible activity per waste package and container. On site impact consequences mitigation measures can be implemented immediately to localize effect on environment and to collect dispersed waste. The additional risk arising from transport of radioactive waste from Building 117/1 will not significantly change present risk level resulting from transport of the operational radioactive waste on INPP site.

1 GENERAL INFORMATION

1.1 ORGANIZER OF THE PROPOSED ECONOMIC ACTIVITY

The organizer of proposed economical activity is State Enterprise Ignalina Nuclear Power Plant.

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1.2 DEVELOPERS OF THE EIA REPORT

The developers of EIA Report are VT Nuclear Services Ltd (UK) and Lithuanian Energy Institute (Lithuania).

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1.3 NAME AND CONCEPT OF THE PROPOSED ECONOMIC ACTIVITY

The proposed economic activity is named as the “Ignalina NPP Building 117/1 Equipment Decontamination and Dismantling”. The proposed economic activity is a part of the Ignalina Nuclear Power Plant (INPP) decommissioning activity.

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1.4 STAGES OF THE ACTIVITY, THEIR SEQUENCE AND DURATION

The proposed economic activity could be subdivided into two main stages:

- D&D project documentation development, licensing and necessary equipment procurement activities;

- Performance of D&D works itself (D&D activity execution stage).

The D&D project documentation development has been started in September 2007.

The objective of the proposed economic activity is the safe, efficient and cost effective dismantling and decontamination of the Emergency Core Cooling System (High Pressure part) components and Helium Make-up Station located in the Building 117/1 and that become redundant after final shutdown of Unit 1 (these components were identified in the decommissioning project for Unit 1 defueling — U1DP0). Following identification of the preferred D&D Strategy, the Basic Design is developed utilising the VT Nuclear Services proposed engineering processes and is produced in compliance with requirements of Lithuanian legislation and regulations and requirements specified in the Technical Specification [1]. The Basic Design forms a basis for licensing of the D&D works.

The production of an Environmental Impact Assessment is also required in order to allow implementation of the D&D activity. The EIA Report is prepared on the basis of approved by the Ministry of Environment Ignalina NPP Decommissioning EIA Programme [2] in compliance with requirements of Lithuanian legislation and regulations [3], [4] and international EIA Conventions [5], [6].

Also, a General Data Set for the anticipated radioactive waste will be produced. The general data that have to be collected are those specified in Attachment 2 “Contents of the General Data Set” of the document “Procedure for Submittal to the Commission of European Communities of the General Data Relating to the Disposal of Radioactive Waste” [7]. The format will be compliant with the Commission Recommendation on the Application of Article 37 of the EURATOM Treaty [8].

The production of a Safety Case to support the D&D Basic Design is required in order to allow licensing of the D&D works. The Safety Case will be presented in a Safety Justification Report in compliance with requirements of Lithuanian legislation and regulations and requirements specified in Technical Specification.

Once the Basic Design is finished, the work will commence on the development of the Detailed Design suitable for implementation of D&D works. The deliverables for this phase are described in the Technical Specification [1] and include D&D Sequence and D&D Working Procedures.

The Building 177/1 equipment D&D activity can start after obtaining the VATESI authorization for performance of D&D works.

Preparatory works for D&D activity are planned to start in the I quarter of 2010. Start-up of the main D&D works is planned for the III quarter of 2010. The proposed economic activity is planned to be finished in III quarter of 2011 and will include final waste removal from the building and transfer of used D&D equipment to the Building 117/2.

Start-up of operation of the new FRMF is foreseen in the III quarter of 2009. Start-up of operation of the Landfill Buffer Storage is foreseen in the II quarter of 2010. If necessary, the D&D activity can be organized in a way considering transport of VLLW to the Landfill Buffer Storage at the end of the proposed economic activity.

1.5 DEMAND FOR RESOURCES AND MATERIALS

1.5.1 DEMAND FOR ENERGY RESOURCES

The electric capacity of the Building 117/1 existing equipment as installed according to the original design is approximately 170 kW [1]. Operation of some of existing systems will be necessasary during D&D activity. These include the existing building supply ventiliation system, upgraded exhaust ventiliation system, operational and emergency lighting systems. The expected electric power demand for the existing systems during D&D activity is about 80 kW.

In addition to the existing installations, electrical power will be required for operation of the new D&D equipment, local lighting sets, ventilation units etc. The electrical power demand for the new installations is estimated to be about 100 kW.

Thermal energy will be necessary for the Building 117/1 heating during the cold season. The design capacity of the Building 117/1 existing heating system is approximately 580 kW [1]. The proposed economic activity does not foresee modification of the existing system. The system will be used as it is designed and licensed. No changes in the current situation are foreseen.

The compressed air will be required for the operation of some D&D tools (vaccum blasting, etc.). The estimated compressed (0.6 MPa) air capacity is up to 420 m^3/h. The Building 117/1 is already equiped with compressed air supply line which might be used for needs of the proposed economic activity. The pressurized air is supplied from the existing facility at the INPP site. Existing installations are sufficient to provide necessary compressed air supply.

Diesel fuel will be needed for the truck transport of D&D materials from the Building 117/1 to the FRMSF or Landfill buffer store. All D&D materials transport operations will take place within boundaries of the INPP industrial site.

The proposed economic activity demand for energy resources is summarised in Table 1.5.1-1.

Table 1.5.1-1 Demand for energy resources for the Building 117/1 equipment D&D activity *)

Energy and fuel resources	Measurement unit	Amount	Supply source
Electric energy	MWh	300	From the power grid
Heat energy	MWh	650	Local steam boiler plant
Compressed (0.6 MPa) air	m^3	200 000 – 500 000	Local supply, from existing facility at INPP site
Diesel fuel	litres	200 - 300	External supply

*) Preliminary estimation, data will be better estimated during the design phase.

1.5.2 DEMAND FOR WATER RESOURCES

The portable water will be necessary for personnel sanitary purposes (hand washing, showers, toilets etc.) only. It is not envisaged to use water for the D&D technology.

There is no potable water supply to the Building 117/1 and no changes in the current situation are planned by the proposed economic activity. The existing infrastructure of Power Unit 1 will be used to cover personnel sanitary needs. Also, the existing INPP personnel will be employed in the D&D activity. No changes in the current situation as concern the use of already licensed water resources for the INPP [9] are foreseen.

1.5.3 OTHER MATERIALS

The necessery tools, D&D equipment, auxiliary equipment (scaffolding etc.) and materials (abrasive material for vaccum blast, waste drums, plastic foil and bags etc.) will be procured as specified in Technical Specification [1].

No chemical substances or preparations containing dissolvents are foreseen to be used.

The main technological resources for the flame cutting of Building 117/1 redundant equipment are oxygen and acytelene, which will be supplied in pressurized bottles. Estimated amounts of oxygen and acetylele needed for the Building 117/1 equipment D&D activities are summarised in Table 1.5.3-1.

Table 1.5.3-1 Oxygen and acetylene consumption during the Building 117/1 equipment dismantling *)

Technological resources	Measurement unit	Amount	Supply source
Oxygen gas in pressurized bottles	kg	4 200	External supply
Acetylene gas in pressurized bottles	kg	300	External supply

*) Preliminary estimation, data will be better estimated during the design phase.

2 TECHNOLOGICAL PROCESSES

The proposed economic activity will decontaminate and dismantle (D&D) the redundant systems located in the Building 117/1 together with the associated auxiliaries according to the best efficient strategy [1], [2]. The strategy to be developed under this proposed economic activity will aim, while complying with the safety goals and the legal Lithuanian requirements, at minimizing the overall cost for Building 117/1 dismantling, including storage/disposal costs.

The proposed economic activity will bring the Building 117/1 systems and equipment into the following situation:

- The redundant systems are dismantled and decontaminated as appropriate, and removed from Building 117/1 in accordance with established waste management routes;
- The integrity and operability of the systems and equipment still needed for Unit 1 post-operation and for Unit 2 (post)-operation have not been compromised by the D&D activities;
- The auxiliaries/utilities (ventilation, heating, liquid drainage system, communications) as well as, in general and for conventional safety reason, the electrical cables, cables trays are still present and operational in Building 117/1 that remains a part of the controlled area;
- The D&D tools and auxiliary equipment that have been used in the frame of the proposed economic activity are adequately removed from the Building 117/1;
- The overall radiological situation of the remaining equipment and components and of the building structures is comparable, except for the natural decay, to that before starting the D&D operations.

2.1 PRESENT LAYOUT

2.1.1 SITE

The Ignalina NPP industrial site is located on the southern bank of the Lake Druksiai. The overall site layout and on-site areas related to the proposed economic activity is shown in the Figure 2.1.1-1.

The Building 117/1 is located in the Ignalina NPP industrial site adjacently to the main building of the Power Unit 1. The Building 117/1 is surrounded by other buildings and structures of Ignalina NPP industrial site. The building of the Power Unit 1 is in about 20 m to the north and in about 27 m to the east. Other nearby structures are Building 135/1 (Gas holding chambers of the Power Unit 1) to the south and Buildings 131 (Water chemical treatment facility) and 132 (Water chemical treatment tanks) to the west.

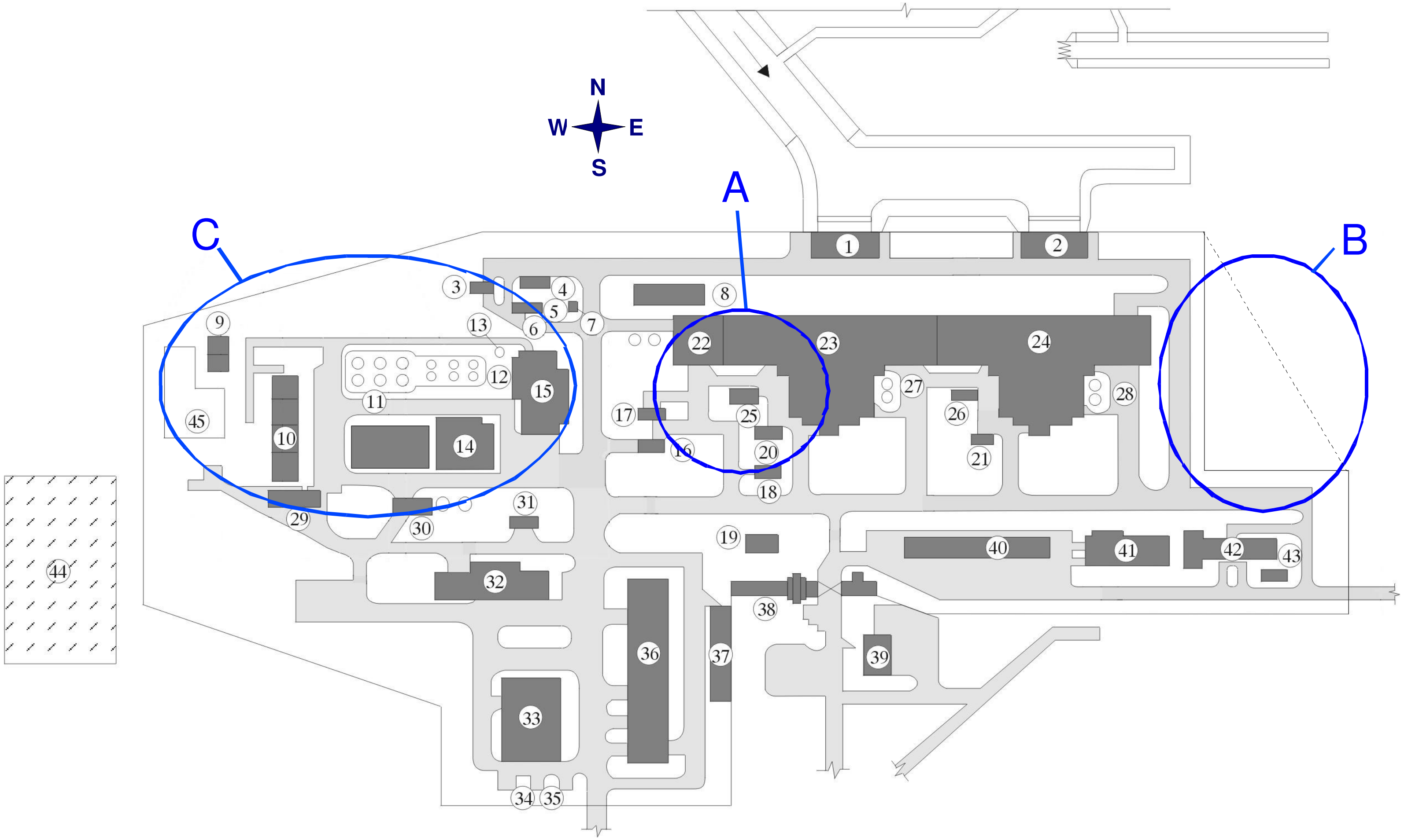

Figure 2.1.1-1 General layout of the INPP industrial site. Areas related to the proposed economic activity: A – Power Unit 1 (23) and Building 117/1 (25), B – location of the new Free Release Measurement Facility (FRMF) and Landfill Buffer Storage, C – location of the INPP existing liquid (11, 12, 13, 14, 15) and solid (9, 10, 45) radioactive waste treatment and storage facilities

2.1.2 BUILDING 117/1

The overall Building 117/1 dimensions in plane (including extension for the Helium Make-up Station) are 36×24.5 m. The Building 117/1 height is up to 20.4 m.

The Building 117/1 structure could be subdivided into two constructively and functionally separate parts:

- The main building structure which consist of the Main Hall and the Aisle;
- Extension for the Helium Make-up Station.

The main Building 117/1 structure houses the accumulator tanks, pipelines of Emergency Core Cooling System (ECCS) and auxiliary equipment. The basement of the building and the base for the columns is made of solid-cast reinforced concrete. The building frame and bulkheads are made of precast reinforced concrete. The walls are from concrete panels, the roof is pitched (for the Main Hall) and flat (for the Aisle). Steel floors, stairs, platforms for ECCS tanks servicing are installed. The building is connected with the Power Unit 1 by ECCS underground gallery. Personnel access is from the Power Unit 1 through the special gallery at level +7.20 m.

The extension to the Building 117/1 for the Helium Make-up Station is constructed as steel columns and beams structure covered by galvanized stamping deck. The base for columns is from prefabricated foundation blocks and separately located base - for roof support. The roof is pitched. Personnel access is directly from outside and not through the changing rooms.

The building is equipped with storm rain water drainage system.

The outline of the Building 117/1 main levels and overview of main installations is provided in the Figures below.

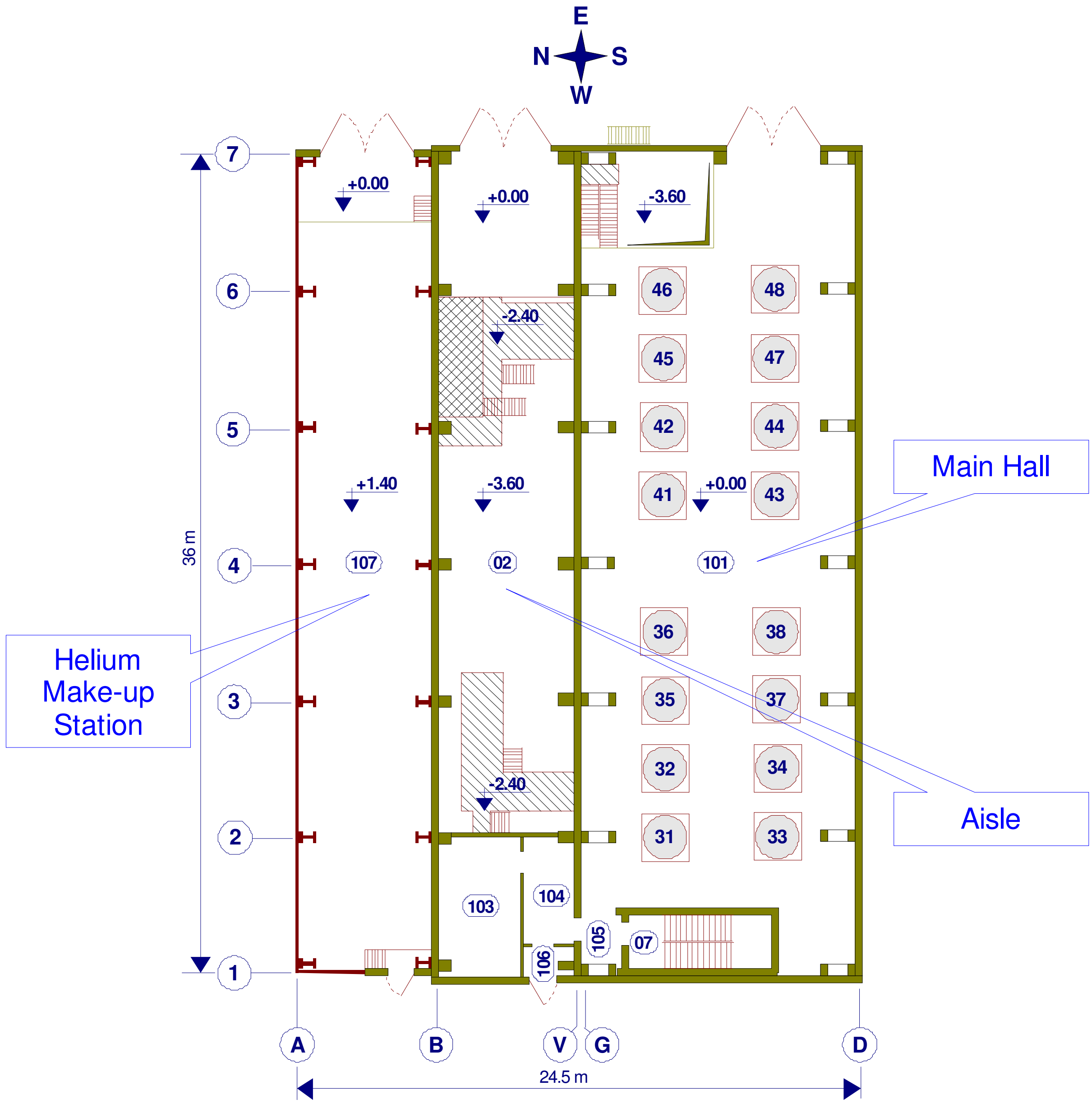

Figure 2.1.2-1 Outline of the Building 117/1 at level +0.00 m (ground level)

(a)


(b)


Figure 2.1.2-2 Overview of the ground level: (a) Helium Make-up Facility, room 107; (b) Main Hall, room 101. ECCS pressurized tanks

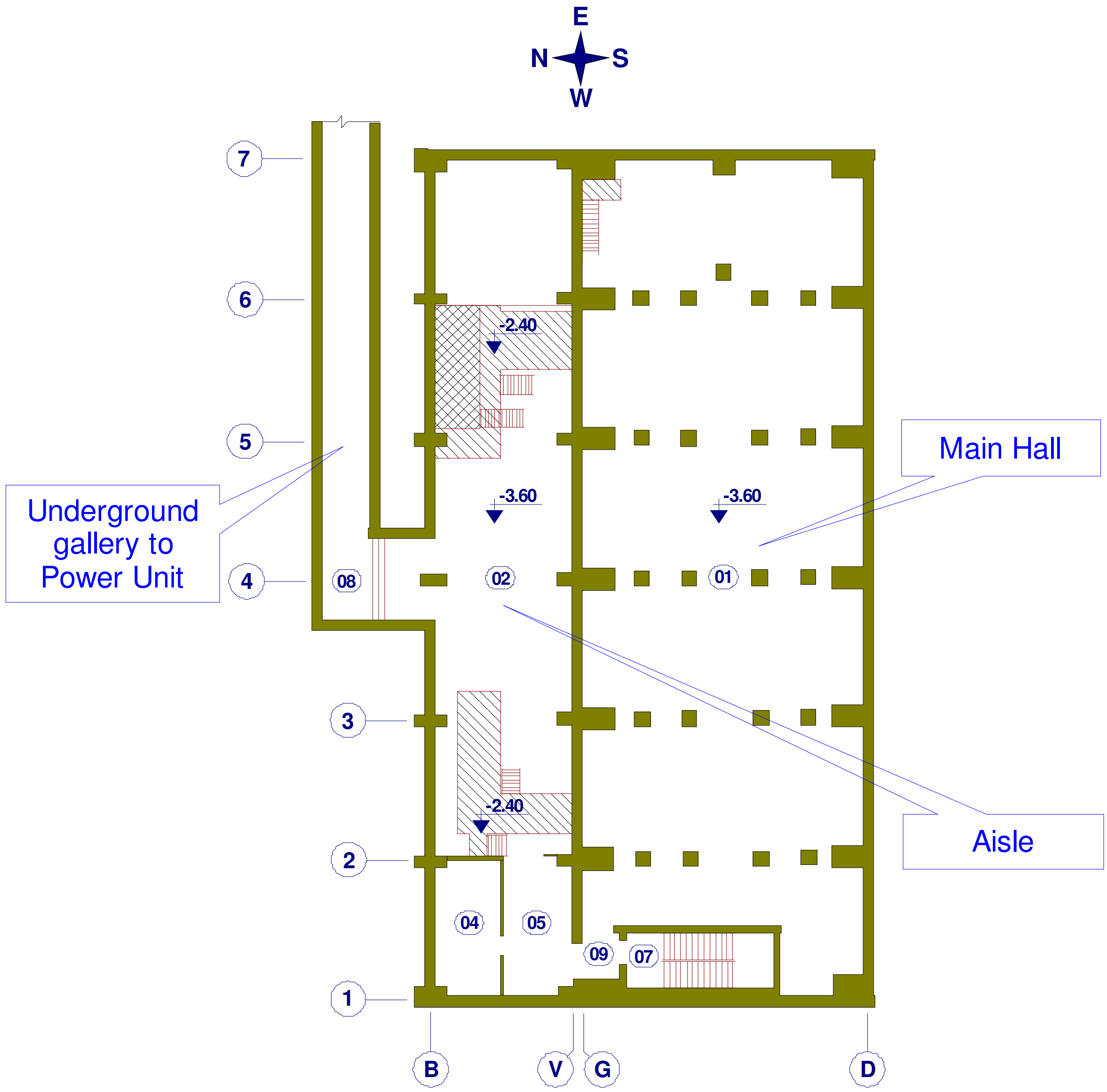

Figure 2.1.2-3 Outline of the Building 117/1 at level -3.60 m (basement level)

(a)

(b)

Figure 2.1.2-4 Overview of the basement level: (a) Aisle, room 02. Steel platforms, electric cabinets and pipework; (b) Main Hall, room 01. Pipelines of large diameter

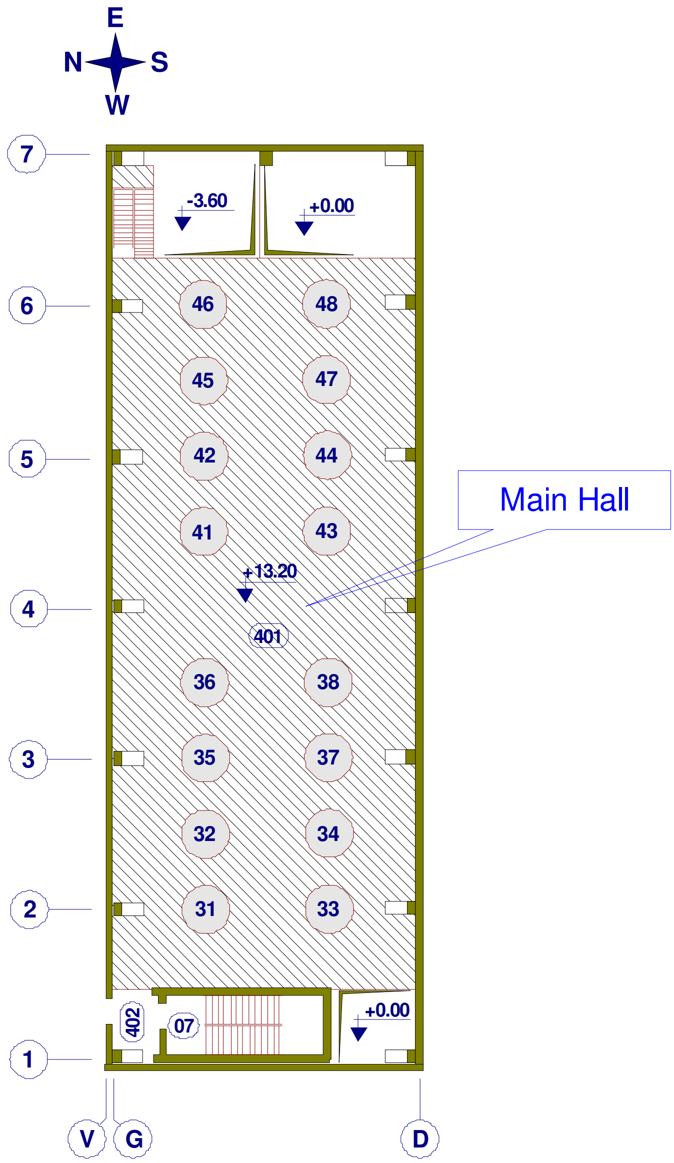

Figure 2.1.2-5 Outline of the Building 117/1 at level +13.20 m (top floor level)

(a)

(b)

Figure 2.1.2-6 Overview of the top floor level: (a) Main Hall, room 401. Upper parts of ECCS pressurized tanks (b) Main Hall, view from the basement level upwards. ECCS pressurized tanks and steel floors at levels +7.20 and +13.20 m

2.1.3 SYSTEMS

Existing systems in the Building 117/1, their present status and requirements on dismantling are summarized in the Table 2.1.3-1 below.

Table 2.1.3-1 Existing systems in the Building 117/1

System	Location (rooms)	Description & status
First and Second channels of Short term ECCS	01,02,04, 08,101, 301,401	The function of system was to ensure emergency reactor cooling during the first two minutes after accident with primary rector cooling system. System includes 16 pressurized tanks, valves and pipelines. The volume of each tank is 25 m^3. During operation the tank is filled with water and pressurized with nitrogen above the water surface. At present the tanks are empty, water supply line from Power Unit 1 is closed. The system shall be dismantled.
Helium Make-up Facility as part of reactor gas circuit	08, 107	The function of system was to supply reactor gas circuit with helium to compensate helium leaks. During operation it comprises 15 groups of five 40-litre helium cylinders pressurized at 15 MPa. The helium cylinders will be removed, the pipelines and valves shall be dismantled.
Nitrogen supply system	08, 02, 04, 05, 01, 101, 301, 401	Compressed nitrogen was used to service and pressurize ECCS tanks. The pipelines and valves servicing ECCS tanks shall be dismantled. Transit pipelines to Power Unit 1 shall remain in operation.
Compressed air system	04, 02, 08	Compressed air was used to service ECCS tanks. The pipelines and valves servicing ECCS tanks shall be dismantled. Transit pipelines to Power Unit 1 shall remain in operation.
System of ECCS pressurized tanks filling-up, make-up and hydro shaping	02, 08	System was used to service ECCS tanks. At present system is empty, water supply line from Power Unit 1 is closed. The system shall be dismantled.
Heat supply system	01, 02, 07, 201, 302, 305, 306	Water heating system, ensures heating of certain room rooms with help of heating batteries. The system shall remain as it is.
Heating and ventilation system	01, 02, 08, 101, 301, 302, 401	Non nuclear ventilation system, consisting mainly of two independently operated supply ventilation and exhaust ventilation subsystems. Supply ventilation subsystem provides air supply to the building to ensure necessary sanitation and process

System	Location (rooms)	Description & status
		conditions. In winter time supplied air is heated. The system maintains in the building slight overpressure to prevent cold air infiltration. Exhaust ventilation subsystem ensures air removal from certain rooms in case of low oxygen concentrations. System operates periodically. Air is directly discharged to the atmosphere. The system will be upgraded to meet D&D needs.
Sewerage system	01, 02	The floors drain system with water collection pit in room 02. From the pit the water can be pumped out to the Power Unit (and transferred to the liquid radioactive waste treatment facility). The system shall remain as it is.
Power supply system	02, 04, 07, 101, 307	The ECCS power supply system shall be dismantled. The building lighting system shall remain as it is.
Control of temperature and oxygen content in the air	01, 05, 401	The system ensures control of necessary sanitation and process conditions during operation of ECCS. The system shall be dismantled.
Alarm signal	305	Alarm signal to the control room of the Power Unit 1. The system shall remain as it is.
Local computers network	305, 306	The system shall remain as it is.

2.1.4 RADIOLOGICAL CONDITIONS

Premises and areas of Ignalina NPP are divided into controlled and supervised area [3] with different access, radiation control and safety provisions. No specific radiological protection measures or safety provisions are normally needed in the supervised area (while exposure conditions are still kept under review). In the controlled area a specific protection measures and safety provisions are or could be required for controlling normal exposures or preventing the spread of contamination during normal working conditions. The Building 117/1 belongs to the controlled area.

Depending on potential radiological impact, the premises of controlled area are classified into radiological categories from III (with potentially lowest radiological hazard) to I (with potentially highest radiological hazard). Requirements for classification are defined by the Lithuanian hygienic norm HN 87:2002 [4]. From radiological hazard point of view personnel working /staying time in premises of category III normally are not specially limited. In premises of categories II and I personnel working time shall be controlled and, if necessary, limited as not to exceed exposure limitations. All premises of Building 117/1 are classified as category III rooms where following controlled limits are assured:

- Gamma dose rate < 12 μSv/h;
- Alfa surface contamination < 4 Bq/cm^2;
- Beta surface contamination < 40 Bq/cm^2;
- Volumetric activity of aerosols < 185 Bq/m^3.

The actual radiological conditions in the premises of Building 117/1 are considerably lower limiting requirements for category III rooms. The levels of dose rate and contamination are relatively modest and will readily allow the use of manually deployed techniques, subject to the consideration of ALARA principle. Radiological survey results are summarized below.

The gamma dose rate increase, c.f. Table 2.1.4-1, is observed close to the lower parts of ECCS PT (room 101) and ECCS pipework (rooms 01, 02 and 08). The internal surfaces of these installations are radiologically contaminated due to recirculation / storage of Power Unit 1 primary circuit water which carried with it fission and activation products from the reactor core. The gamma dose rate is higher close to locations potential for sediments concentration (pipes bends, joints, bottom of ECCS PT). The gamma dose rate is also higher in the areas with higher concentration of radiologically contaminated pipes (room 08). However the measured gamma dose rates are lower (with few local exceptions mostly in room 01) category III limiting gamma dose by about factor of 10. No specific radiation sources are identified in the Helium Make-up facility.

Table 2.1.4-1 Radiological conditions in the premises of Building 117/1 – gamma dose rate

Room	Location	Dose rate, μSv/h	Remark
08	Passage in-between pipelines Pipelines	0.6-0.8 1.0-1.2	Underground gallery from Building 117/1 to Power Unit 1 presents confined area with radiologically contaminated ECCS pipelines.
02	Gamma background in the room Pipeline bend (locally) Valves	0.1-0.2 1.5 0.1-0.6	
01	Gamma background in the room Pipelines Pipelines joints, bends (locally) ECCS PT discharge pipeline joint after tank decontamination tests (locally)	0.2-0.3 0.4-1.0 0.5-2.5 4.1	Efficiency of several Ignalina NPP available decontamination methods was tested in one of ECCS PT. As a result, some of amount of contamination from the tank was washed down into the discharge pipeline.
101	Gamma background in the room ECCS PT	0.1-0.2 0.1-0.7	
107	Gamma background in the room, Helium cylinders, pipeline	0.1	No specific radiation sources are identified in the Helium Make-up facility
Other rooms	Gamma background in the room, equipment components	0.1-0.2	No specific radiation sources are identified

The contamination of rooms and external surfaces of equipment is local, c.f. Table 2.1.4-2. Contamination is detected on the floors and stairs in form of local stains or in specific places like doorsills. The levels of contamination are relatively low. Basing on potential contamination nature (c.f. chapter 2.1.5.2) it can be expected that items in Building 117/1 with surface contamination of about or slightly below 0.4 Bq/cm^2 will meet values of unconditional clearance levels. The detected contamination in most cases is of similar level. No specific contamination sources are identified in the Helium Make-up facility.

Table 2.1.4-2 Radiological conditions in the premises of Building 117/1 – surface beta contamination

Room	Location	Surface contamination, Bq/cm^2	Remark
08, 02, 01	External surfaces of ECCS pipelines	< 0.3	Non-fixed contamination, samples were taken by wet smears
04, 05, 09	Spots on concrete floor	0.2-0.4	
101		0.2-0.6	2 spots
402		0.3-0.7	Floor is covered with epoxy paint
07	Spots on plastic covered stairs and floors	0.3-0.4	2 spots
202		2.5	Spot identified under plastic floor cover (on old plastic) in room 202
301, 401	Spots on corrugated steel floors	0.2-0.4	5 spots
		1.0-3.0	1 spot in room 401
04, 07, 103, 104, 106, 201, 305, 306, 308	Wooden doorsills	0.3-1.0	
107	Helium cylinders, pipeline	0.1	No specific contamination sources are identified

Note: The surface contamination measurements are global for alpha and beta, the contribution of alpha contamination is however negligible (10^{-5} versus beta - see nuclide vector).

2.1.5 MATERIALS TO BE MANAGED

2.1.5.1 TYPES AND AMOUNTS

Elements to be dismantled within the Helium Make-up Station are:

- Helium cylinders;
- Helium make-up station pipework;
- Pipe fittings;
- Steel structures (including pipe supporting parts and hangers, control & instrumentation racks).

Elements to be dismantled within the main structure of the Building 117/1 are:

- ECCS pressurized tanks, radiologically contaminated;
- Pipelines of large (Ø159–426 mm) and medium (Ø57 mm) diameter, radiologically contaminated;
- Fittings of large and medium diameter, radiologically contaminated;
- Pipework of small (Ø14-32 mm) and medium (Ø57-108 mm) diameter which have to a large extent not been in contact with radiologically contaminated media (i.e. high pressure and low pressure nitrogen pipelines, compressed air pipelines, C&I tubes, air feed pipes, differential pressure gauge level control system, etc.);

- Fittings of medium and small diameter which have to a large extent not been in contact with radiologically contaminated media;
- Electrical switchboards;
- Service platforms, steel floors and steel structures (including support elements and pipe hangers).

Types and amounts of main materials to be dismantled, considering potential waste management routs, are summarized in the table below. The relative importance of each of material types is shown in the Figure below.

Table 2.1.5-1 Types and amounts of main equipment and installations to be dismantled in Building 117/1

Equipment	Mass, kg	Material	Mass to FRMF		Mass to Landfill	
			fraction	kg	fraction	kg
ECCS Pressurized Tanks	762 500	carbon steel	100%	762 500	0%	0
Large diameter pipelines (Ø 159-426 mm)	92 300	carbon steel	100%	92 300	0%	0
Steel structures (access platforms, stairs, steel floors etc.)	63 800	carbon steel	100%	63 800	0%	0
Large and medium diameter valves, fast acting valves with motor drive	20 200	carbon steel & various	60%	12 120	40%	8 080
Medium and small diameter pipelines (Ø 20-108 mm)	2 300	carbon steel	0%	0	100%	2 300
Supports for pipelines	1 300	carbon steel	100%	1 300	0%	0
Small diameter pipelines (Ø 14-32 mm)	1 600	stainless steel	0%	0	100%	1 600
Small and medium diameter valves	900	stainless steel	0%	0	100%	900
Supports for ECCS Pressure Tanks	10 100	concrete & carbon steel	50%	5 050	50%	5,050
I&C Equipment (manometers and pressure gauges)	580	various	0%	0	100%	580
Electric equipment (power distribution cabinets, I&C cabinets)	1 400	various	0%	0	100%	1 400
Total	**956 980**		**97.9%**	**937 070**	**2.1%**	**19 910**

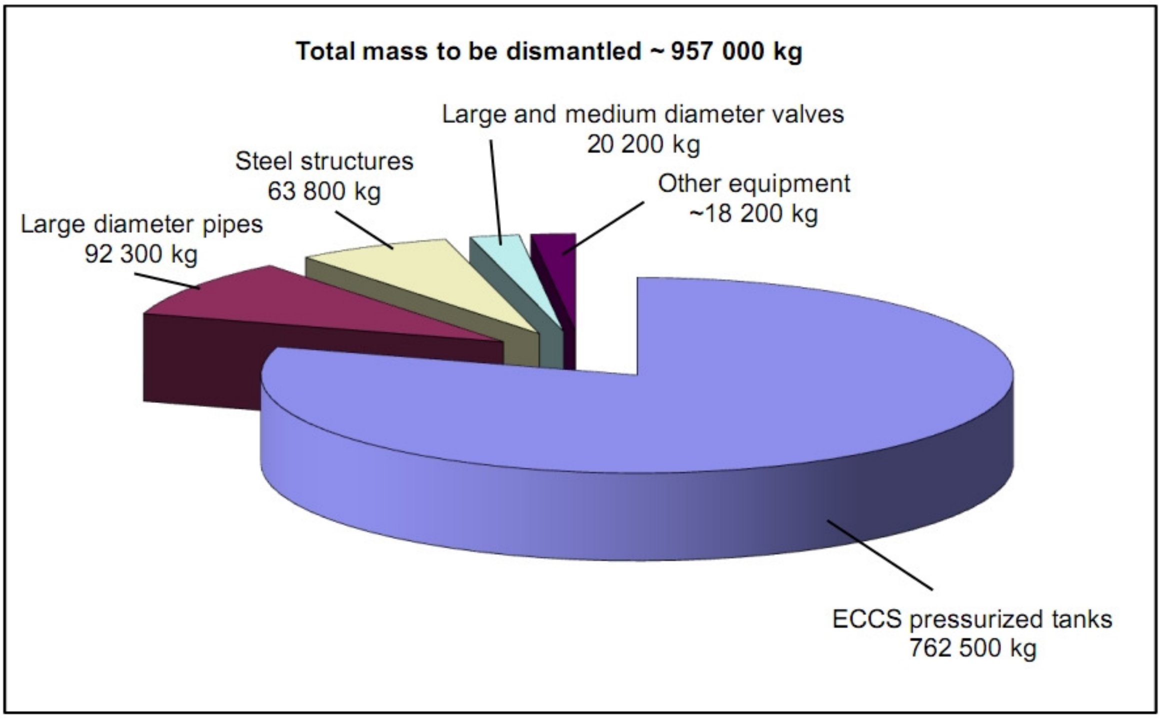

Figure 2.1.5-1 Types and amounts of main equipment and installations to be dismantled in Building 117/1

It is expected that approximately 98% of the mass of the dismantled elements will be appropriately sized and decontaminated to free release conditions. The mass of an individual element to be removed for free release will not exceed 3 200 kg (this maximum mass is determined by the capacity of the planned hoisting mechanisms which are limited to this figure by the Building 117/1 construction).

It can be expected that approximately 2% of the dismantled elements cannot be decontaminated to free release condition. These are mainly pipelines and fittings of small diameter where the inner surface is inaccessible for appropriate decontamination or monitoring. These cut-offs are categorized as non-compactable waste of group A (very low level waste) and will be transported to the Buffer Storage of the Landfill Facility.

In addition there are some relatively small amounts of hazardous waste materials in the Building 117/1, Table 2.1.5-2.

Table 2.1.5-2 Hazardous materials in Building 117/1

Material	Mass, kg	Code *)	Hazard **)	Remark
Congealed lubricants from valves, pump bearings, reducers, valve actuators	19	13 02 08	C51	Oil products, toxic substances are released if combusted
Sealing graphite rings from mechanisms, pump bearings, valves	5	13 02 08	C51	Oil products, toxic substances are released if combusted
Luminescent lamps, 182 pieces	91	20 01 21	C16	Contains Mercury products
Plastic floor cover	1696	17 02 04	C42	Toxic substances are released if combusted
Insulation of cables	1916	17 02 04	C42	Toxic substances are

Material	Mass, kg	Code *)	Hazard **)	Remark
(polyvinylchloride & rubber)				released if combusted. Cables will remain in place (mostly), all cable trays have been sprayed with fire resistant coating.

*) Material code according to the Appendix 2 of the Waste Management Rules [6];

**) Hazard type according to the Appendix 18 of the Waste Management Rules [6].

The non-radioactive hazardous waste, were possible, will be removed from the building prior starting of dismantling works on radioactive components. Waste will be managed in accordance with the requirements of waste management legislation and regulations in force [5], [6], 7], INPP instruction [8] and permission on integrated prevention and control of pollution [9].

Hazardous items which will be identified as radioactive can be transferred to the Landfill buffer store for subsequent disposal in Landfill repository (if finally produced waste packages will meet Waste Acceptance Criteria for Landfill repository).

2.1.5.2 RADIOACTIVE INVENTORY

The radiological contamination of the ECCS and related pipework internal surfaces have resulted from recirculation / storage of Power Unit 1 primary circuit water which carried with it fission and activation products from the reactor core. The Power Unit 1 and subsequently the ECCS have been in operation for 21 years.

The knowledge on origin of contamination source and its properties as well as investigations performed lets expect that majority of the contamination is contained within a matrix of corrosion products on the steel surfaces exposed to contaminated water. The decontamination trials carried out in one of the ECCS pressurized tank show that the corrosion layer makes the contamination relatively difficult to remove by water jetting or chemical methods and thus an aggressive decontamination method is required.

The contamination is not homogeneously distributed within internals of ECCS and related pipework. Mostly contaminated are surfaces with conditions favourable for concentration of sediments – bottoms of ECCS pressurized tanks, elbows and joints of pipelines, valves. Elements, which have to a large extent not been in contact with ECCS water (like nitrogen fill-up and discharge pipelines) radiologically are low contaminated.

The ECCS part located in Building 117/1 consist of two identical and independent pressurized tanks groups. Each group contains 8 pressurized tanks which are connected to one discharge pipeline for reactor cooling water. The scheme of one pressurized tanks group and selected representative locations for measurement / sampling of radioactive contamination are shown in the Figure 2.1.5-2 below. The same investigations have been performed in each group of pressurized tanks.

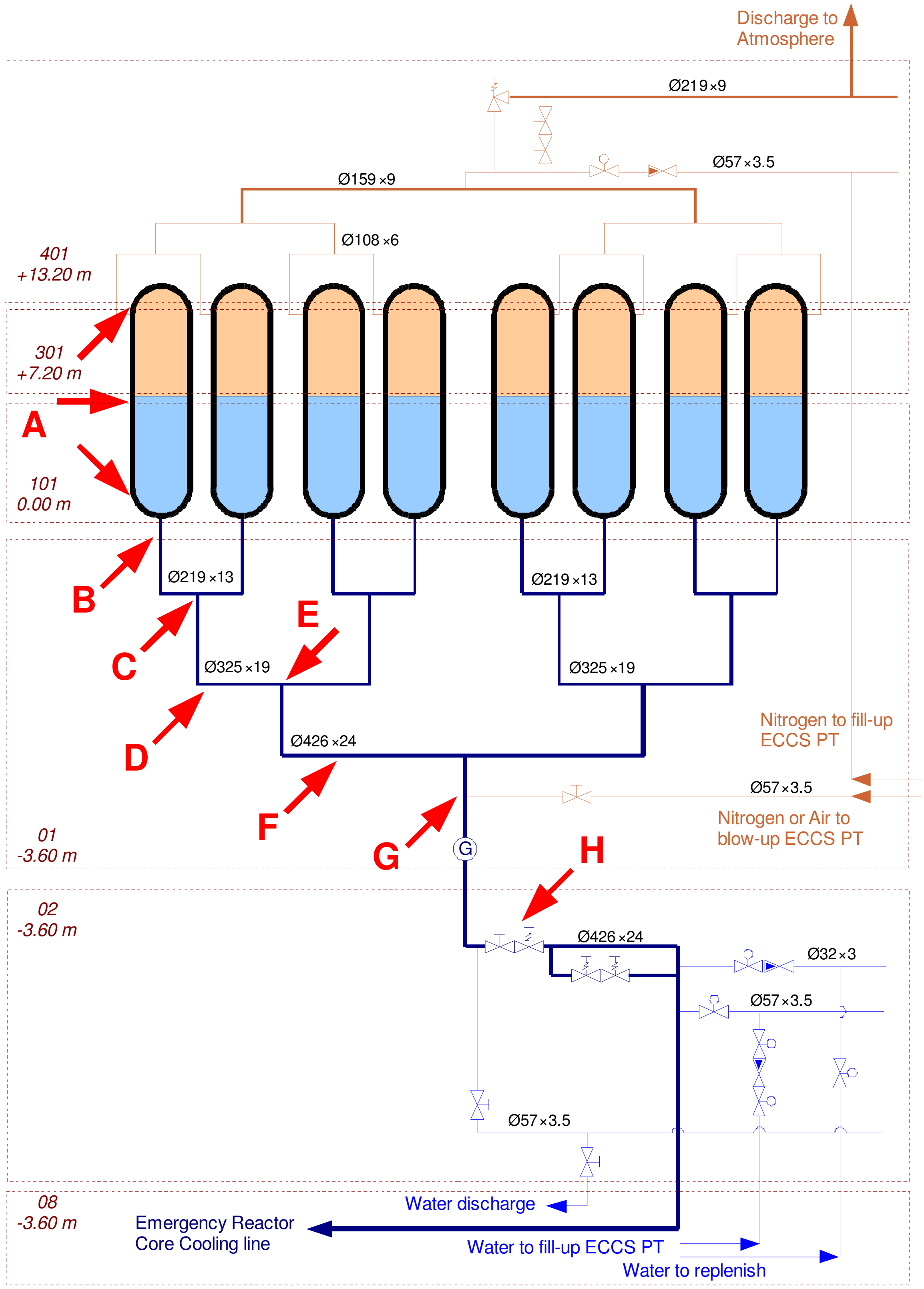

Figure 2.1.5-2 ECCS pressurized tanks group. A, B, C, D, E, F, G and H –representative locations selected for measurement and sampling of radioactive contamination

Several methods were implemented to characterize radiological conditions inside the ECCS pressurized tanks and related pipework:

- Portable gamma-spectrometric system “Iso-Cart” with software package “Isoplus-32” (which allows to perform calculations for the set geometries like pipes, cylinders etc.) was used for in-situ measurements of radioactive contamination of ECCS pressurized tanks and related pipework internal surfaces;
- Portable beta radiometers “MicroCont” and “FHT 111M Contamat” were used for in-situ measurements of total beta radioactive contamination inside ECCS pressurized tanks;
- Portable gamma dosimeters “Teletector” and “FH 40 G-L10” were used for in-situ measurements of gamma dose rate inside ECCS pressurized tanks;
- Wet and abrasive pasta smear samples were taken from internal surfaces of ECCS pressurized tanks and pipework valves. Samples later on have been investigated by means of gamma spectrometry and other relevant laboratory analysis methods with purpose to define content of difficult to measure radionuclides [10].

The radiological investigation results are summarized below.

The internal contamination of ECCS pressurized tanks and related pipework is not homogeneous, Table 2.1.5-3. The ECCS PT height is about 13.4 m, with nominal water filling height up to 7 m (which corresponds to level +7.4 m in Building 117/1). The middle and lower parts of tank, which have been in contact with radioactive water, are contaminated. Contamination concentration is increasing towards bottom of tank. The upper part of ECCS PT which under normal operation conditions was filled with compressed nitrogen is contaminated significantly less.

The highest levels of contamination are measured in horizontal ECCS discharge pipelines just below the pressurized tanks. Surface contamination in pipelines may exceed contamination of tank internals by several times.

The measured gamma dose rate from internal surface of ECCS PT at level 0-1 m (maximal surface contamination) varies in range 3-12 μSv/h. The higher dose rates are to be expected from internal surfaces of pipework (especially from located in room 01) which contamination is higher as compare to the contamination of pressurized tanks.

The fraction of non-fixed activity over most of ECCS pressurized tanks internal surface is below 10% from the total measured activity. The test decontamination results, performed in one of ECCS pressurized tank, also indicate that radioactive contamination on vertical surface (wall of tank) is strongly fixed. Higher percentage (in average 25%, in some places proportion is higher) of non-fixed contamination is observed at the bottoms of the tanks where remnants of silt sediments are found.

The radionuclide content of internal contamination measured by means of portable gamma spectrometry is presented in the Table 2.1.5-4. The Table 2.1.5-5 provides average activity distribution of gamma emitters in non-fixed contamination. The Co-60 activity in the non-fixed contamination prevails, while in-situ gamma spectrometry indicates higher content of Cs-137. Such redistribution of activity correlate with ECCS pressurized tank test decontamination results (decontamination was performed by means of high pressure water jetting, mechanical brushing with application of decontamination chemicals) which indicate that the activity of radionuclide Co-60 is removed better than activity of Cs-137.

Table 2.1.5-3 Gamma contamination of ECCS equipment internal surfaces

Locations		**Level, m**	**Surface gamma contamination, Bq/cm²**		**Measurement method for total contamination**
			Total	**Non-fixed**	
Upper part of tank	A	> 12	< 1.0 *)	0.1-0.2	Beta radiometer
Middle part of tank – at nominal water filling level and above	A	7-10	11-26	0.2-0.9	Portable spectrometry. Activity measured by beta radiometer is up to 2 Bq/cm²
Lower part of tank - below nominal water filling level	A	1-5	< 20 *)	1-3	Beta radiometer
Bottom of tank	A	0-1	62-80	2-36	Portable spectrometry
Tank bottom discharge pipe Ø219×13 mm	B	0-(-1.5)	51-68	***)	Portable spectrometry
Joint of two discharge pipes Ø219×13 mm	C	-1.5	126 **)	***)	Portable spectrometry
Two tanks discharge pipe Ø325×19 mm, joint of pipes **)	D, E	-1.5	141-200 **)	***)	Portable spectrometry
Four and eight tanks discharge pipe Ø426×24, joint of pipes	F, G	-2.6	118-134 **)	***)	Portable spectrometry
Large diameter valves	H	-2.7	36-55	***)	Portable spectrometry

Representative locations selected for measurement and sampling of radioactive contamination - A, B, C, D, E, F, G and H – are shown in Figure 2.1.5-2.

*) The measurements performed by means of portable spectrometer indicate higher activity concentration levels than direct surface contamination measurements performed using beta radiometers. The difference is 5-8% in the upper part of the tank and 10-60% at the bottom surfaces. It is explained by the fact that beta radiation is measured at the surface of contamination, while the internal radioactive contamination of ECCS PT represents a thick oxide layer up to 3 mm in some places (the tank is manufactured from forged unprocessed steel, the surface of which is porous and shaggy) and it is impossible to measure entire activity of the "thick" source by means of direct beta measurements. The results of portable spectrometry therefore shall be considered as more representative.

**) Efficiencies of several Ignalina NPP available decontamination methods were tested in one of ECCS PT. As a result, some amount of contamination from the tank was washed down into the discharge pipelines and local contamination is higher than values provided in the table. Contamination of Ø219×13 mm pipes joint (C) is about 900 Bq/cm², contamination of Ø325×19 mm pipeline (D) is about 310 Bq/cm² and contamination of Ø426×24 mm pipeline (F) is about 260 Bq/cm². No exceptional contamination concentration is observed downward the joint of eight tanks discharge pipeline (G) and large diameter valves (H).

***) Non-fixed surface contamination is evaluated for ECCS PT surfaces only where smear's sampled area can be precisely defined. Wet smear samples were also taken inside ECCS pipework; however samples were used for definition of content of difficult to measure radionuclides.

Table 2.1.5-4 Activity distribution in gamma contamination of ECCS equipment internal surfaces

Locations		Surface gamma contamination, Bq/cm^2	Activity distribution, Bq/cm^2			
			Mn-54	Co-60	Cs-134	Cs-137
Middle part of tank	A	11-26	0	0	0	11-26
Bottom of tank	A	62-80	0	15-39	0	38-52
Tank bottom discharge pipe Ø219×13 mm	B	51-68	0.5-1.2	9-10	0.09-1.3	39-57
Joint of two discharge pipes Ø219×13 mm	C	126 *)	6.6 *)	40 *)	0.06-7.6	79-113
Two tanks discharge pipe Ø325×19 mm	D	200 *)	6.5 *)	41 *)	2.8-3.4	56-149
Joint of two discharge pipes Ø325×19 mm	E	141-190	12-19	106-119	0.03	23-52
Four tanks discharge pipe Ø426×24 mm	F	118 *)	9.5 *)	68 *)	0.04	40-50
Eight tanks discharge pipe Ø426×24 mm	G	120-134	2.9-4.8	26-61	1.2-2	52-104
Large diameter valves	H	36-55	0.9-2.1	6.8-16.9	0-0.6	27-36

*) Without data for pipeline from tank subjected to test decontamination, see comments below Table 2.1.5-3.

Representative locations selected for measurement and sampling of radioactive contamination - A, B, C, D, E, F, G and H – are shown in Figure 2.1.5-2.

Table 2.1.5-5 Activity distribution of gamma emitters in non-fixed contamination of ECCS equipment internal surfaces [10]

Radionuclide	Activity distribution
Mn-54	6.6%
Co-60	54.3%
Zn-65	0.01%
Nb-94	0.08%
Ag-110m	0.06%
Cs-134	1.7%
Cs-137	37.2%

The average radionuclide vector (activity scaling factors respect to activity of reference radionuclide) of non-fixed contamination is provided in Table 2.1.5-6. The Co-60 is proposed as reference radionuclide for both activated corrosion products and fission products, including actinides [10]. The biggest part of activity forms corrosion product Fe-55, however the radionuclide is weak gamma and beta emitter. Other significant activity contributing radionuclides are Mn-54, Co-60, Ni-63, Nb-94m, Cs-134 and Cs-137. Share of alpha radionuclides to the activity is insignificant.

Table 2.1.5-6 Radionuclide vector for non-fixed contamination of ECCS equipment internal surfaces [10]

No	Radionuclide	Scaling factors respect to Co-60	Proportion in total activity
1	C-14	2.40E-03	0.02%
2	Mn-54	0.12	1.03%
3	Fe-55	9.50	81.47%
4	Ni-59	1.70E-04	0.00%
5	Co-60	1.00	8.58%
6	Ni-63	0.13	1.11%
7	Zn-65	1.60E-04	0.00%
8	Sr-90	1.30E-03	0.01%
9	Nb-93m	0.18	1.54%
10	Nb-94	1.40E-03	0.01%
11	Zr-93	1.40E-05	0.00%
12	Tc-99	2.00E-05	0.00%
13	Ag-110m	1.10E-03	0.01%
14	I-129	3.20E-07	0.00%
15	Cs-134	0.03	0.27%
16	Cs-137	0.69	5.92%
17	U-234	1.80E-07	0.00%
18	U-235	3.50E-09	0.00%
19	U-238	5.60E-08	0.00%
20	Np-237	1.10E-08	0.00%
21	Pu-238	6.60E-05	0.00%
22	Pu-239	2.80E-05	0.00%
23	Pu-240	4.80E-05	0.00%
24	Pu-241	1.80E-03	0.02%
25	Am-241	1.50E-04	0.00%
26	Cm-244	1.30E-04	0.00%
	Total	**11.66**	**100%**

2.2 DECONTAMINATION AND DISMANTLING TECHNOLOGY

The facilities and systems of the ECCS and Helium Make-up Station are not interconnected. The decontamination and dismantling of the ECCS and Helium Make-up Station can be performed in parallel to each other.

2.2.1 D&D OF HELIUM MAKE-UP STATION

Deplanting of the Helium Make-up Station will be a relatively straight forward industrial dismantling operation of equipment located within the controlled area which is not likely to be significantly contaminated. Sampling and radiological characterisation of the equipment prior to dismantling will determine the extent of contamination, if any, and this will be supported by monitoring of dismantled components. If necessary, contaminated materials may be processed using the equipment to be installed in Building 117/1 for processing of ECCS components.

Helium cylinders will be removed using INPP existing normal procedures. Elements to be dismantled consist of pipework, pipe fittings and steel structures (including pipe supporting parts and hangers, control & instrumentation racks).

The following tools are proposed for the dismantling of the Helium Make-up Station:

- Standard store-bought angle grinders and cutting tools with abrasive cutting elements;
- Standard bench tools.

No significant preparatory work is anticipated for Helium Make-up Station deplanting. The room is equipped with standard lighting and an electric single-beam crane of 2.0 tonnes Safe Working Load. The switchboard with shutoff protection, automatic circuit breaker and two standard connectors will be installed in order to connect electric tools (angle grinders and cutting tools). An option of power supply for tools' through temporary overhead circuit will be considered by Detailed Design.

Standardized crates (with internal dimensions 1.2×0.9×0.9 m and maximum acceptable gross weight of 1200 kg) consistent with Buffer Storage at the Free Release Measurement Facility (FRMF) will be used for the dismantled parts of the equipment. To control waste mass flow, certificates containing information on waste transportation and further processing will be produced for each package.

The materials to be handled within the Helium Make-up Station are relatively small sized and will be handled using the existing crane and simple methods such as sack barrows or similar. The existing crane will be equipped with corresponding slings (standard four-leg chain sling consistent with containers).

Crates with dismantled parts will be loaded into standard 20 foot half height ISO container (with external dimensions (length × width × height) 6.06×2.44×1.30 m, internal volume approximately 15.2 m^3) and will be transported to the Buffer Storage at the FRMF.

After D&D implementation the room of the Helium Make-up Station will remain not contaminated beyond its existing levels and will remain equipped with the existing lighting.

2.2.2 D&D OF EMERGENCY CORE COOLING SYSTEM AND AUXILIARIES

Due to area limitation D&D of equipment and installations within the Aisle and the Main Hall will be carried out in several consecutive steps. The Figure 2.2.2-1 shows planned D&D work sequence and the subchapter below provides description of each identified step.

Some additional technological aspects (i.e. decontamination concept, confinement/ventilation concept etc.) important from environment impact assessment point of view are detailed in separate subchapters as well.

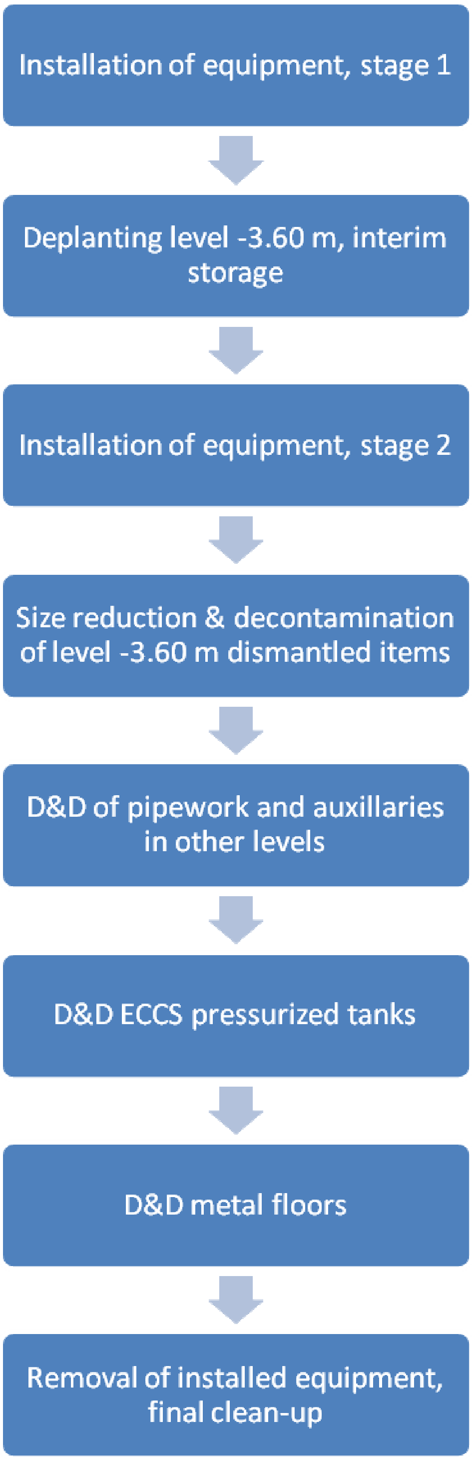

Figure 2.2.2-1 Sequence of D&D of ECCS and auxiliaries in the Building 117/1

2.2.2.1 WORK SEQUENCE

Installation of equipment, stage 1

The following construction civil works and new equipment installation works will be performed prior stating of dismantling activity, c.f. Figure 2.2.2-2 and Figure 2.2.2-3:

- Installation of electric overhead travelling crane (EOTC) of 3.2 tonnes capacity in the Main Hall of Building 117/1. EOTC is necessary to support the transport/installation of required equipment as well as for the later deplanting /size reduction works. The existing original design of Building 117/1 already incorporated the installation of a hoisting mechanism with 3.2 tonnes capacity running on H-beams suspended from the concrete roof girders of building. Nevertheless, although planned, designed and verified with regards to the building structure, the hoisting mechanisms were not installed later on. Depending on the finally selected crane type, the civil works will cover the design of appropriate supporting structures and their anchoring as well as the verification of the concerned parts of the building structure which may become necessary due to deviations of the proposed new crane system from the originally designated system.
- Installation of equipment package to modify the existing ventilation system of Building 117/1;
- Installation of auxiliary systems: power distribution and lighting, radiological monitoring and control equipment, temporary sanitary lock etc.;
- Creation of one or two passages at level -3.60 m between Main Hall and Aisle of Building 117/1 to allow the later transport of parts;
- In order to provide a good, level surface upon which to operate battery powered pallet trucks within the -3.60 m level, it will be necessary to improve the existing floor surface. This would be carried out by applying a screed layer (possibly self-levelling) which would be float finished and have a surface hardener and sealant layer applied. The latter would reduce dust generation during use of the pallet trucks.
- Plastic floor cover will be removed in order to reduce potentiality and to prevent consequences of fire hazard (plastic is hazardous if combusted, c.f. Table 2.1.5-2).

Deplanting level -3.6 m, interim storage of deplanted items

In the first deplanting step the areas of the Aisle, the Underground Gallery to the Power Unit and the level -3.60 m of the Main Hall will be cleared from equipment and installations to be dismantled. This will consist of pipework (including large diameter pipelines and valves of ECCS), switchgear and instrumentation systems, steel platforms and stairs. Removal of installations is necessary to create the interim storage and workshop areas (cf. Figure 2.2.2-3). The waste in these areas will be stored until final treatment and removal from the building.

At first the pressure gauges, sensing tubes, raised platforms and other relatively minor items will be deplanted in order to provide better access to the large plant items. The ‘tool box’ of cutting techniques will be employed and the most likely techniques to be employed will be reciprocating saws and hydraulic shears.

The pipes will then be cut into approximately 1.1 m lengths (suitable for storage in the standard crates) in-situ using the most appropriate system for each cut. Oxygen-acetylene flame cutting method is selected as main deplanting technique. However some pipes tight to the wall may benefit from diamond wire cutting rather than flame cutting. The pipe sections being cut will, depending on their location, be supported in one of four different ways:

- Hydraulic scissor lift placed beneath the pipe section;
- Axle stands placed beneath the pipe;
- Trolley mounted engine hoist;
- Pull-lifts attached to other pipes or pre-attached lifting brackets in the tunnel roof or walls.

Once cut free, the pipe section will have its open ends sealed with polyethylene sheet and adhesive tape before being placed upon a wooden pallet and secured in position. For small pipes, multiple sections may be stacked on a pallet or put into crates. Crates and pallets will be shifted by means of battery powered pallet trucks via the access openings at level -3.60 m to the Main Hall of Building 117/1 for intermediate storage (c.f. Figure 2.2.2-3).

Installation of equipment, stage 2

After clearing of the Aisle, in the created free space now two separated facilities will be installed:

- Size reduction and decontamination workshop;
- Radiological check and packing workshop.

Whereas the size reduction and decontamination workshop (c.f. Figure 2.2.2-3, area in between axes “B-V” and “2-4”) will be installed in the rear part of the Aisle, the radiological check and packing workshop (c.f. Figure 2.2.2-3, area in between axes “B-V” and “4-6”) will be installed at the side of the waste dispatch area.

A new lifting unit (of “Davit arm” type or similar) will be installed in the Aisle for movement of materials (construction materials, new equipment, D&D items etc.) between level -3.6 m and the dispatch area at level +0.0 m.

Size reduction, decontamination and dispatch of level -3.6 m dismantled items

When the facilities for size reduction, decontamination, radiological check and packing will be serviceable, the intermediately stored items at level -3.60 of the Main Hall will be sequentially fed to the workshops (c.f. Figure 2.2.2-3). Battery powered pallet trucks will be utilized for movement of material within basement areas. A hand pulled pallet trucks and simple hoisting systems (e.g. A-frame hoists, pull-lift devices or trolley mounted engine hoists) will be utilized for movement of material within workshop areas.

Depending from the different items to be treated, additional sizing and decontamination will be carried out. Before final packing for dispatch, the treated items will be radiologically checked.

The items will be finally packed for dispatch according to the type, size and transfer destiny. Then D&D material will be loaded into standard 20 foot half height ISO containers and prepared for dispatch. The trucks will carry out the transport of D&D material to the FRMF or Buffer Storage of Landfill facility.

Any other very low level radioactive waste or low level radioactive waste material produced during D&D will be handled in a similar manner before being exported to the relevant on site facility for treatment.

D&D of pipework and auxiliaries in other levels

Depending on the work progress to remove and treat the intermediately stored waste at level -3.60 m, deplanting activities will start also at the Main Hall, beginning with auxiliary equipment at all levels. The equipment will be suitably pre-sized, sorted and put into crates or on pallets. Crates and pallets will be transferred by means of the EOTC and pallet trucks to level -3.60 m of the Main Hall for intermediate storage and/or for further treatment in the Aisle.

D&D ECCS pressurized tanks

After removal of auxiliary equipment steel floors (at levels +7.20 m and +13.20 m) will be partially dismantled step by step to allow suitable scaffolding of ECCS pressurized tanks. It is envisaged to use two sets of scaffold at the same time in order to provide parallel dismantling work. The tent structure over full scaffold length, mobile ventilation unit and automated cutting system (e.g. manually attached cutting tractor with mounted flame cutting torch) will be installed on each scaffolded tank.

Beginning on the side of the maintenance access and continuing to the opposite side of the Main Hall the ECCS pressurized tanks will be deplanted step by step. Deplanting of each tank will be started at the top. The cutting tractor will make circumferential and four longitudinal cuts thus producing ring-segment of approximately 3 tonnes weight which is in-situ subdivided into four quarters. Special lifting ring attached to EOTC slings will fix cut quarters within ring segment. Ring-segment will be suitably wrapped in polyethylene sheet and taped and then removed by means of the EOTC. The ring-segment will then be lowered onto pallet in the -3.60 m level and transferred to buffer storage pending processing in the decontamination workshop. If required by the overall work progress, the segments will be intermediately stored at level +0.00 m of the Main Hall, before they will shifted down to level -3.60 m (c.f. Figure 2.2.2-2).

D&D steel floors

Following the removal of the ECCS pressurized tanks and associated equipment, it will be possible to progressively remove the intermediate steel floors at levels +13.20 m and +7.20 m of the Main Hall. Each floor plate will be removed in turn using abrasive disc cutters to remove welds or flame cutting to remove sections. Prior to cutting free of any section of floor, that section will be attached to the EOTC using a suitable chain sling. Polyethylene wrapping is not considered necessary for this material due to the low contamination levels present outside the ECCS pressurized tanks and pipework.

Removal of installed equipment, final clean-up

After the complete deplanting of parts, the treatment workshops and other installations will be dismantled, decontaminated and removed. After complete evacuation of equipment, the Building 117/1 will be restored to its original condition, though particular equipment like dismantled EOTC could be temporary kept in building for further utilisation (i.e. for use in similar D&D activity at Building 117/2 of Power Unit 2).

After D&D implementation the Building 117/1 will remain not contaminated beyond its existing levels. The following elements and systems will remain in the building:

- Heat supply, heating and ventilation systems;
- Lighting and emergency lighting;
- Sewage system (pit, pump and pipeline to the Power Unit);
- Other miscellaneous equipment foreseen to be left in-situ (nitrogen system by-pass lines, alarm, communication).

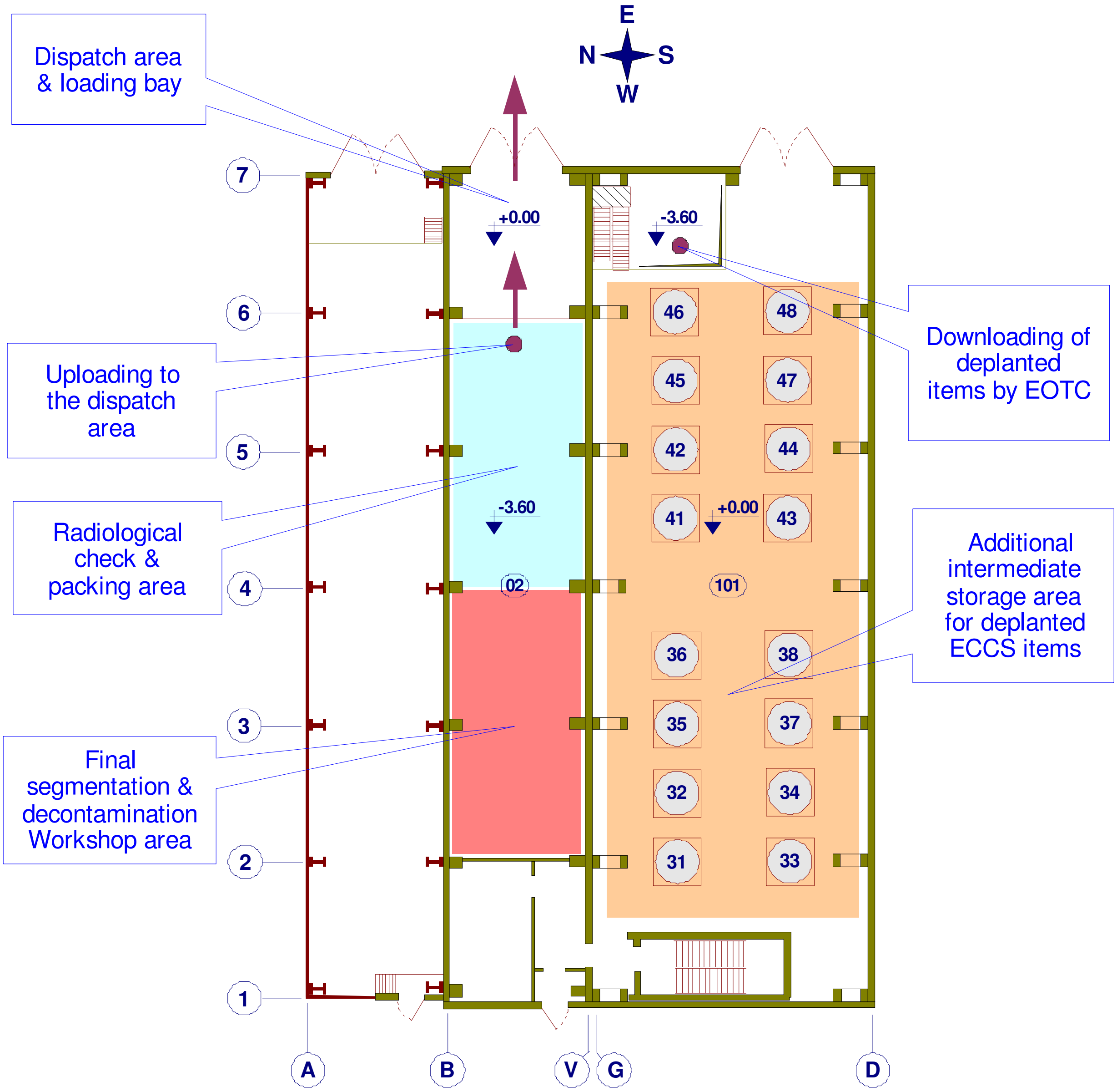

Figure 2.2.2-2 D&D activities at level +0.00 m of the Aisle and the Main Hall

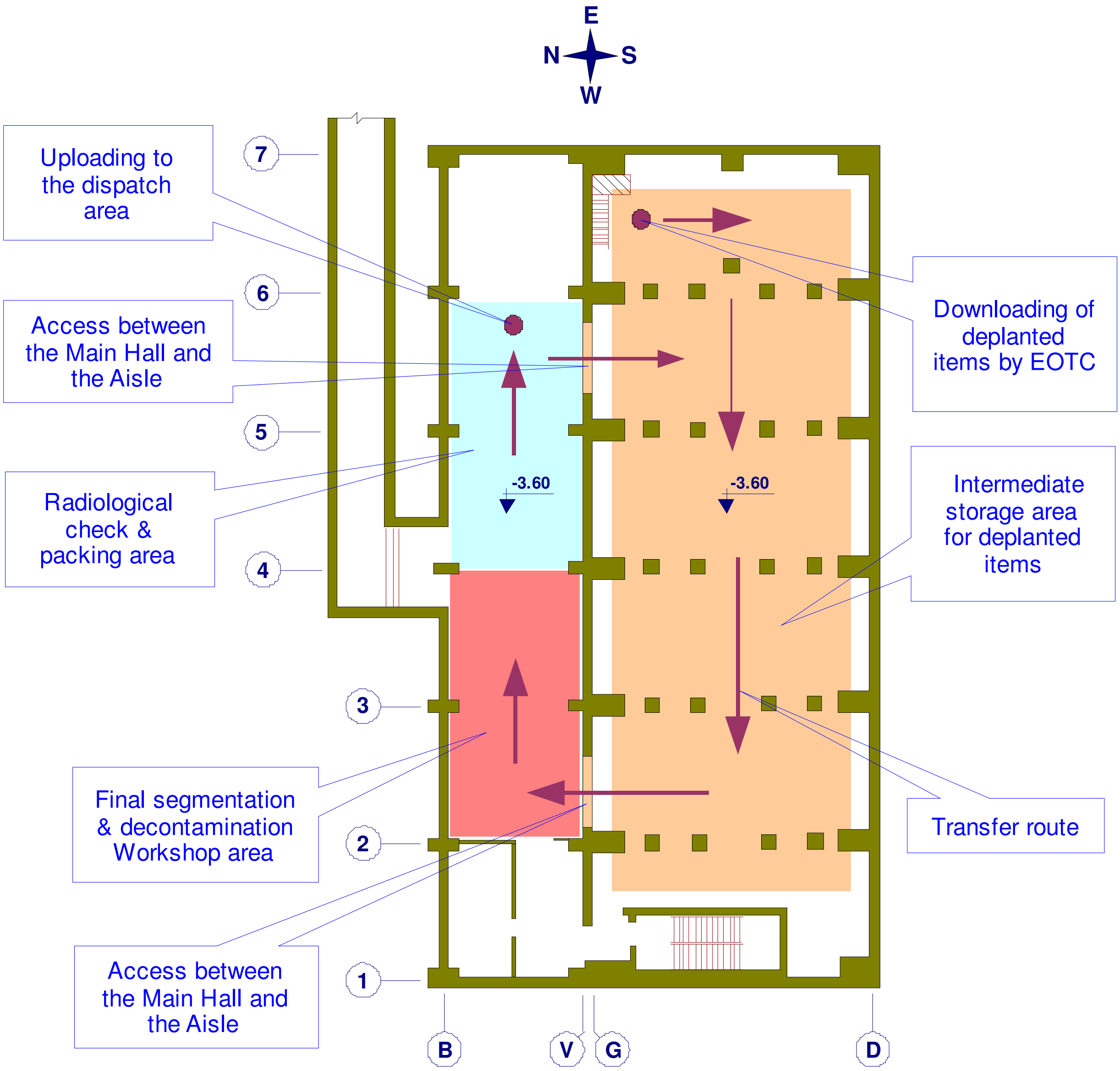

Figure 2.2.2-3 D&D activities at level -3.60 m of the Aisle and the Main Hall

2.2.2.2 FINAL SIZE REDUCTION AND DECONTAMINATION

The size reduction and decontamination workshop will be constructed as area containing following installations:

- Secondary size reduction equipment;
- Handling / lifting equipment;
- Monitoring area and equipment;
- Decontamination containment cell with vacuum blast equipment and handling equipment;
- Ventilation unit for decontamination cell.

The deplanted items will have undergone in-situ primary size reduction prior to arriving at the size reduction and decontamination facility. The final size reduction will suitable prepare items for decontamination, monitoring and final packaging before dispatch.

The secondary size reduction equipment will include vertical band saw with roller paths and saw guides. This unit will allow the pipe sections or valve bodies to be split longitudinally in order to allow decontamination of their inner surfaces. Reciprocating (sabre) saws and hydraulic shears can be used for general size reduction while flame cutter can be used for size reduction of heavy gauge items. Bolt croppers and other hand tools will also be foreseen.

The decontamination process will be based on the use of dry shot blasting applied using vacuum blasting technology with steel grit used as blast material. Vacuum blast equipment (c.f. example in Figure 2.2.2-4) consists of a dry abrasive blasting nozzle mounted within a localised vacuum extraction hood which prevents the release of airborne dust and contamination from the point of application and can be manually deployed. The vacuum retrieval system allows waste material to be transported directly into a waste package (e.g. 25 litre drum) and the inclusion of a shot recycling system can allow separation of reusable shot.

The vacuum blast decontamination will be performed in the containment cell which is currently envisaged as a modular glass-reinforced plastic construction (e.g. Nukem ModuCon). The containment cell will be equipped with a filtration unit including pre-filter and HEPA filters. Workplace lighting, hoisting equipment (for manipulation of material), HEPA filtered vacuum cleaner (for removal of residual surface dust or abrasive spillages) will also be provided in the cell.

Figure 2.2.2-4 Typical vacuum blast unit

In addition to the main technique of vacuum blasting, it may be necessary to carry out very small scale chemical decontamination on some intricately shaped items (e.g. foam decontamination may be required inside some valve bodies). In these cases, the item will be placed in a steel drip tray to prevent spillage of chemicals and the resulting wet waste collected in a plastic drum for transfer to the existing INPP Liquid Radioactive Waste Treatment Facility.

Dose rates from the material will be monitored prior to size reduction and at the end of the decontamination process. This is in addition to further radiological control stage associated with the final packaging of materials for dispatch.

A hand pulled or battery powered pallet trucks and simple hoisting system will be utilized for movement of material within workshop areas.

2.2.2.3 CONTAINMENT, CONTAMINATION CONTROL AND VENTILATION

The important factor in the proposed economic activity is radiological containment of D&D activity as the size reduction and subsequent decontamination of the dismantled material will release contamination, a proportion of which may become airborne. The Building 117/1 is not intact. There is no nuclear ventilation in the building which could assure filtration, control and monitor of emissions into environment. The physical containment afforded by the building structure should be supported by an appropriate ventilation system.

The two main principles that influence the building ventilation system design are:

- Cascade ventilation; In order to maintain containment and avoid cross contamination of areas, air must always be drawn into an area from an area of equal or lower contamination (flow from clean to dirty). Flows across boundaries between areas of different classification should be sufficient to ensure no reverse contamination occurs.

- Exhaust air filtration & monitoring; Air extracted from contaminated areas must be filtered to remove airborne contamination for discharge; this is carried out using HEPA filter installations. Following filtration, the air must be monitored for excessive activity levels prior to discharge.

The proposed economic activity foresees to upgrade Building 117/1 sealing capability with purpose to establish area where reduced pressure conditions respect to the environment could be maintain. The existing extract ventilation system for Building 117/1 will be upgraded by installing a new fan, flow control dampers and a new HEPA filtration unit. Also, the building isolation from Power Unit shall be assured in order to prevent the two ventilation systems adversely affecting each other. Exhausted air from the Building 117/1 will be monitored with a new stack monitoring system.

It is also envisage using of local Mobile Filtration Units (MFU) with pre-filter and two stage HEPA filters in areas where hot cutting or abrasive decontamination is to take place and thus locally remove excessive airborne contamination. Alarm systems (audible and visual) will be connected to the MFU’s to warn the operators if ventilation units fail.

It is envisaged to have MFU’s at the following locations:

- Decontamination facility containment cell;
- ECCS PT dismantling area #1 (MFU is connected to the bottom pipe of the tank being cut);
- ECCS PT dismantling area #2 (MFU is connected to the bottom pipe of the tank being cut);
- Pipe tunnel (connected to the end of pipe being cut – this unit will also need to provide adequate ventilation for the men working in the confined space).

The ventilation concept for D&D activity is shown in the figure below.

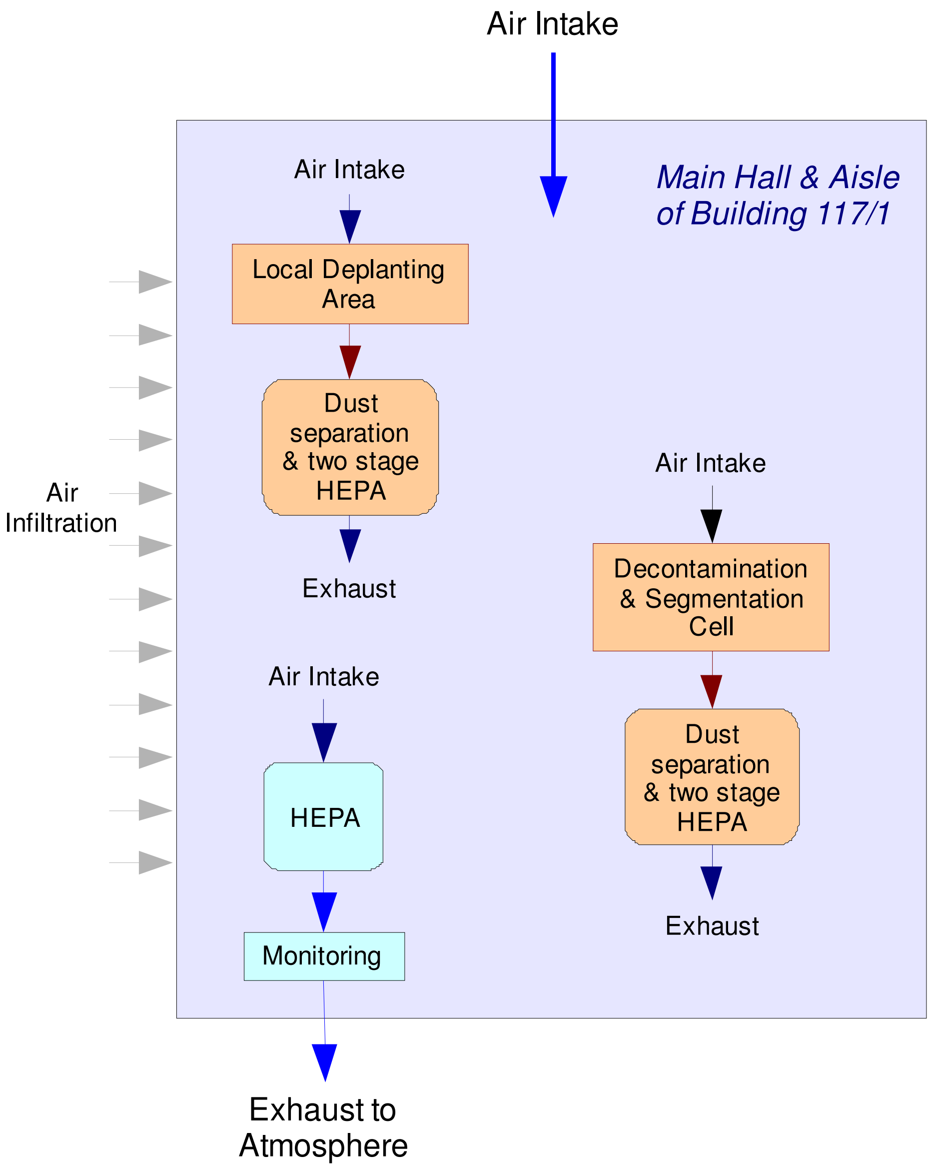

Figure 2.2.2-5 Ventilation concept for D&D activity in Building 117/1

2.2.2.4 MONITORING AND TRACKING OF D&D MATERIALS

As D&D material will be passed to the Free Release Management Facility (FRMF) or to the Buffer Store of the Landfill facility for detailed and final monitoring, the monitoring at the radiological check and packing workshop will be relatively simple as it is only required to allow transfer of material from Building 117/1 to another facility on INPP site.

The required monitoring system will consist of a handheld instrument providing a basic gamma spectrometry function along with the inclusion of a beta window. This will be sufficient for the anticipated nuclides within the surface contamination. Also, such monitoring will be sufficient to establish, with some level of confidence, that the material will meet the requirements for Free Release or Landfill.

All D&D material will be uniquely identified using a coding system before it is packed for transfer to the FRMF or Buffer Store of Landfill. The code will cross reference all the sentencing documentation. This will include information on dose levels, processing techniques, physical attributes and their location on the ECCS facility or Helium Make-up Station.

Any Very Low Level Waste (VLLW) or Low Level Waste (LLW-SL) material produced during D&D will be handled in a similar manner before being exported to the relevant on site facility for treatment.

2.2.2.5 PERSONNEL

The proposed economic activity at most possible extent will be conducted by personnel currently employed at the INPP. Amount of personnel involved in various activity stages may differ. It is planned that performance of D&D works itself will take approximately one year and about 30 workers could be directly involved in the D&D activity. Actual number of personnel required, working positions and involvement schedule will be finally defined after completion of Basic design.

The personnel involved in the D&D activities will be appropriately trained. The designer of the proposed economic activity will develop and implement knowledge transfer and training programs.

The Building 117/1 does not have toilets, shower rooms, rest rooms etc. The proposed economic activity does not foresee installation these facilities as well. Therefore existing infrastructure of Power Unit 1 will be used to cover personnel sanitary needs. The Basic design of the proposed economic activity shall foresee appropriate organizational and technical means for control and prevention of spreading of contamination outside the Building 117/1. This will include creation of areas for changing of overalls, installation of temporary sanitary lock with contamination control and decontamination possibility.

2.3 TRANSFER OF D&D MATERIALS

According to their radioactivity content, the management routes which are available for the dismantled components, equipment and structures are:

- Free release for reuse or disposal in a conventional dump or, in case of hazardous waste, for management by an authorized company;
- Disposal in a Landfill for very low level short lived radioactive waste. Waste packages in the Landfill facility will be disposed off during disposal campaigns, which will take place approximately once in two years. Between disposal campaigns the waste packages will be collected and stored in the Landfill Buffer Storage. The storage will be equipped with the waste characterization unit for the final characterisation and registration of the waste packages. Dismantled items can be transferred either directly Landfill Buffer Storage (for non compressible waste), or via the Building 150 (room 162) where compressible waste are compressed and packaged into the bales with a bale press.
- Should the need occur (items cannot be free released and do not meets WAC for Landfill disposal), transfer to Building 157/1, the existing solid waste interim storage facility, waiting availability of the new Solid Radioactive Waste Management and Storage Facility (SWMSF) for treatment/conditioning as radioactive waste and further interim storage before a Near-Surface Repository is made available in Lithuania.

The transfer of dismantled components from Building 117/1 to the Landfill Buffer Storage or Free Release Measurement Facility (FRMF) will be in standard 20 foot half height ISO containers (with external dimensions (length × width × height) 6.06×2.44×1.30 m, net weight approximately 2000 kg and internal volume approximately 15.2 m^3). Container load for FRMF will contain a combination of 200 litre drums of material, 1.2×0.9×0.9 m boxes of material, polyethylene wrapped pallets of material and individual polyethylene wrapped large size items. Container load for Landfill will mainly contain 200 litre drums of material and individual polyethylene wrapped items."

Landfill Buffer Storage and FRMF will be constructed to the East from the main building of the Power Unit 2, close to the construction site of the planned Power Unit 3. Both facilities will be located nearby to each other, in a distance of about 60 m. The INPP existing security fence will be modified such that the Landfill Buffer Storage and the FRMF are to be within the INPP secured area.

All radioactive or potentially radioactive materials transfer operations performed by this proposed economic activity will take place within boundaries of the INPP industrial site. The INPP existing internal roads and existing MAZ trucks will be used for the transport of containers.

Loading of the Half Height ISO containers will take place within Building 117/1; hence there are three possible options:

- Leave the container on the truck during loading. This ties up the truck for the loading period but has minimum capital cost;
- Purchase a low bed trailer. This would allow the container and trailer to be left for loading and collected by the truck when convenient;
- Purchase jockey wheel sets. These wheel arrangements attach to a Half Height ISO container and would serve the same purpose as the low bed trailer but would require the container to be lifted onto the truck by a crane or forklift outside the building.

The final option will be selected during Basic Design. The transport distance to the Landfill Buffer Storage or FRMF is about 900 m.

3 WASTE

The amounts of material to be dismantled and removed from Building 117/1 are presented in Chapter 2. This chapter discusses generation and management of other waste, which due to the specific of the selected technology, will result from implementation of the proposed economic activity.

3.1 NON-RADIOACTIVE WASTE

Non-radioactive waste will be managed in accordance with the requirements of waste management legislation and regulations in force [1–3], INPP instruction [4] and permission on integrated prevention and control of pollution [5].

Generation of non-radioactive waste during dismantling of the redundant equipment of Building 117/1 and proposed methods of waste management are summarised in Table 3.1.

It is important to note that the amounts of non-radioactive waste to be generated are small compared with the maximum amounts allowed to be produced and disposed of. For example, metal packaging (code 15 01 04), mixed packaging (code 15 01 06), wipers and rags (code 15 02 03), paper and cardboard (code 20 01 01) and mixed utility waste (code 20 03 01) will comprise only 0.003 %, 0.004 %, 0.0015 %, 0.001 % and 0.015 % respectively of the maximum amounts allowed to be disposed of by INPP according to the Permission of Integrated Pollution Prevention and Control for Ignalina Nuclear Power Plant, issued by Utena Region Environment Protection Department under the Ministry of Environment [5]. The maximum amounts allowed to be produced indicated in this Permission are even higher (see Table 3.1).

Table 3.1. Non-radioactive waste generation and management

Technological process	Waste					Maximum amount allowed to be produced [5], 10^3 kg/year	Maximum amount allowed to be disposed of [5], 10^3 kg/year	Proposed methods of waste management [5]
	Name	Amount, 10^3 kg	State of aggregation (solid, liquid, paste)	Code according to the Waste List [2]	Hazardousness			
D&D of redundant equipment of building 117/1	Metal packaging	~0.3	Solid	15 01 04	Non-hazardous	15 000	10 000	D5 – Disposal in industrial waste dump
D&D of redundant equipment of building 117/1	Mixed packaging	~0.2	Solid	15 01 06	Non-hazardous	60 000	50 000	D5 – Disposal in industrial waste dump
D&D of redundant equipment of building 117/1	Absorbents, wipers, rags etc.	~0.3	Solid	15 02 03	Non-hazardous	25 000	20 000	D5 – Disposal in industrial waste dump
D&D of redundant equipment of building 117/1	Paper and cardboard	~0.2	Solid	20 01 01	Non-hazardous	200 000	200 000	D5 – Disposal in industrial waste dump
D&D of redundant equipment of building 117/1	Mixed utility waste	~3	Solid	20 03 01	Non-hazardous	500 000	20 000	D5 – Disposal in industrial waste dump

3.2 RADIOACTIVE WASTE

The radioactive waste produced due to the D&D activities in Building 117/1 will be managed according to the new waste classification system [6]. The following waste streams for radioactive waste resulting from these D&D activities have been identified:

- Cutting slag and swarf. Each cutting technique utilised will produce a form of cutting waste, flame cutting will produce slag, milling or sawing will produce swarf. Such wastes will be collected at or near their source utilising standard techniques such as “catchpot” arrangements, vacuum cleaners etc. These granular wastes can be handled as VLLW in polyethylene bags inside 200 litre drums or can be used loose as a void filling agent in other VLLW packages;

- Spent cutting media. A variety of spent cutting media or components will be generated including damaged saw blades, worn abrasive discs and failed cutting nozzles. These items should be collected in polyethylene waste bags at each work area and be handled as VLLW in 200 litre drums;

- Spent decontamination media. The spent decontamination media will mainly consist of used abrasive shot mixed with removed corrosion deposits in a fine granular waste form. This material can be collected directly at the abrasive recycling unit into a into 20 litre polyethylene bags inside 25 litre drums. The material can be retained in this drum or used as void filling material in VLLW packages. Care needs to be exercised with this material as it constitute LLW-SL and also has a very high density;

- Packaging. Where possible, all packaging should be removed from equipment prior to entry to the controlled area in order to make this waste stream negligible. Any necessary packaging should be handled as VLLW or conventional waste;

- HEPA filters. The size reduction and decontamination operations within Building 117/1 will require the use of HEPA filtered extraction ventilation plants and these will generate contaminated filter elements during their operation. The filters are likely to be VLLW in most case and standard INPP procedures on filter handling would need to be followed;

- Cyclone waste. In areas where hot cutting and abrasive decontamination is being conducted, it will be necessary to equip the local ventilation plants with cyclone pre-filtration systems in order to prevent excessive quantities of fine particles reaching the HEPA filters and blinding them rapidly. The fine dust collected by the cyclone can be collected directly in a polyethylene bag and placed into a VLLW disposal drum;

- Polyethylene wrapping. Due to the need to control contamination, many cut sections of pipe will be temporarily sealed with polyethylene sheet and adhesive tape prior to being sent to the decontamination workshop. Where possible this material will be retained in place or reused. However, a certain amount of this material will enter the VLLW waste stream and should be collected in the polyethylene waste bag at each work area;

- Personal Protective Equipment. D&D operations are likely to require the use of increased PPE and in some cases Respiratory Protective equipment (RPE) which will lead to new waste forms being created. These new wastes are likely to be compressible wastes consisting of paper oversuits, overshoes, gloves, head covers and respirator filters. These items would be collected, where necessary, in polyethylene waste bags at an additional change barrier within Building 117/1 and then handled as VLLW via the existing compressible waste route;

- Concrete blocks from creation of passage(s) at level -3.60 m between Main Hall and Aisle. For creation of one passage it will be necessary to dismantle off of about 10 m^3 of concrete wall. The wall structure will be cut-out by means of a diamond wire saw. Concrete blocks resulting from this operation (max. weight per part approx. 750 kg) will be temporary stored aside. Existing radiological survey results do not give indications on presence of significant radioactive contamination on the floor and walls. Depending on monitoring results and decision taken the concrete blocks may be transferred to the FRMF or left inside the building to be managed later during building demolition stage. Insignificant amounts of concrete debris can be collected into plastic bags and used as void filling material in VLLW packages.

Amounts of the main streams of radioactive waste, produced due to the D&D activities, and their final waste destinations are summarised in Table 3.2.

Table 3.2. Amounts of the main streams of radioactive waste, produced due to D&D activities, and final waste destinations

Waste description	Waste type [6]	Generated amount, m^3	Waste handling in the Building 117/1	Final destination
Cutting slag and swarf from size reduction activity	VLLW	4.5	Waste will be collected into polyethylene bags inside 200 litre drums. Drums are placed into 20 foot half height ISO container	Landfill repository
Spent decontamination media (corrosion deposits, surface removed material, spent abrasive material)	VLLW or LLW-SL	6.6	Will be collected into 20 litre polyethylene bags inside 25 litre drums. Drums or polyethylene bags with VLLW will be placed into 20 foot half height ISO container. Drums with LL waste will be placed into INPP existing waste transport container	Landfill repository or Near surface repository
Wipers, rags, cleaning materials etc.	VLLW	20	Waste will be collected into polyethylene bags and placed into INPP existing waste transport container, bags will be compacted into ~1 m^3 volume bales	Landfill repository
Personal protective equipment (PPE) like paper oversuits, overshoes, gloves, head covers, respirator filters etc.	VLLW	10	Waste will be collected into polyethylene bags, bags will be compacted into ~1 m^3 volume bales	Landfill repository

The non-compressible VLLW packages collected into 20 foot half height ISO containers will be transported to the Landfill Buffer Storage.

The compressible VLLW packages at first will be transported to the Building 150 where they will be compacted into the ~1 m^3 volume bales using INPP existing bale press. The bales will be wrapped in polyethylene film, registered and send to the Landfill Buffer Storage. INPP existing containers and waste management procedures would be used for waste collection and transport.

Should it appear that some radioactive waste, produced due to these D&D activities, needs to be processed by the INPP planned new solid waste treatment facility, such waste will require interim storage, possibly in the existing storage building for operational waste, until the new facility is commissioned. INPP existing containers and waste management procedures will be used for waste collection and transport.

Liquid radioactive waste, if any (e.g. small amounts from foam decontamination), will be processed by INPP existing liquid waste treatment facility (LWTF). The LWTF is designed for storage and treatment of all liquid radioactive waste produced at INPP. INPP existing containers and waste management procedures will be used for waste collection and transport. No release of liquids into the environment from Building 117/1 is foreseen.

The new equipment used in the Building 117-1 D&D project will be decontaminated and re-used in further decommissioning projects.

4 POTENTIAL IMPACTS OF THE PROPOSED ECONOMIC ACTIVITY ON THE COMPONENTS OF THE ENVIRONMENT AND IMPACT MITIGATION MEASURES

The components of the environment that might be affected by potential impacts belong to the physical, chemical and biological media or to the socio-economic medium. The description of the environmental baseline included in the beginning of each Section of this Chapter characterises these components of environment prior to Building 117/1 D&D activities, so that the subsequent impact can be assessed.

For identification of the potential impacts of the project on the environment the Impact Identification Matrix provided in the EC funded study “Environmental Impact Assessment for the Decommissioning of Nuclear Installations” [1] is used as required in Technical Specification [2]. This relates the Building 117/1 D&D activities that might cause impacts to the components of the physical, chemical, biological and socio-economic environments affected. The Building 117/1 D&D activities with potential environmental impacts are selected from the generic list of the main actions to be considered provided in the EC study [1] and INPP Decommissioning EIA Programme [3] and identified for this particular project after analysis of alternatives. Other actions from the generic list, such as modification of the INPP industrial site, modification of property limits, demolition of buildings, construction of new buildings etc., are not relevant for this particular project.

The Impact Identification Matrix is presented in Table 4-1. When there is an interaction, the intersection box of the matrix is marked with a symbol and then the interaction is analysed in the corresponding Sections of this Chapter. This matrix makes it possible only to identify possible impacts, after which it is necessary to evaluate each cell marked in the matrix. Care should be taken to ensure that additional approaches are used in order to identify indirect and cumulative impacts. This matrix is only used as a starting point in the following assessment of potential impacts on the components of the environment and should not be regarded as a definitive list of likely impacts.

Table 4-1 Impact identification matrix for Building 117/1 D&D activities

			D&D PROJECT ACTIVITIES WITH POTENTIAL ENVIRONMENTAL IMPACTS												
			Modification of industrial buildings	Refill and earth movements	Recycling, reusing of waste	Transport of materials	Handling of hazardous materials (radioactive and toxic)	Controlled releases of liquid and gaseous effluents	Interim storage of solid radioactive waste	Occurrence of fires	Incidental/accidental releases of contaminated liquids and gases	Operating failures	Personnel accidents	Structural failures due to external events	Monitoring and control operations
COMPONENTS OF THE ENVIRONMENT			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
PHYSICAL ENVIRONMENT	E1	WATER		**X**		**X**	**X**	**X**	**X**		**X**			**X**	**X**
	E2	AIR		**X**		**X**	**X**	**X**	**X**	**X**	**X**			**X**	**X**
	E3	LAND AND SOIL	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**			**X**	**X**
	E4	UNDERGROUND					**X**	**X**	**X**		**X**			**X**	**X**
	E5	BIODIVERSITY		**X**	**X**		**X**	**X**	**X**	**X**	**X**			**X**	**X**
	E6	LANDSCAPE	**X**	**X**					**X**	**X**					
SOCIO-ECON. ENVIRON.	E7	POPULATION AND ECONOMY			**X**					**X**	**X**			**X**	
	E8	INFRASTRUCTURE				**X**				**X**					
	E9	CULTURAL HERITAGE													
	E10	PUBLIC HEALTH		**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

4.1 WATER

4.1.1 HYDROLOGICAL CONDITIONS

Lake Druksiai is the largest lake in Lithuania and has its eastern margin in Belarus. The total volume of water is about 369×10^6 m^3 (water level altitude of 141.6 m). The total area of the lake, including nine islands, is 49 km^2 (6.7 km^2 in Belarus, 42.3 km^2 in Lithuania). The greatest depth of the lake is 33.3 m and the average is 7.6 m. The length of the lake is 14.3 km, the maximum width 5.3 km and the perimeter 60.5 km. Some characteristics of the lake are given in Table 4.1.1-1 [1], [2], [3].

Table 4.1.1-1 Main data of hydrologic regime of water cooling reservoir of the INPP

No	Characteristics of Lake Druksiai	Value
1.	The catchment area of Lake Druksiai, km^2	564
2.	Water area of lake at normal affluent level, km^2	49
3.	Multiyear flow rate of water from lake, m^3/s	3.19
4.	Multiyear discharge from lake, m^3/year	100.5×10^6
5.	Multiyear quantity of atmospheric precipitation, mm/year	638
6.	Multiyear value of evaporation from water surface, mm/year	600
7.	Normal affluent level of lake, m	141.6
8.	Minimum permissible lake level, m	140.7
9.	Maximal lake level, m	142.3
10.	Regulating volume of lake, m^3	43×10^6
11.	Permissible drop of lake level, m	0.90

The INPP region is drained into watersheds of the rivers Nemunas (Sventoji) and Daugava. The small territory in the northeastern part of the region belongs to the upper course of the Stelmuze stream (Stelmuze–Luksta–Ilukste–Dviete–Daugava). The greater northern part of the region belongs to the Laukesa watershed (Nikajus–Laukesa–Lauce–Daugava). The greatest part of the region belongs to the Dysna watershed, which may be divided into two parts: the upper course of the Dysna and the Druksa watershed with Lake Druksiai (Druksiai lake – the present effluent Prorva – from the Drisveta or Druksa watershed – Dysna) (Table 4.1.1-2) [4], [5].

Table 4.1.1-2 The main river watersheds of the INPP region

River	Main watershed	The length of river till the INPP region, km	The distance from the mouth, km	Watershed area, km^2	Average height of spring flood, mm
Sventoji	Nemunas	23.0	241.6	218	90
Dysna	Daugava	19.1	154.3	445.2	90
Druksa	Daugava	0.5	44.5	620.9	90
Laukesa	Daugava	2.3	29.1	274.9	95
Stelmuze	Daugava	3.8	7.8	48.3	100

There are a lot of lakes in the INPP region. Their total area of water surface is 48.4 km^2 (without Lake Druksiai). The net density of rivers is 0.3 km/km^2. There are 11 tributaries to Lake Druksiai and one river that flows from it (the Prorva). The main rivers, which are connected to Lake Druksiai are the Ricianka (area of catchment: 156.6 km^2), the Smalva (area of catchment: 88.3 km^2) and the Gulbine (area of catchment: 156.6 km^2) [1], [2], [3], [4].

The catchment basin of Lake Druksiai (Figure 4.1.1-1, Table 4.1.1-1) is small (only 564 km^2). The greatest length of the catchment basin (from south-west to north-east) is 40 km; maximum width is 30 km and average 15 km. The lake is characterized by relatively slow water exchange rate. The main outflow is the River Prorva (99 % of all surface outflows) in the south part of the lake. Then, following the hydrographic net lake Druksiai → Prorva → Druksa → Dysna → Daugava → Gulf of Riga (at the Baltic Sea) which makes about 550 km, before the outflows of Lake Druksiai enters the Baltic Sea [4], [5].

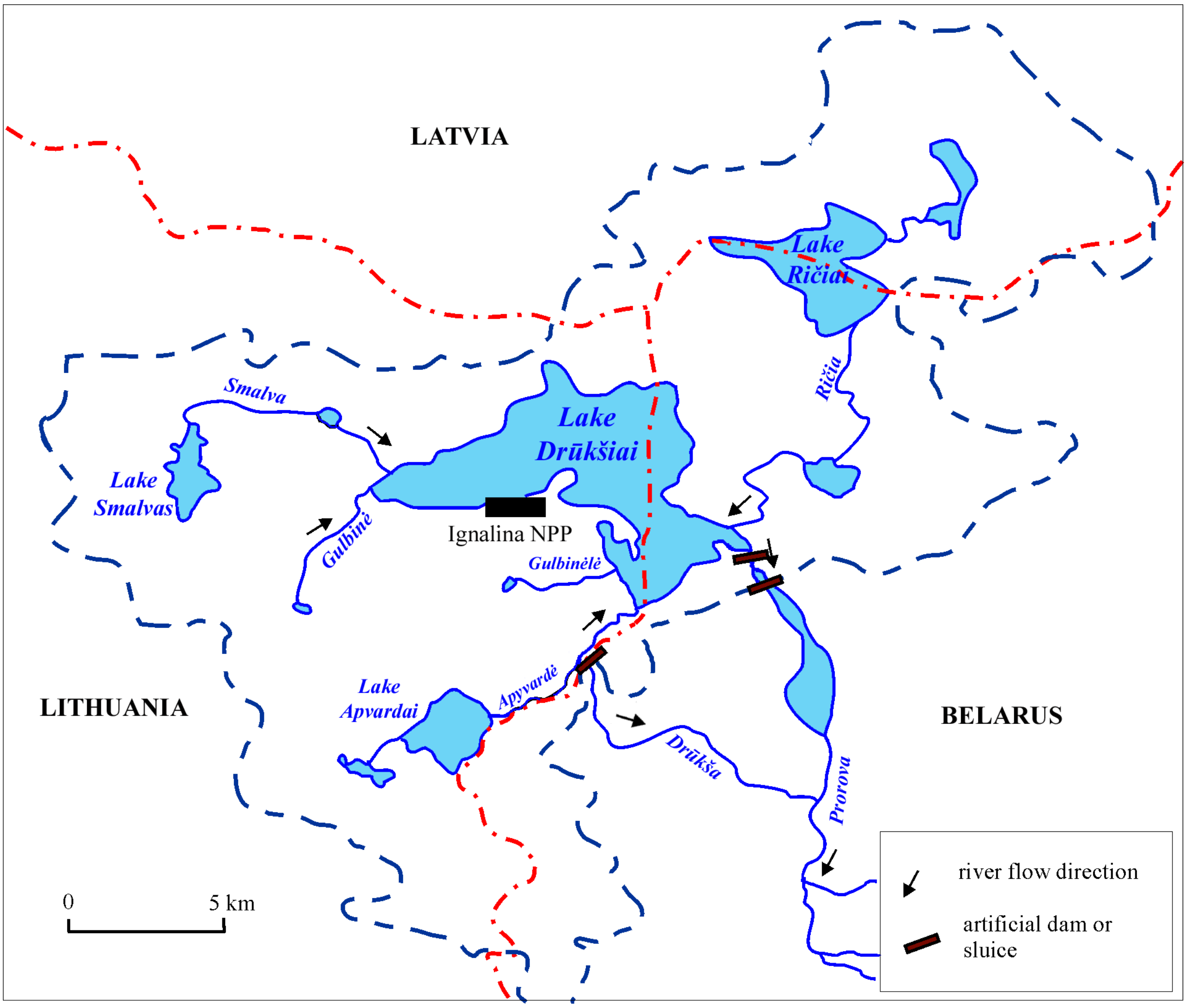

Figure 4.1.1-1 Scheme of Lake Druksiai catchment basin

The region is dominated by clay, loamy and sandy loam soils, which are responsible for varying water filtration conditions in different parts of the region. The percentage of the forestland of the region also varies widely, the highest being characteristic of Lake Druksiai basin. The average annual precipitation ranges from 590 to 700 mm. Two thirds of this value belongs to warm season. The snow cover accumulates 70–80 mm of precipitation. The summary evaporation from the land is about 500 mm [4].

4.1.2 HYDRO-GEOLOGICAL CONDITIONS

The INPP area is located in the recharge area of the eastern part of the Baltic artesian basin. The hydrogeological cross-section data indicates presence of hydrodynamical zones of the active, slower and slow water exchange. The active water exchange zone is separated from the slower water exchange zone by the 86–98 m thick regional Narva aquitard, located at the depth of 165–230 m. It is composed of loam, clay, domerite and clayey dolomite. The lower part of the aquitard contains an 8–10 m thick layer of gypsum-containing breccia. The slower water exchange zone is separated from slow water exchange zone by 170–200 m thick regional Silurian–Ordovican aquitard, located at the depth of 220–297 m [6].

The thickness of the Quaternary aquifer system is 60–260 m (mostly – 85–105 m). This aquifer system includes seven aquifers: the upper shallow unconfined groundwater aquifer and six confined groundwater aquifers located in Baltijos–Grudos, Grudos–Medininku, Medininku–Zemaitijos, Zemaitijos–Dainavos, Dainavos–Dzukijos and Dzukijos intertill fluvioglacial deposits [6].

The shallow aquifer is located in moor deposits (peat), aquaglacial deposits (sand, gravel, cobbles and pebbles), and the fissured upper part of the eroded silt of the glacial till, and the lenses of sand and gravel within the glacial till, here the aquifer is sometimes confined [6].

The aquifers in the intertill deposits are composed of sand, gravel, and in some palaeo-valleys – cobble and pebble deposits. The thicknesses of different aquifers vary from 0.3–2 m to 20–40 m, and in palaeo-valleys – 100 m and higher [6].

The confined aquifers in the intertill deposits are separated from each other by the low permeability till aquitards of sandy silt and silt, with lenses of sand and gravel. The thickness of different aquitards varies from 0.5 to 50–70 m, mostly – from 10–15 to 25–30 m [6].

The Sventoji–Upninkai aquifer system is located under the Quaternary aquifer system in the interlayering deposits of fine and very fine grained sand, weak cemented sandstone, silt and clay. The aquifer system is 80–110 m thick. The water of the Sventoji–Upninkai aquifer system is used for the water supply for Visaginas town and INPP. The Visaginas town waterworks (with water abstraction boreholes) are located in about 4 km to the southwest from the INPP building 117/1. The Sventoji–Upninkai aquifer system is relatively safe from the surface contamination. The system is covered by an isolating layer of more than 25 m and 50–75 % of its section is composed of clay or loam [5], [7].

According to the field investigations [8], [9] the groundwater at the INPP site was found mainly to be at 1.0–4.0 m below the soil surface. Locally the groundwater was found at depths of 0–19 m below the soil surface. The typical feature is that the aquifer can consist of several hydraulically connected layers. The main flow is directed to the north and northeast towards Lake Druksiai.

4.1.3 PLANNED WATER DEMAND

The planed water demand for Building 117/1 D&D activities is given in Section 1.5.2 and is estimated to be about 3000 m^3. The planned water demand is to be managed by the existing equipment and technologies of INPP and no modifications are foreseen. The potable water is supplied by “Visagino energija”. Existing installations are sufficient to provide necessary potable water supply. No new boreholes are foreseen. The potable water is processed at local purification plant. Its quality is constantly monitored.

4.1.4 WASTE WATER MANAGEMENT

There are no showers and lavatories in Building 117/1, therefore no domestic waste water will be produced. The INPP personnel, performing D&D activities in Building 117/1, will wash and change clothes in INPP personal service rooms, located in the adjacent buildings, from where waste water from showers and lavatories is discharged into the trap water system and is managed according to the requirements of LAND 42-2007 [11] and the Regulation on Waste Water Management [12]. Since the proposed economic activity is carried out by a relatively small number of the staff, no significant increase of the amount of INPP domestic waste water is foreseen.

Process water in Building 117/1 will contain liquids resulting from wet cleaning of the premises and water condensate from heating, ventilation and air conditioning system, collected in the drip trays of the air conditioning and heating systems.

For cleaning Building 117/1, a vacuum cleaner for wet cleaning will be used, that will significantly reduce volumes of utilized liquids. After performing wet cleaning of the premises, liquids from the vacuum cleaner tank will be discharged directly into the drain of the trap water system. Surface decontamination will be undertaken only in exceptional cases, when deviations from normal operation mode occur, e.g., when solid radioactive waste is spilled. In this case, decontamination would be performed by using wet absorbing materials (cloth, paper towels). Such decontamination requires only a small amount of liquids, which are absorbed by materials used for decontamination. As a result, during decontamination instead of liquid waste, wet solid combustible waste is generated.

Condensation water from heating, ventilation and air conditioning system, collected in the drip trays of the air conditioning and heating systems, is discharged into the trap water system. Moisture, condensed on the surfaces of the building equipment, etc., is drained onto the floor of the premises, where the equipment is located, and then flows into the trap water system.

Water from the fire control system, if used, will also be drained onto the floor of the premises, where the system is provided, and then will flow into the trap water system.

With the purpose to avoid radionuclides release to the environment, all sewage generating during the proposed economic activity will be treated as potentially radioactive. The sewage will be pumped to the INPP liquid radioactive waste treatment facility.

There will be no uncontrolled waterborne releases into the environment during the proposed economic activity under normal operation conditions. The structures, technological systems and components of Building 117/1 used for collection and storage of potentially radioactive effluents are designed to isolate them fully against any potential interaction with environmental water.

Flooding from Lake Druksiai is not expected. The storm water drainage systems, installed and permanently maintained within the INPP site, prevent the flooding of Building 117/1 by ground water. Surface waste water is managed according to the requirement of the Regulation on Surface Waste Water Management [10].

Building 117/1 is located within the INPP industrial site, which is surrounded by an existing system of boreholes for underground water monitoring. In each observation borehole water radionuclide contamination, as well as the chemical content of waste water and groundwater are monitored (see Chapter “Monitoring”).

Accidental spills of combustive-lubricating materials from vehicles during transportation of dismantled equipment of Building 117/1 could potentially contaminate soil and groundwater at the INPP site. The personnel will be trained to store and handle hazardous and toxic materials. An emergency response plan will be prepared, and the workers will be acquainted with waste water removal procedures and correspondingly trained in the event of an accidental spill.

4.1.5 POTENTIAL IMPACT

There will be no uncontrolled releases into the water component of the environment due to Building 117/1 D&D activities and therefore no potential impact is foreseen during normal operation. Possible accidents are analysed in Chapter 8 “Risk assessment”.

4.1.6 IMPACT MITIGATION MEASURES

Accidental spills of combustive-lubricating materials from vehicles during transportation of dismantled and decontaminated materials to the FRMF and Landfill Buffer Storage could potentially contaminate soil and groundwater at INPP site. A written emergency response plan will be prepared and retained on the site, and the workers will be trained to follow specific procedures in the event of an accidental spill.

Radionuclides concentration in the storm drain water and in the groundwater of each observation borehole, which are installed at INPP site, as well as the chemical content of storm drain water and groundwater are monitored (see Chapter 7 “Monitoring”).

4.2 ENVIRONMENTAL AIR (ATMOSPHERE)

4.2.1 CLIMATIC AND METEOROLOGICAL CONDITIONS

4.2.1.1 CLIMATE

The region concerned is located in the continental East Europe climate area. One of the main features of the climate in the region is the fact that no air masses are formed over this area. Cyclones are mostly connected with the polar front and determine continuous movement of air masses. The cyclones formed over the medium latitudes of the Atlantic Ocean move from the west towards the east through Western Europe and the INPP region is often located at the intersection of the paths of the cyclones bringing humid maritime air. The variation of maritime and continental air masses is frequent, therefore the climate of the region can be considered as a transient climate from the maritime climate of Western Europe to the continental climate of Eurasia [1].

In comparison with other Lithuanian areas, the INPP area is characterized by bigger variations of air temperature over the year, colder and longer winters with abundant snow cover, and warmer, but shorter summers. Average precipitation is also higher.

4.2.1.2 PRECIPITATION AND SNOW COVER

Monthly and annual averages of precipitation for the INPP region are given in Table 4.2.1-1, [2], [3] and [4]. Average annual amount of precipitation around INPP for the year 1988–2008 was 638 mm. About 65 % of all precipitation takes place during the warm period of the year (April–October), and about 35 % during the cold period (November–March).

Table 4.2.1-1 Monthly and annual averages of precipitation (mm) for the INPP region

Meteorological station and observation period	Month (s)												Total for months		
	January	February	March	April	May	June	July	August	September	October	November	December	Jan.-Dec.	Nov.-Mar.	Apr.-Oct.
Dukstas, 1961–1990	32	25	28	43	58	69	75	66	64	50	42	40	592	167	425
Utena, 1961–1990	39	31	37	47	53	69	73	75	66	50	57	53	650	217	433
Zarasai, 1961–1990	45	36	39	42	59	72	75	66	66	55	60	56	671	236	435
INPP, 1988–1999	41	41	46	33	55	84	60	64	70	66	58	57	676	244	432
INPP, 2000–2008	46	40	42	37	65	72	63	77	37	67	54	38	639	221	418

The snow cover in the region lasts about 100–110 days per year. Average thickness of snow cover is 16 cm, and maximum is 64 cm. Density of snow cover gradually increases from 0.2 to 0.5 g/cm^3 in the middle of March [1].

4.2.1.3 WIND

Western and southern winds dominate. The strongest winds have western and south-eastern directions. The average annual wind speed is about 3.5 m/s, and maximal (gust) speeds can reach 28 m/s. No-wind conditions are observed on average of 6 % of the time and last no more than one day

(24 hours) in the summer, and no more than two days in the winter [1]. The wind rose at INPP region is based on local wind measurements and is presented in Figure 4.2.1-1, [3].

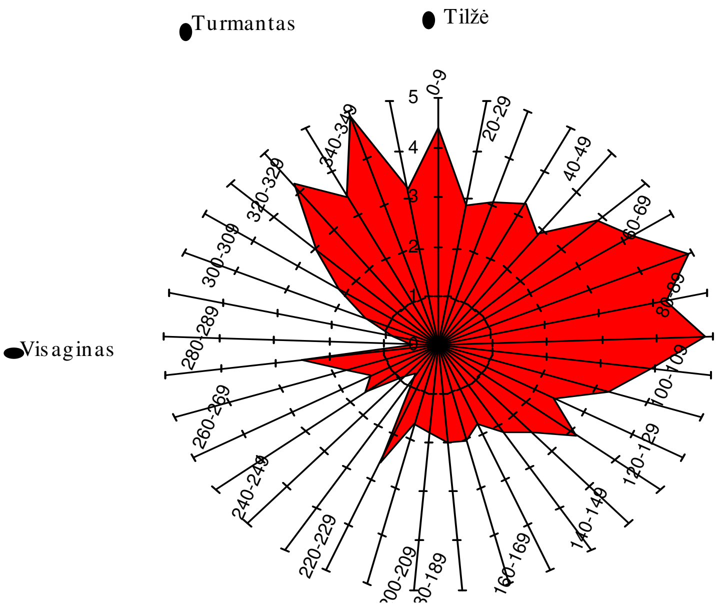

Figure 4.2.1-1 Wind rose at the INPP region (wind direction off the INPP)

Winds with speeds below 7 m/s dominate – recorded events constitute more than 90 % of the total number of observations. Recorded events with wind speeds above 10 m/s are not frequent – less than 10 events per year.

Calculated average wind pressure is 0.18 kPa and pulsation component of wind load is 0.12 kPa. With the reliability coefficient 1.4, calculated value of uniform wind load is 0.42 kPa and extreme wind load (with frequency 1 per 10 000 years) is 1.05 kPa with the reliability overloading coefficient 2.5.

Extreme events (tornadoes) are rare in the vicinity of Ignalina site. During a storm in 1998 a wind speed of 33 m/s was recorded. Tornadoes in the vicinity of the INPP have not exceeded class F-2 according to Fujita classification. The season of tornadoes begins at the end of April and ends in the first half of September. The direction of tornado motion is from south-west to north-east in 75 % of the cases. The average length of tornado shift trajectory is 20 km and the length varies from 1 to 50 km. Average width of the tornadoes is 50 m with variations from 10 to 300 m. Calculated maximum tornado velocity with a frequency of 1 in 10 000 years is 39 m/s [5].

4.2.1.4 TEMPERATURE

Monthly average temperatures in the INPP region are given in the Table 4.2.1-2, [6], [3]. Average calculated air temperatures of the coldest five-day period are –27 °C. Absolute maximum of recorded temperature is 36 °C and absolute minimum is –40 °C. Absolute maximum of calculated temperature with a frequency of 1 in 10 000 years is 40.5 °C and absolute minimum of calculated temperature with a frequency of 1 in 10 000 years is –44.4 °C.

Table 4.2.1-2 Monthly average temperatures (°C) for the INPP region

Meteorological station and observation period	Month												Average per year
	January	February	March	April	May	June	July	August	September	October	November	December	
Dukstas, 1961–1990	-6.8	-5.9	-1.9	5.2	12.1	15.5	16.8	15.9	11.2	6.2	0.9	-3.8	5.5
Utena, 1961–1990	-6.0	-5.2	-1.2	5.5	12.2	15.6	16.8	15.9	11.4	6.6	1.4	-3.2	5.8
INPP, 1988–1999	-2.5	-2.2	0.3	6.6	12.4	16.5	17.9	16.5	11.3	6.0	-0.1	-3.1	6.6
INPP, 2000–2008	-3.1	-5.0	0.3	7.2	12.4	15.7	18.8	17.4	12.2	7.0	1.8	-1.9	6.9

4.2.2 POTENTIAL NON-RADIOLOGICAL IMPACT

4.2.2.1 LIMITATION OF NON-RADIOACTIVE EMISSIONS INTO ATMOSPHERE FROM THE INPP SITE

Release of non-radioactive pollutants into atmosphere from the INPP site is regulated by conditions of the Integrated Permission of Pollution Prevention and Control for the INPP [7]. The document provides information on actual airborne emissions from the INPP for the year 2006 and permitted (licensed) emissions for the years 2007 - 2009. The conditions for airborne emissions have been established on the basis of the Environment Air Impact Assessment Report [8]. The Permission has to be renewed by the year 2010.

The permitted emissions for carbon monoxide (CO), nitrogen oxides (NO_X) and solid particles at the INPP site are provided in the Table 4.2.2-1.

Table 4.2.2-1 INPP licensed emissions into atmosphere for carbon monoxide, nitrogen oxides and solid particles

Pollutant	Pollutant source group	Pollutant code	Licensed emission for years 2007-2009, kg
CO	A	177	99 652
	B	5917	31
	C	6069	33
NO_X	A	250	41 394
	B	5872	10
	C	6044	39
Solid particles	A	6493	74
	B	6486	243
	C	4281	1 671

According to requirements of the [9], the stationary pollutant sources are grouped into three groups A, B and C.

The group A includes pollutant sources where emissions result from production of heat and power energy. Sources on INPP site are 12 emergency diesel generators and a new steam boiler plant. The diesel generators' building is located approximately in 300-400 m to the south-east of Building 117/1. The emissions occur from the 27.4 m height stacks. The new steam boiler plant is located approximately 450 m to the south-west of Building 117/1. The emissions occur from two 45 and 100 m height stacks.

The group B includes pollutant sources which emissions result from the fuel combusting installations (furnaces etc.). Source on the INPP site is furnace located in the repair shop building. The emission occurs at 11 m height in about 450 - 500 m to the south-west of Building 117/1.

The group C include pollutant sources which emissions results from chemical reactions of technological processes. This group comprises all other INPP stationary pollutant sources, in total 24 units in range from 100 to 700 m around the Building 117/1. Most of them are located in the repair shop and equipment storehouse buildings, power units 1 and 2, nitrogen and oxygen workshop building. Emission heights are variable and mostly fall into the range 1.5 m to 15 m with exception for releases from the main ventilation stacks of the power units (where release height is 150 m).

4.2.2.2 POTENTIAL NON-RADIOACTIVE EMISSIONS INTO ATMOSPHERE DUE TO THE PROPOSED ECONOMICAL ACTIVITY

Potential airborne emission sources and release pathways

In order to dismantle and size reduce equipment and installations in the Building 117/1 it is foreseen to use flame cutting (e.g. oxygen-acetylene) and mechanical cutting (e.g. saw) techniques. The use of flame cutting will result in generation of airborne fumes and gases. The use of mechanical cutting will result in generation of airborne dust.

Local ventilation systems (e.g. MFU) equipped with pre-filters and HEPA filters will be set up at the main cutting locations in order to clean the air from pollutants generated during cutting processes, c.f. chapter 2.2.2.3. In addition to the local ventilation units, the Building 117/1 ventilation system will be equipped with HEPA filters in order to clean exhaust air prior discharge to the atmosphere. The Building 177/1 and existing ventilation system will be upgraded to assure that all airborne emissions from the building will be released in a controlled manner through the ventilation stack. The exhaust parameters are provided in the Table 4.2.2-2.

Table 4.2.2-2 Stationary environment air pollution source (Building 117/1 upgraded exhaust ventilation system)

Pollution source			Parameters of exhaust gases *)			Release duration, h **)
Coordinates	Height, m	Exhaust mouth diameter, m	Speed, m/s	Tempera-ture, °C	Volume yield, m^3/h (Nm^3/s)	
X = 6166274 Y = 661209	21	0.8	9.95	20	18 000 (5.4)	1 800

*) The upgrading of the Building 117/1 ventilation system (c.f. chapter 2.2.2.3) may require increasing the exhaust capacity. The exhaust volumetric yield may reach 29 000 m^3/h (8.7 Nm^3/s);

**) The existing exhaust system was used occasionally, e.g. in case of low oxygen concentration in the rooms etc. During the D&D activity the ventilation system will work on a permanent basis.

In order to remove D&D materials from the Building 117/1, it is foreseen to use diesel fuelled trucks. The use of trucks will lead to emission of engine exhaust gases.

All the D&D materials transfer operations performed by this proposed economic activity will take place within boundaries of the INPP industrial site, c.f. chapter 2.3. The INPP existing MAZ trucks will be used for the transport of containers with D&D material. The operation of the INPP existing trucks and resulting impact on environment are already covered by conditions of the Integrated Permission of Pollution Prevention and Control for the INPP [8]. Therefore impact on the environment due to emissions that would result from the mobile sources is not considered further in this report.

Estimation of airborne emissions into atmosphere due to flame cutting

The equipment to be flame cut (pipes, ECCS pressure tanks, etc.) is made from carbon steel. The surfaces of some components are painted, however available information do not indicate that the paint could contain hazardous materials which could be formed or be released during deplanting activity [11].

Flame cutting of the carbon steel will lead to release of the following airborne pollutants:

- Welding aerosols;
- Welding gases – carbon and nitrogen oxides (CO, NO_X).

Guiding values for the release fractions can be taken from the methodology [10]. The provided release fractions linearly depend on thickness of material to be cut. Therefore release fractions for the cutting thicknesses as relevant for the proposed economical activity have been defined using linear approximation. The selected release fractions are presented in Table 4.2.2-3.

Table 4.2.2-3 Pollutant airborne release fractions for the flame cutting of carbon steel

Components	Thickness of cut material, mm	Airborne release fraction, g/m		
		Welding aerosols	Welding gas,	
			CO	NO_X
Steel platforms, floors	4	1.8	1.3	0.9
Pipes ∅154×9, ∅219×9	9	4.5	2.18	2.20
Pipes ∅219×13	13	5.9	2.5	2.25
Pipes ∅325×19	19	8.6	2.9	2.39
Pipes ∅426×24	24	10.8	3.1	2.5
ECCS Pressurized Tanks	80	36	4.5	3.0

The geometric characteristics and the cutting length of the flame cut components have been defined on the basis of design drawings [11]. It is foreseen that pipes are cut into segments up to 1.1 m length (suitable for storage in the standard crates). The steel platforms and floors are cut into elements similar to those as were used during construction works.

The two stage HEPA filtration with total efficiency of 99.99% is considered when calculating release of airborne aerosols into atmosphere outside the Building 117/1. The filtration will be assured either by use of MFU or by the building ventilation system. No filtration is considered for emission of gases.

The estimation of airborne release into atmosphere resulting from the use of the flame cutting technology is presented in Table 4.2.2-4. The data in the table are summarized considering sequence of the main deplanting steps, c.f. chapter 2.2.2.1.

About 70% from the total amount of pollutants will be released during flame cutting of the ECCS PT. Another about 8% from the total amount of pollutants will result from deplanting of the ECCS pipelines and the steel structures at the basement levels of the Main Hall and the Aisle. Assuming that the large diameter pipes will be halved by means of the flame cutting, the airborne pollutant share will be about 12% from the total amount. The last about 10% from the total amount of pollutants are expected to be produced during dismantling of the steel floors at levels +7.2 m and +13.2 m.

Table 4.2.2-4 Airborne emissions into atmosphere due to flame cutting of components in the Building 117/1

Deplanting activity	**Cutting length, m**	**Cutting thickness, mm**	**Released pollutants, kg**		
			Aerosols	**CO**	**NO_X**
Flame cutting ECCS pipelines and steel platforms in rooms 01 and 02	306	4 - 24	0.00025	0.81	0.66
Flame cutting ECCS pipelines in room 08	155	24	0.00017	0.48	0.39
Flame cutting pipelines in room 401	22	9	0.00001	0.05	0.05
Flame halving large diameter pipes in the size reduction and decontamination workshop	669	9 - 24	0.00063	1.95	1.63
Flame cutting of ECCS PT in rooms 401, 301, 101	2747	80	0.00989	12.36	8.24
Flame cutting steel floors at levels +7.2 and +13.2 m	1327	4	0.00024	1.73	1.19
Total release			**0.011**	**17.37**	**12.15**

Estimation of airborne emissions into atmosphere due to mechanical cutting

The large diameter pipes may also be halved by means of mechanical cutting. The use of saw for halving of pipes will produce steel dust. Cutting will be performed within the size reduction and decontamination workshop. The workshop will be constructed as containment cell and will be equipped with a filtration unit including pre-filter and HEPA filters. Therefore all the dust and aerosol emissions from the cell will be filtered.

The amount of produced dust is proportional to the amount of mechanically affected material, i.e. cut length, width and thickness of the cut material. In calculation of airborne emissions it is assumed that up to 10% from the total amount of the produced swarf may become airborne and is released after pre-filtration and HEPA filtration of total efficiency of 99.99%. Saw thickness assumed to be 4 mm. The potential airborne releases into atmosphere are summarized in the Table 4.2.2-5.

Table 4.2.2-5 Airborne emissions into atmosphere due to mechanical halving of pipes in the Building 117/1

Type of pipes	Cutting length, m	Swarf mass, kg	Released dust, kg
Pipes Ø159×9 and Ø219×9	66.7	18.9	0.00019
Pipes Ø219×13	84.3	34.5	0.00034
Pipes Ø325×19	51.7	30.9	0.00031
Pipes Ø426×24	466.5	352.0	0.00352
Total	**669.2**	**436.2**	**0.00436**

It can be seen from the table, that mechanical halving of the largest Ø426×24 pipes would result in emission of more than 80% from the total dust release. The share of remaining components is less than 20%. The total mass released solid particles is estimated to be less than 5 g. The airborne emissions are evaluated to be very low.

It can be expected that due to higher efficiency, the flame cutting will be selected as the primary option for the halving of the large diameter pipes (or for a part of amount of the large diameter pipes). In this case the airborne releases will be lower as estimated. Therefore release of pollutants due to halving of pipes by means of flame cutting is also considered, c.f. Table 4.2.2-4.

Summary of emissions into atmosphere

The emissions resulting from the proposed economic activity are to be classified as emissions from a stationary pollutant source of the group C. Comparison of the estimated emissions into atmosphere from the Building 117/1 with the INPP site licensed emissions for the group C pollutant sources is given in Table 4.2.2-6.

Table 4.2.2-6 Comparison of the INPP site licensed (for the group C pollutant sources) and estimated emissions due to the proposed economical activity

Pollutant	Pollutant source group	Pollutant code	Permissible emission for years 2007-2009, kg	Estimated emissions due to D&D of Building 117/1 equipment	
				Total, kg	Fraction from licensed values
CO	C	6069	33	17.37	52.6%
NO_X	C	6044	39	12.15	31.2%
Solid particles	C	4281	1671	0.015	0.001%

The proposed economic activity planned emissions will constitute about 30-50% from the licensed values for the group C pollutant sources. The updating of the Integrated Permission of Pollution Prevention and Control shall take into account the increase of airborne emissions from the Building 117/1 equipment D&D activities.

The emissions of aerosols and dust, due to planned use of local and overall building filtration systems are negligible and potential impact on environment therefore is further not considered. Usage of effective systems for filtration of emissions is necessary for assurance of radiation safety and for consideration of ALARA principle, c.f. chapter 4.2.3.

Comparison of the planned emissions with the total emissions from the existing stationary sources at the INPP site is given in Table 4.2.2-7.

Table 4.2.2-7 Comparison of the INPP site total licensed emissions with estimated emissions due to the proposed economical activity

Pollutant	Total licensed emissions from INPP site for years 2007-2009, kg *)	Estimated emissions due to D&D of Building 117/1 equipment	
		Total, kg	Fraction from licensed values
CO	99 716	17.37	0.017%
NO_X	41 443	12.15	0.029%
Solid particles	1 988	0.015	0.001%

*) Total licensed emissions consider emissions from all pollutant sources of groups A, B and C. These emissions form actual on site concentration of pollutants in the ambient air.

Respect to the total emissions from the INPP site, the additional increase of emissions due to Building 117/1 equipment D&D will constitute of about 0.2–0.3%. So, the increase of the total emissions from the INPP site due to implementation of the proposed economic activity would not be significant.

4.2.2.3 AMBIENT AIR NON-RADIOLOGICAL POLLUTION FORECAST

Ambient air pollution by carbon monoxide and nitrogen oxides is regulated by requirements of the normative documents [12], [13]. The requirements are summarized in the Table below.

Table 4.2.2-8 Limit values for carbon monoxide and nitrogen oxides in the ambient air

Pollutant	Parameter	Averaging period	Limit value *)
CO	Limit value for the protection of human health	Maximum daily 8 hour mean	10 mg/m^3
NO_X	Hourly limit value for the protection of human health	1 hour	200 $\mu g/m^3$ NO_2 not to be exceeded more than 18 times a calendar year
	Annual limit value for the protection of human health	Calendar year	40 $\mu g/m^3$ NO_2
	Annual limit value for the protection of vegetation	Calendar year	30 $\mu g/m^3$ NO_X

*) Enters into the force after January 1, 2010 or earlier. The limit value must be standardised at a temperature of 293 K and a pressure of 101.3 kPa.

The Building 117/1 equipment dismantling will consist of several deplanting stages which will be performed successively, c.f. chapter 2.2.2.1. At first the ECCS PT pipelines and steel structures at the lower levels of the Main Hall and of the Aisle will be deplanted in order to fee up area for installation of size reduction and decontamination workshops. After that, deplanting of the ECCS PT can be started. Deplanting of the steel floors at levels +7.2 and +13.2 m will follow deplanting of the ECCS PT.

Emission of pollutants during different deplanting stages will vary. It could be expected that most extensively flame cutting will be used during deplanting of the ECCS PT. At the same time, the pipes halving will be performed at the size reduction and decontamination workshop. Therefore, the possibility of meeting established ambient air pollution limitations for the short averaging periods is demonstrated considering emissions arising at the stage of dismantling of the ECCS PT.

The preliminary estimations based on Contractor experience foresee that the deplanting of the one ECCS PT (without consideration of time necessary for the preparatory activity) will take about 53.5 working hours with effective flame cutting time of 23.5 h. Maximal continuous cutting time would be up to 1 h. As the two ECCS PT deplanting positions are planned, the preparatory works for deplanting of the next ECCS PT can be performed in advance and the flame cutting of the next ECCS PT will start immediately after dismantling of the previous ECCS PT.

Basing on the 6 h per day effective working time [11], the dismantling of one ECCS PT would take about 9 working days with effective flame cutting time of 2.64 h per day. Estimated emissions into atmosphere are summarized in the Table below.

Table 4.2.2-9 Emissions into atmosphere due to flame cutting of the ECCS PT

Emission type	**Amount, g**	
	CO	**NO_X**
Emissions due to deplanting of one ECCS PT	772.49	514.99
Emissions per working day	86.63	57.76
Maximal emissions per 1 hour	32.87	21.91

Compliance with established requirements for limitation of ambient air pollution can be preliminarily estimated using the simplest and most pessimistic screening approach assuming that pollutant concentration at the receptor location is equal to the pollutant concentration at the point of release (e.g. Building 117/1 ventilation stack exhaust). Thus dispersion of pollutants in the downwind direction is conservatively neglected.

The ground level pollutant concentration in ambient air C_A for a certain averaging period of time can be calculated:

$$C_A = \frac{P_P \times M_{\Delta t}}{V \times \Delta t}$$

Where:

$M_{\Delta t}$ - is the amount of pollutant released during averaging period Δt, Table 4.2.2-9.

Δt – is the concentration averaging period;

V – is the exhaust flow rate, Table 4.2.2-2;

P_P – is the fraction of the time the wind blows towards the receptor location. In case of the short time averaging periods (e.g. 1 – 8 hours), the value of $P_P = 1$ should be used assuming no changes in wind direction. In case of calculation annual averages, the value of $P_P = 0.25$ can be justified as conservative for screening purposes.

The screening calculation results for the concentration of CO in the ambient air depending on upgraded building ventilation system exhaust flow rate are presented in the Table 4.2.2-10. The calculated concentration of CO is below the limit for the maximum daily 8-hour mean. Considering also subsequent downwind dispersion of pollutant in the atmosphere, it can be concluded that concentration of CO in the ambient air will be low and requirements for limitation of ambient air pollution can be met. The background CO concentration due to existing emissions does not exceed 0.04 mg/m^3 [8] and also is far below the established limit.

Table 4.2.2-10 Estimated concentrations of the CO in the ambient air depending on the upgraded building ventilation system exhaust flow rate

Parameter	**Value for the exhaust rate**	
	18 000 m3/h	**29 000 m^3/h**
Maximum daily 8 hour mean concentration limit, mg/m^3	10	
Estimated maximum 8 hour mean concentration, mg/m^3	0.602	0.249
Fraction of calculated concentration from concentration limit	6.02%	2.49%

The calculations of annually average concentrations shall consider total release of pollutant during Building 117/1 equipment D&D, c.f. Table 4.2.2-4. The screening calculation results for the annual concentration of NO_X in the ambient air depending on the upgraded building ventilation system exhaust flow rate are presented in the Table 4.2.2-11. Calculations assume that all nitrogen is released in the form of NO_2. Considering also subsequent downwind dispersion of pollutant in the atmosphere, it can be concluded that concentration of NO_X in the ambient air will be low and requirements for limitation of ambient air pollution can be met. The annual average of background NO_X concentration due to existing emissions does not exceed 1 µg/m^3 [8] and also are far below the established limit.

Table 4.2.2-11 Estimated concentrations of the NO_2 in the ambient air depending on the upgraded building ventilation system exhaust flow rate

Parameter	**Value for the exhaust rate**	
	18 000 m3/h	**29 000 m^3/h**
Calendar year mean concentration limit, µg/m^3	40	
Estimated calendar year mean concentration, µg/m^3	19.3	12.0
Fraction of calculated concentration from concentration limit	48.2%	29.9%

The conservative "no dilution" approach is not sufficient for justification of compliance with requirement for NO_2 concentration hourly limit value, c.f. Table 4.2.2-8. Therefore a more realistic approach, which takes into account dispersion of pollutant in the atmosphere, shall be used.

For a continuous release from an elevated point source under constant wind velocity and atmospheric conditions the well known Gaussian plume model can be used. The concentration of pollutant in the ambient air C_A at the certain point downwind of the release can be calculated as:

$$C_A = Q \times X$$

Where:

Q – is the pollutant release rate, g/s;

X – is the so called dispersion coefficient which is defined as the time-integrated concentration at on the diffusion axis per unit of release, s/m^3. The dispersion coefficient and hence the concentration of pollutant in the air is dependent upon a number of variables, including weather type, distance from release point to reception point and height of release point. For the purpose of preliminary estimation of potentially expected near surface concentration of pollutant a weather conditions and reception point location leading to highest value of ground level concentration have been assumed. The dispersion coefficient has been taken from [14] for a 30 minute release and release height of 20 m. The maximal value for the dispersion coefficient is therefore 4.0×10^{-4} s/m^3 under category weather A conditions.

The estimated short time release concentration for NO_2 is 2.4 µg/m^3. The maximal short-time background concentration of nitrogen oxides due to existing emissions is reported [8] to be in range from 9.3 to 12.8 µg/m^3. The total concentration of nitrogen oxides will be below established hourly limit value for the protection of human health (200 µg/m^3).

Basing on preliminary estimations it can concluded that emission of non-radioactive pollutants into atmosphere will not compromise the limits imposed by the regulations in force. Current ambient air pollutant levels in the environment of INPP will not be significantly enhanced by the planned D&D activities. Ground level concentrations of pollutants in ambient air will be below the limit values for the protection of human health.

4.2.2.4 NON-RADIOLOGICAL IMPACT MITIGATION MEASURES

No specific environmental impact mitigation measures in addition to those planned in the design concept are proposed. The use of pre-filters and high efficiency HEPA filters will prevent any significant dust or other particular matter being released into atmosphere.

The release of gases resulting from the flame cutting should be considered when updating the Integrated Permission of Pollution Prevention and Control [7]. However in the context of total emissions from the INPP site, the increase of emissions due to the proposed economical activity will not be significant.

The use of wet type filters, which could wash out gases from the flame cutting, may be considered by the design. However this option will result in generation of secondary liquid waste within the controlled area. The waste has to be managed as radioactive and therefore this option may not be feasible from economical and radiation protection points of view.

Personnel safety during performance of flame cutting works shall be assured by design. Monitoring of working conditions in specific working locations and access routes would be important; therefore use of local or portable monitors for detection of content of hazardous gases shall be foreseen.

4.2.3 POTENTIAL RADIOLOGICAL IMPACT

Implementation of the proposed economical activity potentially may lead to generation of certain amount of airborne activity. The planned design solutions [1], [2] foresee multi barrier concept for localization, entrapment and collection of airborne radioactive materials thus preventing any significant radioactive emissions into working environment and / or atmosphere. Nevertheless, the radiological impact on environment components due to potential release of airborne activity shall be considered and investigated.

4.2.3.1 ACTUAL RADIOACTIVE EMISSIONS INTO ATMOSPHERE AND RADIOLOGICAL IMPACT

The radioactive emissions into atmosphere from the INPP site are limited by the conditions of the Permission for the Emission of Radioactive Material into Environment [3]. The document provides annual limits for the specific radionuclides that can be released into atmosphere and includes information on future planned INPP annual radioactive emissions.

The annual limit values for radioactive emissions are established basing on total annual effective dose of 0.1 mSv which corresponds to a half of the established dose constraint [4]. The annual limits are provided for emissions through the main ventilation stacks (release height is 150 m) of power units. If actual emissions occur at lower heights, the released activity shall be appropriately scaled [5] prior comparison with licensed values. The daily releases shall not exceed 1% and the monthly releases shall not exceed 25% from the annual limit values.

The summary of the licensed conditions for radioactive emissions into atmosphere is presented in Table 4.2.3-1. INPP planned annual operational releases constitutes about 6.8% from the permissible limit.

Table 4.2.3-1 Summary of licensed conditions for radioactive emission into atmosphere from the INPP site

Radioactive emissions	Limit Bq/a	INPP planned emissions	
		Bq/a	% from limit
Noble gases	1.39E+16	9.64E+14	6.9%
Aerosols	9.40E+11	9.56E+09	1.0%
H-3	2.39E+14	2.43E+12	1.0%
C-14	2.27E+11	1.27E+11	55.9%
I-131 *)	9.87E+11	1.00E+11	10.1%
Total	**1.41E+16**	**9.66E+14**	**6.8%**

*) Total value for molecular, organic and aerosol fractions

The actual radioactive emissions into atmosphere from the INPP site after shut down of Power Unit 1 and corresponding impact on environment are overviewed in Table 4.2.3-2 and Table 4.2.3-3. Data are taken from annually reported radiation monitoring results of the INPP region [6], [7], [8] and [9]. Radioactive emissions into atmosphere are low and in general are below 1% from the permitted limits. Consequently, the population exposure due to radioactive emissions is also low. Annual effective doses to the critical group members of population are about 1-2 μSv. Annual dose constitutes less than 1% from the established dose constraint [4], which equals to 200 μSv (or 0.2 mSv).

Table 4.2.3-2 Actual radioactive emissions into atmosphere from the INPP site

Radionuclides, released into the environment	2005		2006		2007		2008	
	Bq	% from limit	Bq	% from limit	Bq	% from limit	Bq	% from limit
Noble gases	7.45E+13	0.54	3.12E+13	0.22	7.76E+13	0.56	1.03E+14	0.74
Aerosols	5.82E+08	0.06	5.68E+08	0.06	7.45E+08	0.08	2.14E+09	0.23
I-131 *)	6.67E+09	0.68	7.70E+09	0.78	8.49E+09	0.86	1.14E+10	1.16

*) Total value for molecular, organic and aerosol fractions

Table 4.2.3-3 Annual effective doses to the critical group members of population due to actual radioactive emissions into atmosphere from the INPP site

Radionuclides, released into the environment	Annual effective dose, Sv			
	2005	2006	2007	2008
Noble gases	1.65E-08	1.07E-08	3.42E-08	1.28E-08
Aerosols	3.06E-08	4.08E-08	2.50E-08	3.90E-08
I-131	1.08E-06	1.34E-06	1.31E-06	1.38E-06
Total dose	**1.13E-06**	**1.39E-06**	**1.37E-06**	**1.43E-06**
% from dose constraint (0.2 mSv)	0.56 %	0.70 %	0.69 %	0.72 %

4.2.3.2 POTENTIAL RADIOACTIVE EMISSIONS INTO ATMOSPHERE DUE TO THE PROPOSED ECONOMICAL ACTIVITY

Potential airborne activity sources and release pathways

The airborne radioactivity during D&D activity in the Building 117/1 may be generated by several sources:

- The first airborne activity source could be deplanting and in-situ size reducing of contaminated ECCS equipment and installations. The flame cutting method is selected as the main deplanting and in-situ size reducing method for ECCS pressurized tanks and pipelines, i.e. elements, which contain mostly the total amount of radioactivity as accumulated in Building 117/1. Mobile ventilation units with pre-filters and HEPA filters will be engaged to collect and filter locally produced airborne contaminants. Several physical phenomena may result in generation of airborne activity. Ventilation of equipment internals may lead to aerodynamic entrainment of surface contamination. In this case usually a small fraction of non-fixed contamination may become airborne. Flame cutting resulting thermal stresses and melting of steel in the seam may be other mechanisms producing airborne radioactivity. The air after filtration will be exhausted into environment of the Building 117/1.

- The second airborne activity source could be secondary size reducing of radioactivity contaminated ECCS pipelines and large diameter valves in the decontamination workshop. The large diameter pipe items and valve bodies will be half cut using saw in order to expose contaminated surfaces for subsequent blast decontamination process. During cutting process the swarf will be produced, some amount of steel dust may become airborne. The cutting swarf will be collected; the airborne dust will be filtered by local HEPA unit.

- The third airborne activity source could be decontamination using vacuum blasting technology. To remove surface contamination the blaster will shoot blasting material (steel grit) with high speed onto contaminated surface. The rebounded shots and in the air suspended contaminated surface remnants will be vacuum sucked into the blast unit waste collection system. However, some amount of air entrained contamination may spread outside the vacuum suction zone. The vacuum blast decontamination will be performed inside the confined area (cell) which is equipped with local ventilation system. Airborne contamination produced inside the confined area will be captured by pre-filter and HEPA filters of local ventilation system prior the air will be released into the environment of Building 117/1. During blasting process the whole contaminated oxidized surface will be removed from the base steel.
- Other D&D activities include preparation works, installation of new and radiologically clean equipment, deplanting of non-contaminated or low and locally contaminated ECCS auxiliaries. These D&D activities will not produce airborne activity or the produced amounts will be considerable lower as compare to the emissions from D&D activities on main ECCS components as described above.

All radioactive airborne emissions generated within internal environment of Building 117/1 prior to release into atmosphere will be additionally HEPA filtered by upgraded building ventilation system. Details on proposed ventilation concept are provided in chapter 2.2.2.3.

Airborne release assessment concept

The atmosphere released and dispersed radioactive material may lead to contamination of environment components and subsequently to exposure of population or other living organisms. The significance of impact depends on various factors, however the amount of released activity and activity dispersion conditions are factors of primary importance.

According to the requirements of the normative document LAND 42:2007 [5] in assessing the radiological impact on environment two main principles should be followed:

- Assessment of impact to the environment from nuclear object should be based on the principle, according to which the protection measures ensuring an adequate safety for human are sufficient to protect both the environment and natural resources (clause 5);
- Assessment of doses is performed gradually: at first the simplest and most conservative models, which do not take into account radionuclide dispersion in the environment are applied (screening approach). If the results of simple models do not meet assessment goals, a generic model taking into account dispersion and dilution of radionuclides in the environment with generic factors describing life style and diet shall be implemented. The most precise results are obtained using the site specific models which consider actual radionuclide dispersion and migration pathways, actual life style and nutrition conditions for the critical group members of population and are based on site specific parameters of radionuclide dispersion in atmosphere, hydrosphere and lithosphere (normative appendix 1, clause 3).

Following this approach at first the most conservative bounding case for radioactive emissions is evaluated to consider necessity for more precise investigations. The considered bounding case is based on few conceptual assumptions, which in turn use, if necessary, conservatively selected (respect to generation and emission of airborne activity) parameters:

- The first assumption states that once radioactivity becomes airborne during certain D&D step and is released into environment, it is not restored back. Therefore the maximal amount of activity which can be considered as available for release is bounded by total contamination of D&D items within the Building 117/1 (statement #1);

- The total activity accumulated within the Building 117/1 and may be released as result of D&D activity is bounded by internal contamination of ECCS. The rest of activity is considerably smaller and is accounted by conservative selection of ECCS contamination (statement #2);
- The total contamination of ECCS is calculated using conservatively rounded up of actually measured surface contamination values for particular radionuclides (statement #3);
- The HEPA filtration with total efficiency of 99.99% is considered when calculating airborne emissions into environment of the Building 117/1 or atmosphere (statement #4).

The conservatively selected internal contamination activity distribution within particular ECCS equipment elements is presented in Table 4.2.3-4. Data are selected on the basis of radioactive inventory analysis (c.f. chapter 2.1.5.2) as defined by statement #3 (see above).

Table 4.2.3-4 Selected surface contamination values for the main gamma emitters used for estimation of internal contamination of ECCS components

Elements and locations		**Activity distribution, Bq/cm^2**				**Total conta-mination, Bq/cm^2**
		Mn-54	**Co-60**	**Cs-134**	**Cs-137**	
Nitrogen release / supply pipes in room 401		0	0	0	3	3
Upper part of tank – above nominal water filling level	A	0	0	0	30	30
Lower part of tank – below nominal water filling level	A	0	40	0	60	100
Tank bottom discharge pipe Ø219×13 mm	B	1.5	10	2	60	73.5
Joint of two discharge pipes Ø219×13 mm	C	7	40	8	115	170
Two tanks discharge pipe Ø325×19 mm	D	7	40	4	150	201
Joint of two discharge pipes Ø325×19 mm	E	20	120	0.1	55	195.1
Four tanks discharge pipe Ø426×24 mm	F	10	70	0.1	50	130.1
Eight tanks discharge pipe Ø426×24 mm	G	5	65	2	105	177
Large diameter valves	H	5	60	2	100	167
Pipes Ø426×24 mm after large diameter valves		5	60	2	100	167
ECCS water fill-in and drainage pipes		5	60	2	100	167

The total internal contamination Q_j^{EC}, [Bq] of equipment component j is then calculated as follows:

$$Q_j^{EC} = \sum_i q_i \times A_j ;$$

Where:

q_i - is radionuclide i specific surface contamination of equipment component j, [Bq/cm^2], Table 4.2.3-4;

A_j - is the equipment component j internal surface, [cm^2]. Geometric characteristics of the components have been defined on the basis of design drawings [1].

Calculated activities for ECCS components are summarized in Table 4.2.3-5. ECCS pressurized tanks internal surface constitutes about 73% from total internal surface area and activity share of main radionuclides is about 55%. ECCS pipelines (below pressurized tanks) internal surface constitutes about 24% from total internal surface area and activity share of main radionuclides is about 44%.

Table 4.2.3-5 Estimated internal contamination of ECCS components

Elements	Surface area, m^2	Activity distribution, Bq				Total activity, Bq
		Mn-54	Co-60	Cs-134	Cs-137	
Nitrogen release / supply pipes in room 401	32.9	0	0	0	9.87E+05	9.87E+05
ECCS pressurized tanks	1072.3	0	2.25E+08	0	4.91E+08	7.16E+08
ECCS pipes in room 01	115.0	7.17E+06	5.98E+07	2.79E+06	1.04E+08	1.74E+08
ECCS pipes in room 02	63.4	3.17E+06	3.80E+07	1.27E+06	6.34E+07	1.06E+08
ECCS pipes in room 08	176.0	8.80E+06	1.06E+08	3.52E+06	1.76E+08	2.94E+08
Total	**1459.7**	**1.91E+07**	**4.29E+08**	**7.58E+06**	**8.35E+08**	**1.29E+09**

The conservatively assessed bounding airborne releases during D&D steps are presented in Table 4.2.3-6. Calculation considers statements #1, #2 and #4 (see this sub-chapter above). The airborne emissions during particular D&D step Q_k^{AIR}, [Bq] is then calculated as follows:

$$Q_k^{AIR} = \frac{\sum_j Q_j^{EC}}{DF};$$

Where:

Q_j^{EC} - is internal contamination [Bq] of equipment component j relevant for particular D&D step k, Table 4.2.3-5;

DF - is decontamination factor for HEPA filtration. For total efficiency of 99.99% the DF value is 10 000.

The potentially expected releases are low. The same emission values are applicable for released activity into working premises and into atmosphere as no assumptions are made concerning filtration of activity prior to release it outside the Building 117/1.

Table 4.2.3-6 Airborne radioactive emissions during Building 117/1 equipment D&D (bounding scenario estimation)

Activity	Airborne emissions, Bq				
	Mn-54	Co-60	Cs-134	Cs-137	Total
D&D of ECCS PT and other auxiliaries	0	2.25E+04	0	4.92E+04	7.17E+04
D&D of ECCS pipelines in rooms 01, 02 and 08	1.91E+03	2.03E+04	7.58E+02	3.44E+04	5.74E+04
Total	**1.91E+03**	**4.29E+04**	**7.58E+02**	**8.35E+04**	**1.29E+05**

4.2.3.3 ENVIRONMENTAL AIR POLLUTION FORECAST AND RADIOLOGICAL IMPACT

To demonstrate the significance of the assessed activity of environmental radionuclides releases, it is compared against the established limits of activity of environmental radionuclides releases, and against the potential activity of planned environmental radionuclides releases from the nuclear facilities located within the INPP site in future [3]. The activity values of environmental radionuclides releases, indicated in the Permit, are established for releases at the height of the main ventilation stacks (150 m) of the power units. The release of radioactive substances from Building 117/1 will occur at the lower height. In order to compare the calculated activity of environmental radionuclides releases against the value, indicated in the Permit, the assessed activity of environmental radionuclides releases therefore shall be appropriately scaled. The scaling factor of 30 is used for release height of 20 m, which corresponds to the level of Building 117/1 roof. The value of this factor was selected according to the set out data [5] for release heights of 75 and 13 m.

The values of activity of environmental radionuclides releases, indicated in the Permit [3], and potential activity of environmental radionuclides releases due to the proposed economic activity, corrected for 150 m release height, are compared in Table 4.2.3-7. The potential activity of environmental radionuclides releases due to the proposed economical activity shall be considered as extremely low. The activity of airborne radionuclides releases makes at most three thousandths (2.55E-03) from the INPP planned releases. In comparison to the limit values, the fractions of released radionuclide activity are lower by several orders of magnitude more. The potential activity of airborne radionuclide releases will not influence either the set out radionuclide activity limits or the activity values of radionuclides planned to be released from the nuclear facilities located within the INPP site in future.

Table 4.2.3-7 Comparison of INPP licensed radioactive emissions and the proposed economical activity potential radioactive emissions

Radionuclide	Permissible activity of radionuclides, released from INPP		Potential activity of environmental radionuclides releases due to the proposed economic activity, corrected for 150 m release height		
	Activity limit, Bq/year	INPP planned activity, Bq/year	Total, Bq/year	Fraction from activity limit	Fraction from INPP planned activity
Mn-54	9.05E+10	7.14E+08	5.74E+04	6.35E-07	8.04E-05
Co-60	2.88E+11	4.14E+09	1.29E+06	4.46E-06	3.11E-04
Cs-134	1.33E+09	7.18E+07	2.27E+04	1.71E-05	3.17E-04
Cs-137	1.39E+11	9.84E+08	2.51E+06	1.80E-05	2.55E-03

Potential impact to population

The radiation exposure of the critical group members of population in the environment of INPP resulting from the determined release of radioactive material into atmosphere can be calculated using the dose conversion factors and the multiplication factors for the different emission heights as recommended by normative document LAND 42:2007 [5]. These radionuclide specific conversion factors give a relation between a radionuclide specific permanent long term activity release and the dose caused to the critical group member of population at the location of the highest predicted exposure (that means highest predicted activity concentration in air and at ground level and consumption of the highest predicted contaminated food). Conversion factors are derived using the Gaussian atmospheric diffusion model, considering a meteorological statistic of INPP site of several years and taking into account the site-specific life style and nutrition features of the critical group members together with all pathways of external and internal exposure:

- In the case of farmers – external exposure from immersion in the cloud and radionuclides deposited on the ground as well as re-suspension of deposited radionuclides and internal exposure due to inhalation and ingestion of radionuclides in the food stuffs;
- In the case of fishermen – the external dose, resulted by radionuclides in the lake water and in the coastal zone sediments as well as the internal dose resulted by the fish used for food;
- In the case of gardeners – external dose resulted by the exposure from radionuclides deposited in the irrigated soil as well internal dose due to consumption of food from irrigated garden and inhalation of re-suspended particles.

The annual effective dose to the critical group member of population is calculated:

$$E = \sum_j Q_j \times DCF_j \times K_{VS} \ ,$$

Where:

Q – is the annual release of airborne activity into atmosphere, Bq;

DCF – is radionuclide specific dose conversion factor for unit of released activity, Sv/Bq [5];

K_{VS} – is correction factor for the emission height if emission height differs from the height of power unit's main ventilation stacks.

The dose assessment methodology [5] assumes that activity release takes place in the air flow displacement zone where wake effects from other local obstacles (like surrounding buildings etc.) on activity dispersion do not need to be considered. Actually the Building 117/1 is surrounded by other structures which may influence dispersion conditions and lead to suppression of dispersed activity closer to the release point. However respect to the impact outside the borders of the INPP industrial site, assumption on favourable dispersion conditions under minimal emission height keeps assessed doses on the conservative side.

The value of K_{VS} = 30 is used for releases at the height of 20 m, i.e. level of the Building 117/1 roof. Estimation of the population exposure is summarized in Table 4.2.3-8. The calculated effective dose to the critical group member of population is below 4×10^{-4} µSv. Annual dose constitutes a fraction of less than 2×10^{-6} from the established annual dose constraint [4], which equals to 200 µSv (or 0.2 mSv). The potential radiological impact on the environment components outside the INPP industrial site due to radioactive emissions resulting from the proposed economical activity is evaluated to be very low and therefore further is no more considered. More detailed overview of applicable radiation protection requirements in force are presented in chapter 4.9.

Table 4.2.3-8 Evaluation of effective dose to the critical group member of population due to potential radioactive emissions into atmosphere from the proposed economical activity

Radionuclide	Airborne emission, Bq	DCF, Sv/Bq	Dose, Sv
Mn-54	1.91E+03	3.20E-18	1.84E-13
Co-60	4.29E+04	5.70E-17	7.33E-11
Cs-134	7.58E+02	8.30E-17	1.89E-12
Cs-137	8.35E+04	1.20E-16	3.01E-10
Total	**1.29E+05**		**3.76E-10**

Potential impact to personnel

The bounding value for collective dose to personnel due to airborne emissions can be estimated assuming that all radioactive releases consist of respirable size particles that are inhaled by members of personnel.

$$E = \sum_j Q_j \times e(g)_{j,inh}$$

Where:

Q – is the released airborne activity, Bq;

$e(g)_{j,inh}$ – is radionuclide specific inhaled activity to dose conversion factor, taken from hygienic norm HN 73:2001 [10].

Dose evaluation is summarized in Table 4.2.3-9. The evaluated collective dose to personnel dose is below 2 man mSv. The collective dose is low.

Table 4.2.3-9 Evaluation of collective dose to personnel due to radioactive emissions from the proposed economical activity

Radionuclide	Airborne emission, Bq	$e(g)_{j,inh}$, Sv/Bq	Dose, man Sv
Mn-54	1.91E+03	1.50E-09	2.87E-06
Co-60	4.29E+04	2.90E-08	1.24E-03
Cs-134	7.58E+02	9.60E-09	7.28E-06
Cs-137	8.35E+04	6.70E-09	5.60E-04
Total	**1.29E+05**		**1.81E-03**

The individual inhalation doses are to be lower collective dose. Conservatively it can be assumed that maximal individual dose is bounded by evaluated collective dose. The individual worker dose of 2 mSv during several months of D&D activity is still low. For comparison purpose it can be indicated that daily exposure of member of the personnel performing works in the supervised area normally is planned not to exceed 0.2 mSv. Taking into account planned impact control and mitigation measures, it can be concluded that personnel exposure can be kept below established radiation safety limits. Overview of applicable radiation protection requirements is presented in chapter 4.9.

4.2.3.4 RADIOLOGICAL IMPACT MITIGATION MEASURES

No specific radiological impact mitigation measures in addition to those that planned by design concept are proposed. The planned design solutions foresee multi barrier concept for localization, entrapment and collection of airborne radioactivity thus preventing any significant radioactive emissions into working environment and / or atmosphere. The potential radioactive emissions and consequently, the impact to environment are evaluated to be very low. The monitoring of actual radioactive emissions into working premises and atmosphere during Building 117/1 equipment D&D shall be assured in accordance with regulations in force.

4.3 SOIL

4.3.1 INFORMATION ABOUT THE SITE

According to Hygiene Norm of Lithuanian HN 60:2004 [1] soil is defined as an upper loose layer of earth, which is formed from the native rock under influence of soil formation processes (a complex of impacts from water, air, living organisms) and is characterized by its potential productivity. The area of the INPP site has been changed in the past because of construction and industrial activity, thus natural soil in this area is almost totally absent. The INPP site is almost entirely covered by artificial ground which consists of clay loam with pebble and gravel, sand at places with organic remains. Layer thickness is about 2 m [2], [3].

According to the INPP monitoring programme, samples of the soil in the INPP region are continuously monitored. The information on detected radionuclides and their radioactivities is presented in Table 4.3.1-1 [4], [5] and [6].

Table 4.3.1-1 Specific activity of the radionuclides in the soil of INPP region

Year	Specific activity in the soil, Bq/kg								Total (except Ra, Th, K)	
	Cs-137	Cs-134	Mn-54	Co-60	Sr-90*	Ra-226	Th-228	К-40	Bq/kg	Bq/m^2
1999	7.89	1.28	0.17	0	<20.0	21.9	33.1	807	9.35	170
2000	5.10	1.50	0.10	0	<20.0	31.4	30.2	618	6.70	339
2001	4.89	1.36	0.08	0	<20.0	42.6	31.9	606	6.34	320
2002	7.02	1.65	0	0	<20.0	45.9	45.2	850	7.36	154
2003	3.70	1.03	0	0	<1.53	22.9	29.3	596	6.26	131
2004	4.98	0.43	0.08	0	2.08	34.2	26.8	549	7.47	158
2005	3.38	0	0	0	1.49	13.8	18.6	462	4.87	31.3
2006	3.38	0	0	0.05	0	22.0	25.6	613	3.43	74.8
2007	2.77	0	0	0	0	19.6	21.5	631	2.77	76.7
2008	3.59	0	0	0	3.27	12.1	16.5	399	6.86	262

* – since 2003 detection methodology of Sr-90 has been improved.

4.3.2 POTENTIAL IMPACTS

Soil and underground water are inseparable elements of the environment as additional pollution of soil is rinsed in underground water by rainfalls. As can be seen from the results of INPP region radiation monitoring presented in Table 4.3.1-1, specific activity of the radionuclides in the soil remains practically unvaried or even declines in recent years.

It is not foreseen to use the chemical reagents that, in case of accidental releases during the proposed economic activity, could contaminate the soil. The potential for contamination of soil (chemical, radiological, etc.) associated with decontamination and dismantling activities for Building 117/1 will be very low. The planned emissions to atmosphere are also estimated to be very low. There can only be a slight physical (mechanical) impact on topsoil around the Building 117/1 due to loading and transportation of dismantled equipment. Also, accidental spilling of oil products during transport operations may be expected.

4.3.3 IMPACT MITIGATION MEASURES

A slight physical (mechanical) impact on topsoil around the Building 117/1 due to loading and transportation of dismantled equipment will be temporary. Topsoil layer on the site around the Building 117/1 will be re-established and planted as appropriate after finishing the D&D works.

In case of accidental spilling of oil products during transport operations, the procedures established in regulation LAND 9-2002 [7] will be performed.

4.4 UNDERGROUND (GEOLOGY)

4.4.1 CHARACTERISATION OF THE UNDERGROUND CONDITIONS

The INPP area is located in the western margin of the East European Platform. It is located in the junction zone of two major regional tectonic structures: the Mazur-Belarus Rise and the Latvian Saddle that makes the structural pattern of the area rather complicated. The contemporary relief of the crystalline basement reflects movements over a period of 670 million years. Several tectonic structures (blocks) of the lower order are distinguished in the surface of the Precambrian crystalline basement: the North Zarasai Structural terrace, the Anisimoviciu Graben, the East Druksiai Uplift, the Druksiai Depression (Graben) and the South Druksiai Uplift. The North Zarasai Structural terrace, the Anisimoviciu Graben and the East Druksiai Uplift are related to the Latvian Saddle. The South Druksiai Uplift belongs to the Mazur-Belarus Rise and the Druksiai Depression (Graben) is located within the junction zone of the two aforementioned regional structures [1].

The crystalline basement is buried to a depth of about 720 m from the current ground level. It is comprised of the Lower Proterozoic rocks predominantly of biotite and amphibole composition: gneisses, granite, migmatite, etc. The thickness of the sedimentary cover in the region of the INPP varies in the range of 703–757 m. Pre-Quaternary succession is represented by the Upper Proterozoic Vendian complex, overlain by sediments of the Paleozoic systems. The Vendian deposits are represented by a succession of gravelstone, feldspar-quartz sandstone of different grain size, siltstone and shale. The Paleozoic section comprises the successions of the Lower and Middle Cambrian, the Ordovician, the Lower Silurian and the Middle and Upper Devonian sediments (Figure 4.4.1-1 and Figure 4.4.1-2).

The Lower Cambrian is represented by quartz sandstone with inconsiderable admixture of the glauconite, siltstone and shale. The sandstone is of different grain size with the fine-grained and especially fine-grained sandstone predominating. The Middle Cambrian comprises the fine-grained sandstone. The Ordovician is composed of interbedded marlstone and limestone. The Lower Silurian is composed of dolomitic marlstone and dolomite. The Middle Devonian – of gypsum breccia, dolomitic marlstone and dolomite as well as interbeds of the fine-grained and very fine-grained sand and sandstone, siltstone and claystone; the Upper Devonian – of fine-grained and very fine-grained sand and sandstone, interbeds of the siltstone and claystone. The Vendian deposits vary in thickness from 135 to 159 m; the total thickness of the Lower and Middle Cambrian succession reaches 93–114 m, the thickness of the Ordovician varies in a range of 144–153, the Silurian – 28–75 m and the total thickness of the Devonian sediments reaches 250 m [1].

Sub-Quaternary relief of the area is highly dissected by paleoincisions. The thickness of the Quaternary cover varies from 62 up to 260 m.

The Quaternary deposits are of Pleistocene and Holocene age. The area is made up of glacial deposits (till) of the Middle Pleistocene Dzukija, Dainava, Zemaitija and Medininkai Formations, and of the Upper Pleistocene Upper Nemunas Formation (Gruda and Baltija). The intertill glaciofluvial (sand, gravel, cobble, pebble) and glaciolacustrine (fine-grained sand, silt, clay) sediments are detected in the area. The thickness of the intertill deposits varies from 10–15 m up to 25–30 m (Figure 4.4.1-3). The intersticial deposits are composed of very fine-grained and fine-grained sand, silt and peat (Figure 4.4.1-5 and Figure 4.4.1-6). The Holocene deposits are represented by alluvial, lacustrine and bogs sediments. Alluvial sediments are variously grained sands with 1–1.2 m thick organic layers. The lacustrine sediments (fine-grained sand, clay, silt) reach a thickness of 3 m. The thickness of the peat is 5–7 m [1].

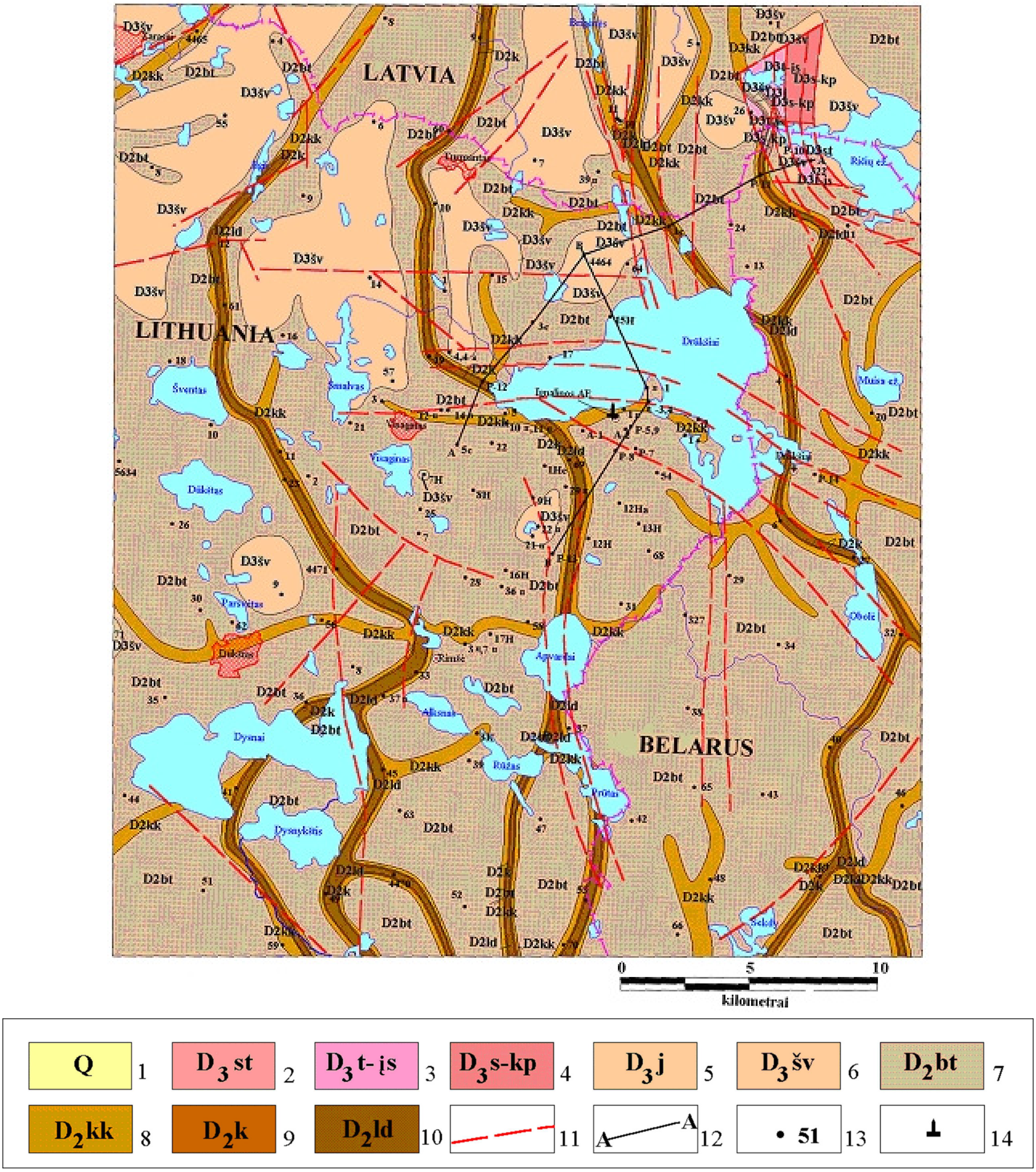

Figure 4.4.1-1 Pre-Quaternary geological map of the INPP region [1]: 1 – Quaternary deposits (on the sections); Upper Devonian formations: 2 – Stipinai; 3 – Tatula–Istra; 4 – Suosa–Kupiskis; 5 – Jara; 6 – Sventoji; Middle Devonian formations: 7 – Butkunai; 8 – Kukliai; 9 – Kernave; 10 – Ledai; 11 – Fault; 12 –Line of geological-tectonical cross-section; 13 – Borehole; 14 – INPP

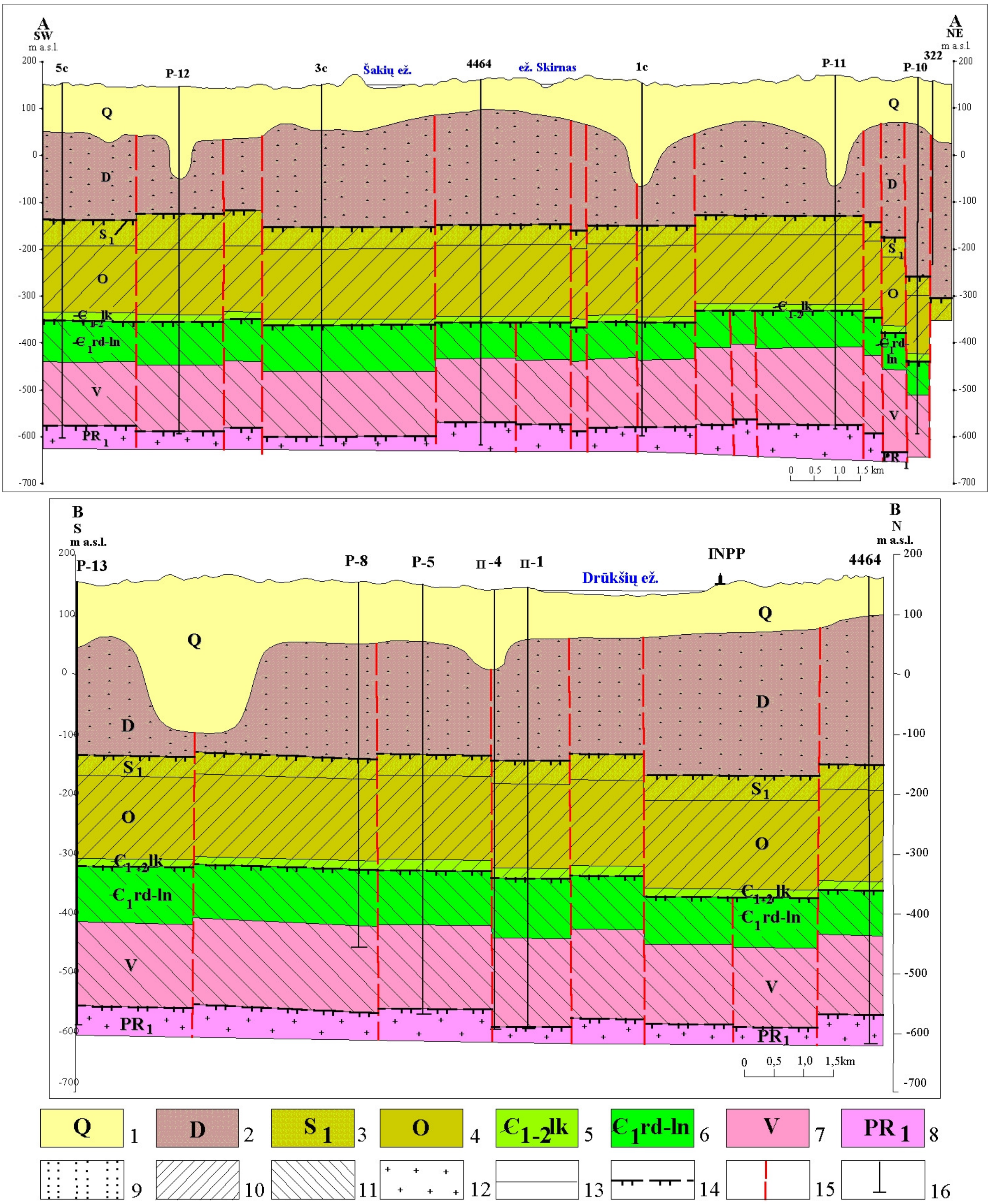

Figure 4.4.1-2 Geological-tectonic cross-sections (location see in Figure 4.4.1-3) of the INPP region [1]: 1 – Quaternary: till, sand, silt and clay; 2 – Middle and Upper Devonian: sand, sandstone, siltstone, clay, domerite, dolomite, breccia; 3 – Lower Silurian: domerite, dolomite; 4 – Ordovician: limestone, marl; 5 – Lower and Middle Cambrian Aisciai Series Lakajai Formation: sandstone; Lower Cambrian Rudamina–Lontova Formations: argillite, siltstone, sandstone; 7 – Vendian: sandstone, gravelite, siltstone, argillite; 8 – Lower Proterozoic: granite, gneiss, amphibolite, mylonite; Structural complexes: 9 – Hercynian; 10 – Caledonian; 11 – Baikalian; 12 – Crystalline basement; 13 – Border between systems; 14 – Border between complexes; 15 – Fault; 16 – Borehole

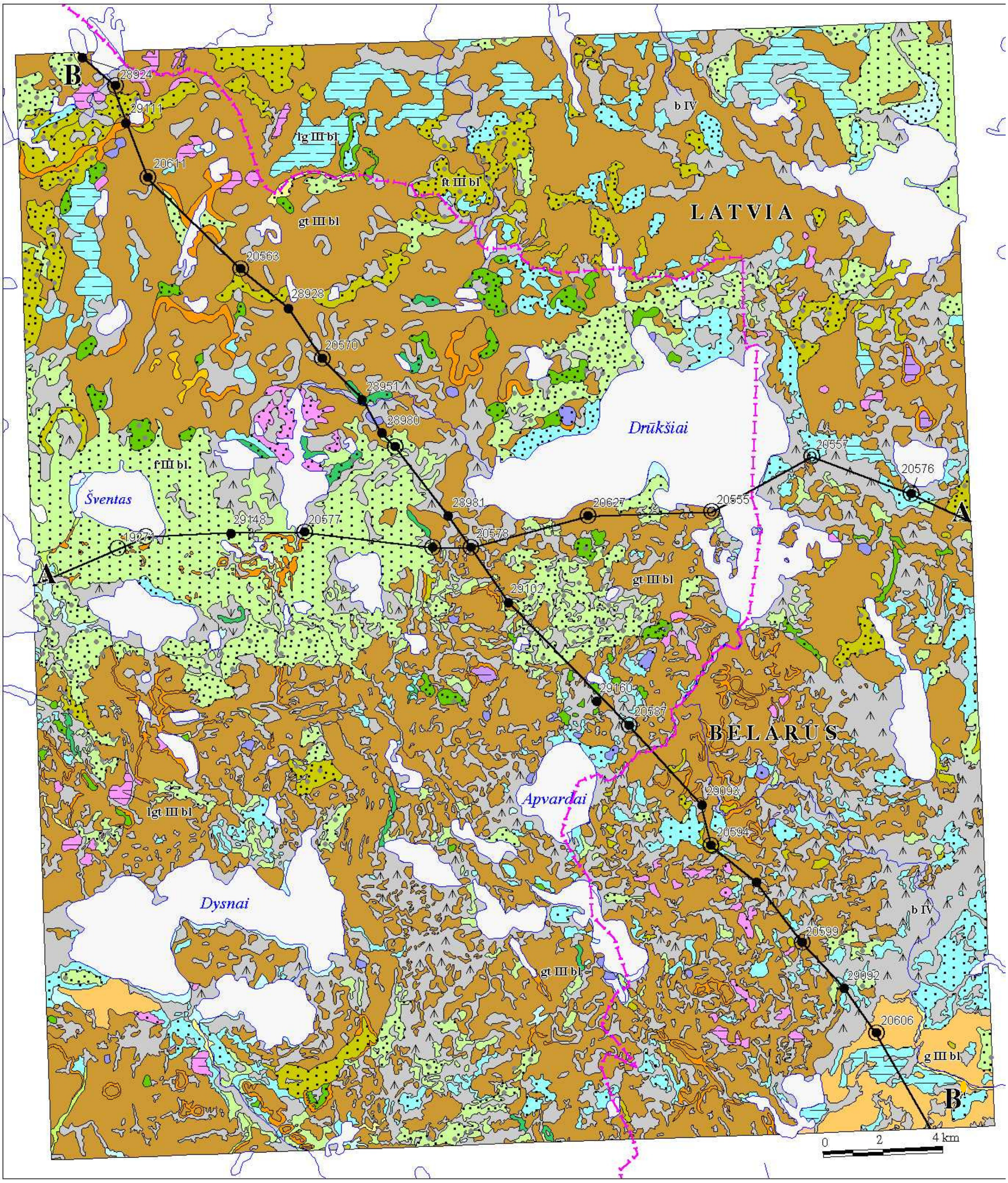

Figure 4.4.1-3 Quaternary geological map of the INPP area (original scale 1:50 000, author: R. Guobyte [1]); legend see in Figure 4.4.1-4

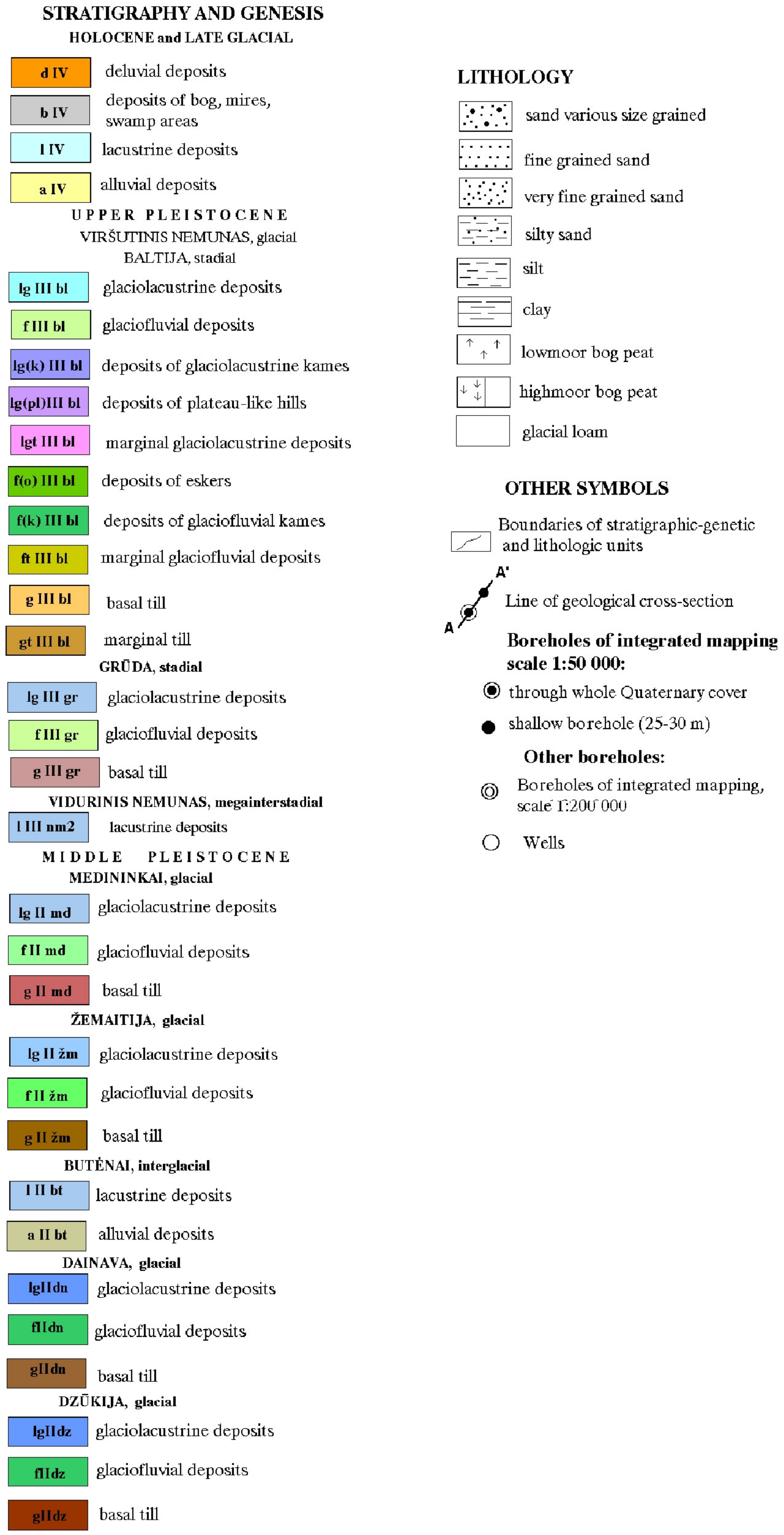

Figure 4.4.1-4 Legend for Quaternary geological map and geological cross-sections of the INPP region

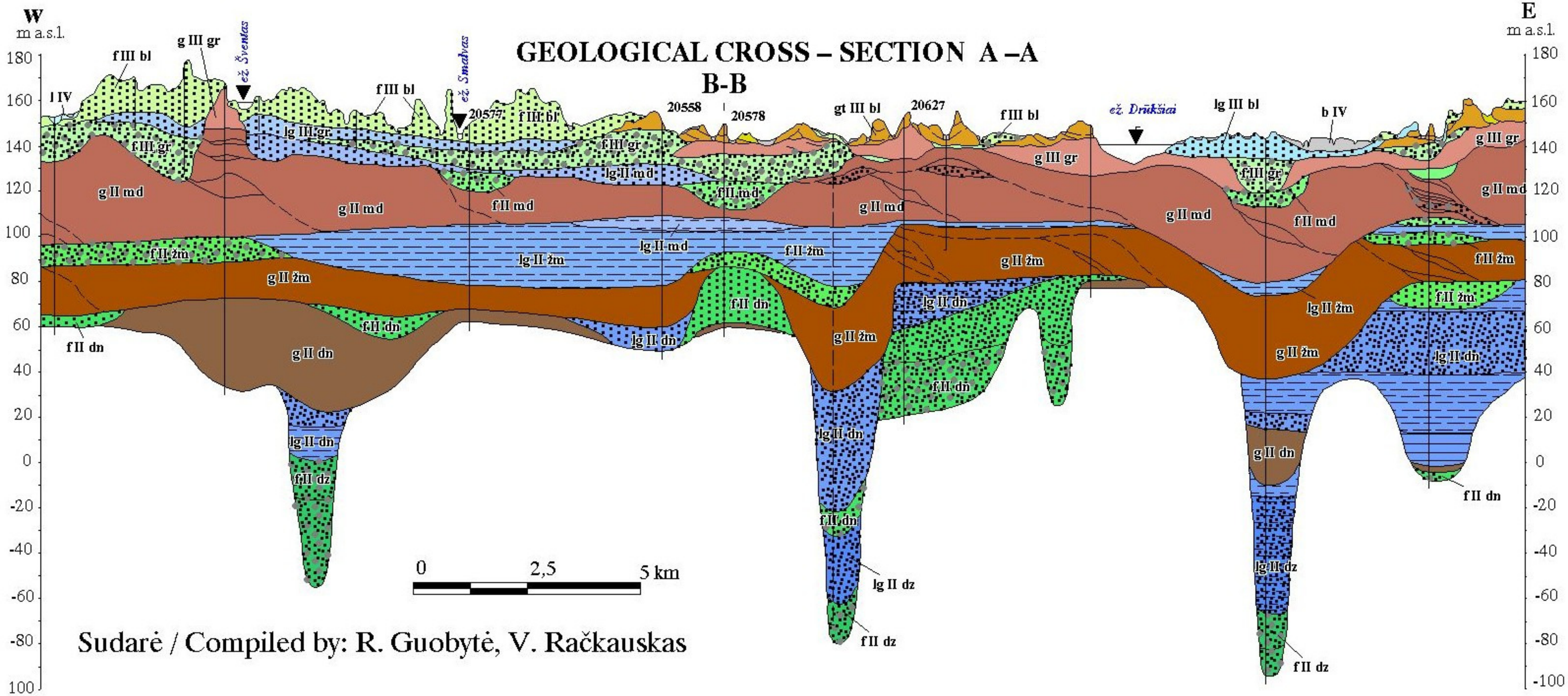

Figure 4.4.1-5 Quaternary geological cross-section A-A of the INPP area (original scale 1:50 000, authors: R. Guobyte, V. Rackauskas [1]); legend see in Figure 4.4.1-4

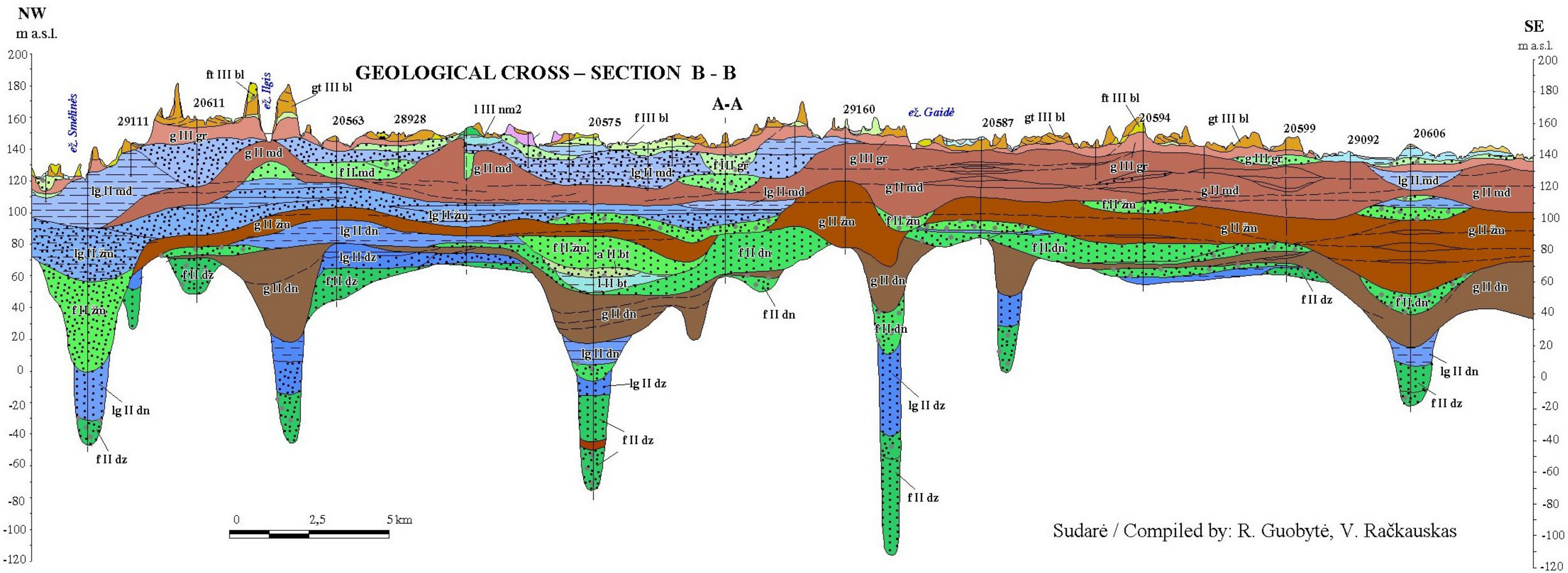

Figure 4.4.1-6 Quaternary geological cross-section B-B of the INPP area (original scale 1:50 000, authors: R. Guobyte, V. Rackauskas [1]); legend see in Figure 4.4.1-4

4.4.2 POTENTIAL IMPACTS

Since no construction works, new foundations, refill and earth movements are planned there will be no additional influence on the geological ground structure.

Rules on underground water protection from contamination with dangerous substances [2] will be met while no dangerous substances or sewage will be released directly (without passing through the soil or subsoil) or indirectly (passing through the soil or subsoil) during building 117/1 D&D project implementation. Underground cavities will not be used for storage or disposal of any toxic substances.

4.4.3 IMPACT MITIGATION MEASURES

Since no negative consequences of the building 117/1 D&D activities on the region underground are identified, no impact mitigation measures are required.

The net of survey boreholes (wells) for monitoring underground run-off water is installed throughout the INPP site as part of required environmental monitoring [3].

4.5 BIODIVERSITY

4.5.1 INFORMATION ABOUT THE SITE

The Building 117/1 is within the INPP industrial site. Protected species, as designated by Lithuanian or European Law, are not encountered within the boundaries of the INPP site.

4.5.1.1 RADIONUCLIDES IN THE PLANTS

Specific activity of radionuclides in the selected samples of flora, vegetables and foodstuff in the INPP region in 2008 and resulting population exposure due to consumption of foodstuff are summarized in Table 4.5.1-1 [1]. Annual effective dose due to consumption of foodstuff containing radionuclides in year 2008 was about 4.5 μSv. The dose forms only a small fraction from the dose constraint (200 μSv), which limits admissible population exposure due to operation of nuclear facilities. More detailed overview of the applicable radiation protection requirements is presented in Chapter 4.9.

Table 4.5.1-1 Specific activity of radionuclides in selected flora, vegetables and foodstuff in the INPP region in 2008

Object	Annual consumption, kg	Specific activity, Bq/kg					Annual dose due to food chain (except K-40), 10^{-8} Sv
		Cs-137	Mn-54	Co-60	Sr-90	K-40	
Grass	–	0.03	0	0	0.89	601	–
Milk	259	0	0	0	<0.05	45.7	36.3
Potatoes	93	<0.3	<0.3	<0.4	<0.1	164	0
Cabbage	83	<0.9	<0.7	<0.8	<0.73	99.8	170
Moss	–	17.4	0	0	3.41	165	–
Mushroom	3	46	0	0	0.01	72.6	179
Fish	19.5	1.26	0	0	0.51	92.9	59.8

4.5.1.2 NATURA 2000 NETWORK AND OTHER PROTECTED AREAS

European ecological network "NATURA 2000" is a network of protected areas of the European Community, established when implementing the Directives of the Council of the European Community 79/409/EEC [2] and 92/43/EEC [3]. The main objective of the NATURA 2000 network is to conserve, maintain and restore (in case of necessity) natural habitats, as well as animal and plant species throughout the territory of the European Community.

Basing on the Council Directive 79/409/EEC of April 2, 1979 on the Conservation of Wild Birds (further – Birds Directive) the Special Protection Areas (SPAs) are to be designated. When implementing the Council Directive 92/43/EEC of May 21, 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (further – Habitat Directive) the Special Areas for Conservation (SACs) are to be established.

Prior to the establishment of SACs, based on scientific research, sites, meeting the criteria of Special Areas for Conservation are selected. The list of sites meeting the criteria of Special Areas for Conservation is presented to the European Commission (EC). After the list of sites meeting the criteria of Special Areas for Conservation is approved by EC, they are supposed to be called Sites of

Community Importance (SCIs). Based on Sites of Community Importance the member states shall establish Special Areas for Conservation.

Sites, corresponding to the criteria of Special Areas for Conservation, meet the criteria of SACs designation, approved by the Minister of the Environment [4]. According to the EU Habitat Directive the member states shall introduce measures in order to ensure that the quality of the natural habitats and the habitats of species in the NATURA 2000 network does not deteriorate and that no factors arise which might disturb the species for which the areas have been designated.

According to the Republic of Lithuania Law on Protected Areas [5], first a national protected area is to be established. Later on it can be granted with the status of SPA or a site meeting the criteria of Special Area for Conservation, or a Site of Community Importance or SAC can be established. The European Commission has already approved the list of sites meeting the criteria of Special Area for Conservation or SCIs.

The order of the Republic of Lithuania Minister of Environment [4] is the legal base of designation of the aforementioned SCIs.

The nearest to INPP Sites of Community Importance (SCIs) of the “NATURA 2000” network are summarized in Table 4.5.1-2 and shown in Figure 4.5.1-1.

Table 4.5.1-2 The nearest to INPP Sites of Community Importance (SCIs) of the “NATURA 2000” network

The name of location	Area, ha	SCI code in ”NATURA 2000” network data base and comments on SCI boundaries	Valuable species in the area	Preliminary area habitats, ha
Lake Druksiai	3611	LTZAR0029 The border is defined according to the special map.	Spinned loach (*Cobitis taenia*)	
			European otter (*Lutra lutra*)	
River Smalvele and adjacent limy fens	547	LTZAR0026 The border is the same as for Smalvos hydrographical reserve.	Fire-bellied toad (*Bombina bombina*)	
			European otter (*Lutra lutra*)	
Lakes and wetlands Smalva and Smalvykstis	2225	LTZAR0025 The border is the same as for Smalvos landscape reserve.	3140, Hard oligo-mesothrophic waters with benthic vegetation of Chara formations	354.6
			3160 Dystrophic lakes	45.0
			7140 Transition mires and quaking bogs	265.9
			7210 Calcareous fens with Cladium mariscus and Carex davaliana	88.7
			7230 Alkaline fens	88.7
			9010 Western taiga	265.9
			9080 Fennoscandian deciduous swamp woods	88.7
			91D0 Bog woodlands	88.7
			Fen orchid (*Liparis loeselii*),	

The name of location	Area, ha	SCI code in "NATURA 2000" network data base and comments on SCI boundaries	Valuable species in the area	Preliminary area habitats, ha
			Slender green feather-moss (*Hamatocaulis vernicosus*)	
Grazute regional park	26125	LTZAR0024 The border is the same as for Grazute regional park, with the exception of recreational, agriculture and residential priority zones.	3130 Oligothrophic waters with amphibious vegetation	105
			3140 Hard oligo-mesothrophic waters with benthic vegetation of Chara formations	18.4
			3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation	2.0
			6120 Xeric sand calcareous grasslands	5.0
			6210 Semi-natural dry grasslands	1568.0
			7120 Degraded upland bogs	26.0
			7140 Transition mires and quaking bogs	69.6
			7160 Non calcareous springs and springy bogs	2.0
			9010 Western taiga	810.0
			9020 Broad leaved and mixed woodlands	99.0
			9060 Coniferous woodlands on fluvioglacial eskers	45.0
			9080 Fennoscandian deciduous swamp woods	201.0
			91D0 Bog woodlands	2012.0
			Large copper (*Lycaena dispar*)	
			(*Thesium ebracteatum*)	
			Fire-bellied toad (*Bombina bombina*)	
			Great crested newt (Triturus cristatus)	
			European otter (*Lutra lutra*)	
			Eastern pasque flower (*Pulsatilla patens*)	
Pusnis wetland	779	LTIGN0001 The border is the same as for Pusnis telmological reserve	6230 Species-rich Nardus grasslands	8.0
			6430 Hydrophilous tall herb fringe communities of plains	39.0
			7140 Transition mires and quaking bogs	234.0

Protected territories or their parts in the Republic of Lithuania comprising Special Protection Areas (SPA) are approved by the Government [6]. The nearest to INPP SPAs of the “NATURA 2000” network are listed in Table 4.5.1-3 and shown in Figure 4.5.1-1. Table 4.5.1-3 also indicates the protected bird species of European importance found in every SPA. The main forbidden activities in the Special Protection Areas are summarized in Table 4.5.1-4.

Table 4.5.1-3 The nearest to INPP Special Protection Areas (SPA) of the “NATURA 2000” network

Republic of Lithuania protected area (or its part)	Code in ”NATURA 2000” network data base and location of the SPA	Protected bird species of European importance	Comments on SPA boundaries
Part of the protected zone for Lake Druksiai	LTZARB003 Lake Druksiai	Great Bittern (*Botaurus stellaris*)	SPA takes a part of the protected territory. The border is defined according to the plan.
Parts of protected zone for Lakes Dysnai and Dysnyksciai	LTIGNB004 The limy fens complex of Dysnai and Dysnykstis lake area	Corn crake (*Crex crex*)	SPA takes a part of the protected zone. The border is defined according to the plan.
Part of Grazute regional park	LTZARB004 North eastern part of Grazute regional park	Black-throated Diver (*Gavia arctica*), Pygmy owl (*Glaucidium passerinum*)	SPA takes a part of the protected territory. The border is defined according to the plan.
Smalva hydrographic reserve	LTZARB002 The complex of Smalva limy fens	Black Tern (*Chlidonias niger*)	The border of the SPA is the same as for Smalva hydrographic reserve

Table 4.5.1-4 Forbidden activities in the Special Protection Areas (SPAs) to the INPP site

Area of SPA, "NATURA 2000" code	Bird species of European importance	Forbidden activities [7]
LTZARB003 Lake Druksiai	Great Bittern (*Botaurus stellaris*)	Reap reeds (in certain areas); Visiting places of above water vegetation overgrowth from ice melting till July 1 (in certain areas); Boating and yachting (in certain areas); Camping, excepting in specially predefined recreational areas, from ice melting till July 1 (in certain areas); Hunting of water and wetland birds excepting cases of regulation of cormorant population in pisciculture waters; Change the land usage main purpose excepting cases of changing to more conservative purpose; Change the hydrological regime if it leads to decrease of habitability area or quality; Plant forest
LTIGNB004 The limy fens complex of Dysnai and Dysnykstis lake area	Corn Crake (*Crex crex*)	Change the land usage main purpose excepting cases of changing to more conservative purpose; Convert meadows and pastures into plough-land; Change the hydrological regime if it leads to decrease of habitability area or quality; Plant forest.
LTZARB002 The complex of Smalva limy fens	Black tern (*Chlidonias niger*)	Boating and yachting from May to July; Change the hydrological regime if it leads to decrease of habitability area or quality; Perform water body bed renovation works if it leads to decrease of habitability area or quality.
LTZARB004 North eastern part of Grazute regional park	Black-throated Diver (*Gavia arctica*)	Visiting from ice melting till July 1 (in certain areas); Erect constructions which are not related to purpose of protected territory and expand infrastructure (in certain areas).
	Pygmy owl (*Glaucidium passerinum*)	Perform general deforesting (in certain areas); Perform deforesting and timbering works from February till May (in certain areas); In case of general deforesting not less than 20 (per hectare) seminal of main group and trees (arranged in biogroups) necessary to maintain biodiversity shall be left (in certain areas).

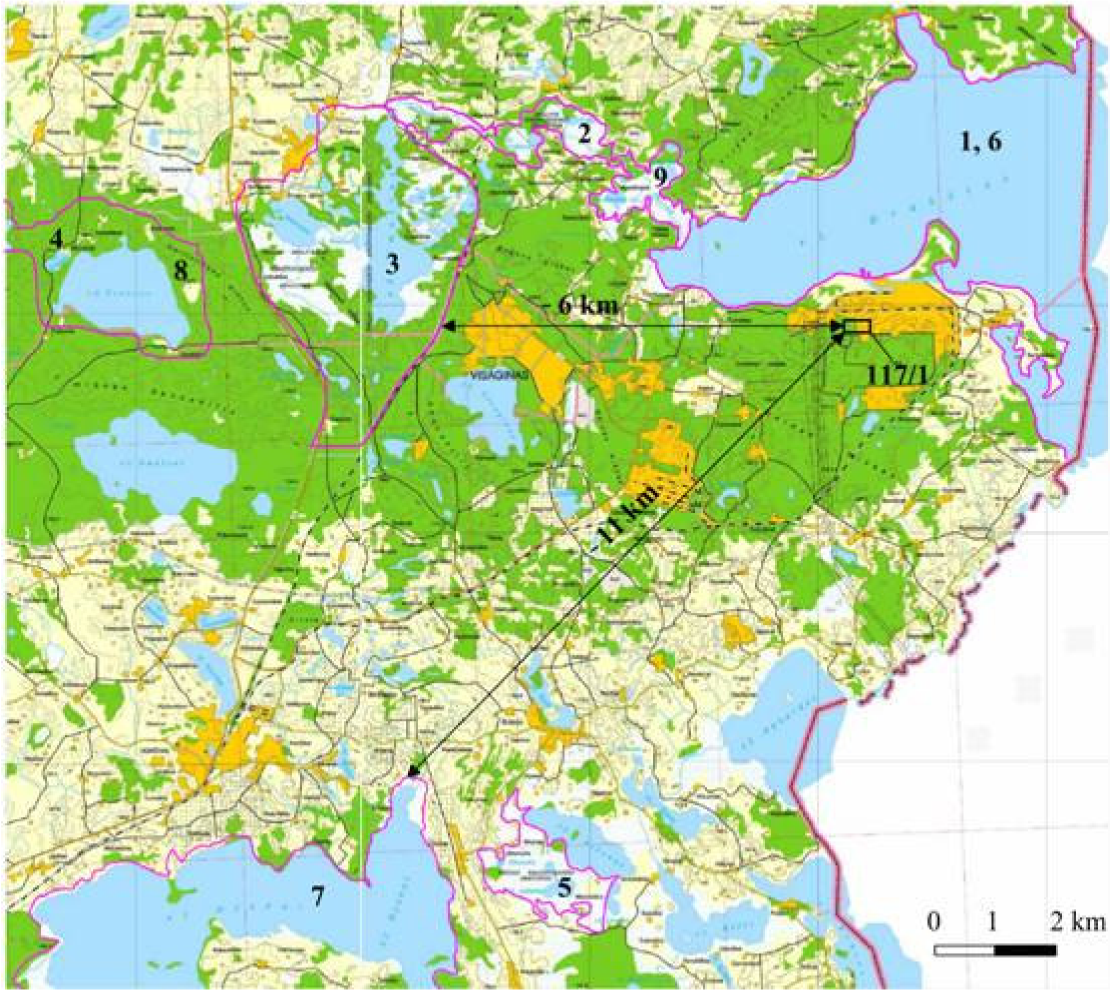

Figure 4.5.1-1 The nearest to the INPP sites of European ecological network "NATURA 2000" (perimeters marked in red). Sites of Community Importance (SCIs): 1 – Lake Druksiai; 2 – River Smalvele and adjacent limy fens; 3 - Lakes and wetlands of Smalva and Smalvykstis; 4 – Grazute regional park; 5 – Pusnis wetland. Special Protection Areas (SPAs): 6 - Lake Druksiai; 7 - Limy fens complex of Dysnai and Dysnykstis lake area; 8 - North eastern part of Grazute regional park; 9 - Complex of Smalva limy fens

4.5.2 POTENTIAL IMPACTS

The functional and structural changes in Druksiai lake biota are caused by thermal releases from INPP and chemical pollution, which main sources are waste waters of INPP and Visaginas municipal sewerage, that are returned to Druksiai lake, after being processed at the general household sewage water cleaning system (the former Skripki lake). The Building 117/1 D&D activities will not change the thermal releases and discharges of municipal sewerage and INPP.

The proposed economic activity will be held within the INPP industrial site. Protected species, as designated by Lithuanian or European Law, are not encountered within the boundaries of the INPP industrial site.

The proposed economic activity will have no relevant interaction with biodiversity outside the INPP industrial site. Building 117/1 D&D project, either individually or in combination with other plans or projects, will not have an effect on the natural habitats and the species or the birds habitats and the species for which the SCIs and SPAs have been designated. There will be no project implications for the SCIs and SPAs in the vicinity of INPP in view of their conservation objectives.

4.5.3 IMPACT MITIGATION MEASURES

No impacts on biodiversity due to implementation of proposed economic activity are foreseen. Therefore no impact mitigation measures are proposed.

4.6 LANDSCAPE

4.6.1 INFORMATION ABOUT THE SITE

The building 117/1 is within the INPP site. The landscape of the site is industrial and is characterized by power production units and buildings connected to power production operation. The most visible part of the power plant is stack.

Landscape around the INPP is mainly composed of forests and wetlands. Residential areas consist of small villages with traditional houses. Lake Druksiai is a major natural landscape element with associated activities (fishing, recreational use). The recreation areas along the Lake Druksiai with their specific natural and visual qualities have a great value for the quality of life. The valuable landscape areas (like Grazute Regional Park and Smalva hydrographic reserve) are located at about 10 kilometers from the building 117/1.

4.6.2 POTENTIAL IMPACTS

Demolition of building 117/1 is not foreseen in the project. Dismantling and decontamination of the redundant equipment in the building 117/1 will not change the landscape characteristics of the INPP site. There are also no foreseen impacts on residential and recreational areas in the vicinity of the site. Slightly higher traffic on the roads of sanitary protection zone during transportation of materials and waste will not change a visual impact.

4.6.3 IMPACT MITIGATION MEASURES

Since no potential impacts on landscape are identified, there are no impact mitigation measures foreseen.

4.7 SOCIAL AND ECONOMIC ENVIRONMENT

4.7.1 INFORMATION ABOUT THE SITE

4.7.1.1 POPULATION AND DEMOGRAPHY

According to data for 2007 the total population of the INPP region, which includes the municipality of Visaginas (58 km^2), Ignalina district (1 447 km^2) and the Zarasai district (1 334 km^2) was 69 760 (in Visaginas 28 579 people and in Ignalina and Zarasai districts 20 386 and 20 795 people, respectively). Even INPP region comprises 4.3 % of Lithuania territory, however the population number is about 2.1 % of the total Lithuania population. During the recent years, a decrease of population in the INPP region is observed. From 1999 to 2007 the total population of the region has decreased approximately by 17 %. The information about the main demographic indicators and population distribution in the region within a radius of 30 km is presented in Table 4.7.1-1, Table 4.7.1-2 and Figure 4.7.1-1.

Table 4.7.1-1 Demographic indicators of INPP region in 2007

Factor	Ignalina district	Zarasai district	Visaginas	INPP region
% of population < 15 years	13.58	14.42	12.12	13.23
% of population 15–44 years	34.73	36.96	46.09	40.1
% of population 45–64 years	24.95	24.6	31.89	27.71
% of population ≥ 65 years	24.07	21.44	8.04	16.68
% of population ≥ 75 years	11.11	10.07	2.17	7.11
Birth rate per 1000 pop.	6.3	7.5	9.6	7.8
Death rate per 1000 pop.	22.5	20.2	8.0	16.9
Natural increase per 1000 pop.	-16.2	-12.7	1.6	-9.1

Table 4.7.1-2 Population distribution (thousands) in 2007

Radius of circle	N	NE	E	SE	S	SW	W	NW	Amount of inhabitants	
									in the ring	cumulative within the radius
30 km	27.9	0.6	6.3	1.0	1.2	1.7	1.7	0.7	41.1	101,0
25 km	1.0	0.7	1.8	1.8	3.3	1.1	1.0	6.2	16.9	59,9
20 km	0.3	0.2	1.0	0.9	0.9	2.1	0.7	0.5	6.6	43,0
15 km	0.4	0.6	0.7	0.7	0.7	0.9	0.2	0.7	4.9	36,4
10 km	0.3	0.4	0.5	0.3	0.7	0.3	28.6	0.2	31.3	31,5
5 km	–	–	–	–	0.1	–	–	0.1	0.2	0,2
3 km	-	-	-	-	-	-	-	-	-	-
Total in the segment	29.9	2.5	10.3	4.7	6.9	6.1	32.2	8.4	Total 101.0	

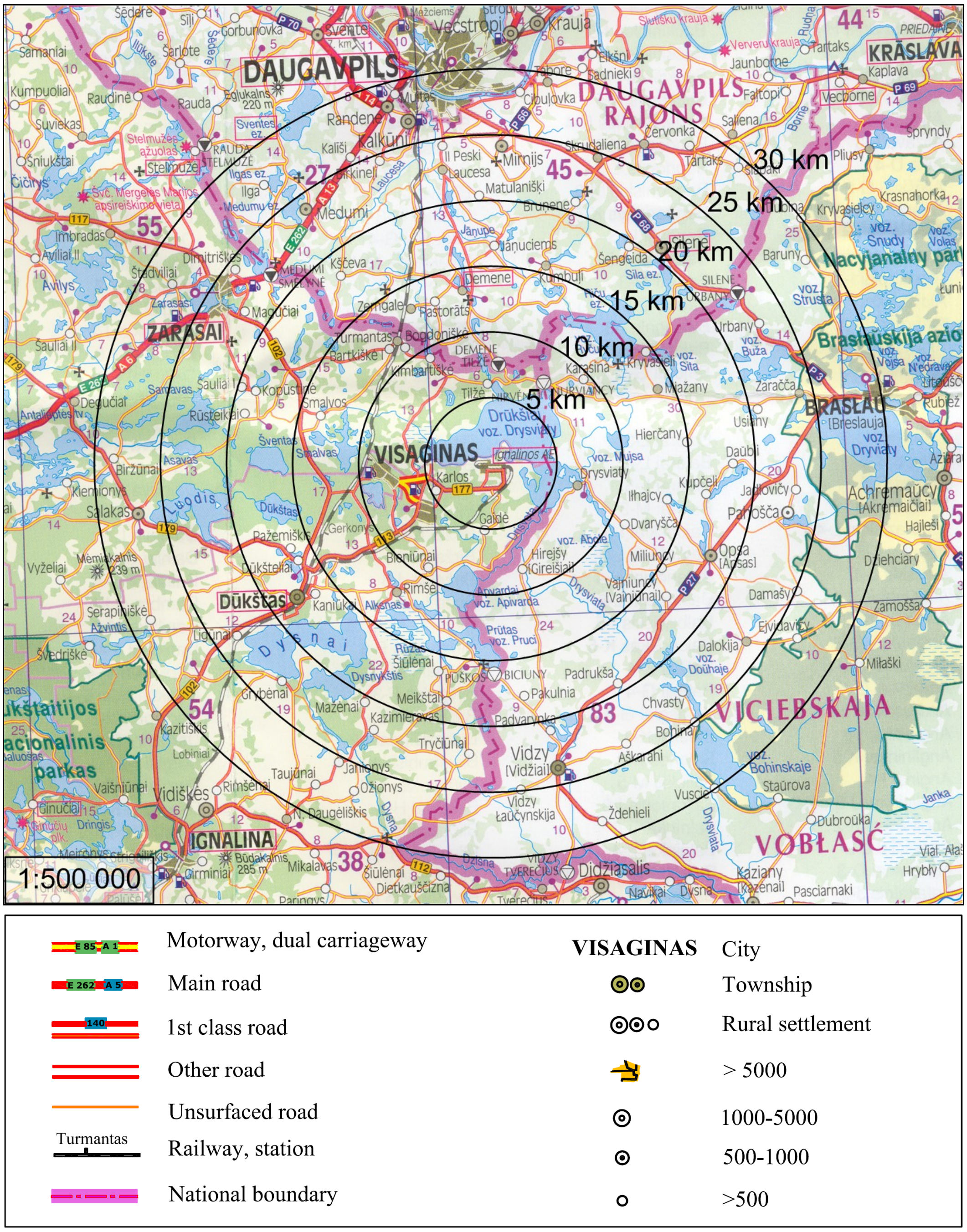

Figure 4.7.1-1 Population distribution within 5, 10, 15, 20, 25 and 30 km radius around the INPP

Inhabitants, living in the territories of Latvia and Belarus, which fall into 30 km radius zone around INPP are taken into account (Table 4.7.1-2). Within the 30 km radius the density of population is about 36 people per km^2. This is lower than the average density of population in Lithuania – about 52 people per km^2. In fact, population density in the INPP region is one of the lowest in Lithuania.

A 3 km radius sanitary protected zone is established around the INPP there are neither farms nor settlements and economic activities are limited. The closest town is Visaginas, which is situated about 6 km from the INPP.

4.7.1.2 ECONOMIC ACTIVITIES

A 3 km radius sanitary protected zone is established around the INPP where economic activities are limited. Land use in the surrounding area is made of: lakes =15 %, swamps = 15 %, farming land = 40 % and forests = about 30 %.

From the economic point of view the INPP region, except the town of Visaginas, is a less developed region in Lithuania. Agriculture and forestry of low intensity dominate in the region (for example, the intensity of cattle breeding is about 1.4 times lower than on the average in Lithuania). No important minerals (with the exception of quartz sand) are found in the region. The turnover of the retail trade in the region is 1.5, and the volume of services is more than 2.5 times lower than on the average in the country.

The town of Visaginas has an urban type labour force, which means a younger age structure (residents under 41 years of age is 67 %), more educated people and greater variety of professional training. Ignalina and Zarasai districts have a rural type labour force, which means an older age structure, lower education and a small variety of professional training.

Neither chemical nor oil process industries exist in the vicinity of the INPP.

4.7.1.3 ROAD AND RAILWAY CONNECTIONS, FORBIDDEN FOR FLIGHTS AREAS

The existing road and railway systems are shown on Figure 4.7.1-2. The nearest highway passes 12 km to the west of INPP. This highway joins Vilnius with Zarasai the border town to Latvia and has an exit to the highway connecting Kaunas–St Petersburg. The entrance of the main road from INPP to the highway is near the town of Dukstas. The road from INPP to Dukstas is about 20 km.

Figure 4.7.1-2 Road and railway network

The main railroad line Vilnius–St Petersburg passes 9 km to the west of INPP. The INPP is connected to the railroad by an extension from Dukstas. The railway station Dukstas is used for cargo traffic as well as for passenger transportation. The railway gauge is 1520 mm.

There are 3 zones where flights are prohibited in Lithuania, the one of which is territory within 10 km around the INPP (Figure 4.7.1-3).

There are about 30 000 flights per year (in 2005) from Vilnius airport, which is located 130 km from the INPP site. About 125 000 aeroplanes per year cross the Lithuanian air space. Altogether 30 airports of civil, military and mixed purpose are located in the country.

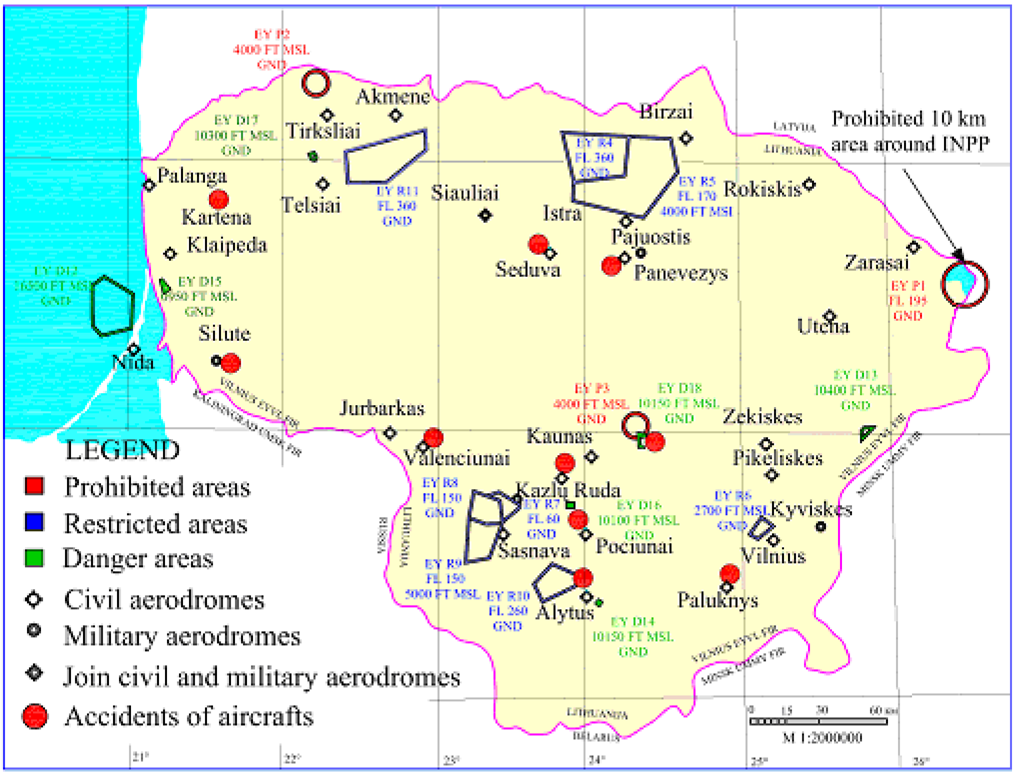

Figure 4.7.1-3 Airports, forbidden, restricted and dangerous areas in Lithuania

4.7.2 POTENTIAL IMPACTS

The proposed economic activity will be held within the INPP industrial site and within the existing 3 km radius sanitary protection zone of INPP. There is no permanently living population within the existing sanitary protection zone, and the economic activity is limited as well.

No impacts or evident changes of social and economical environment are foreseen. Necessary labor resources to perform Building 117/1 D&D implementation activities are available at INPP. Moreover, this project will decrease the social and economic impacts of the INPP final closure by using the work force with a high skill level associated with work in the nuclear industry. The project will employ up to 30 people. The initial training of the personnel including training for use of software tools for D&D management will be organized within the scope of supply.

The Building 117/1 D&D activities will be performed in accordance with the modern environmental requirements using state-of-the-art technologies. The proposed economic activity represents the EU direct investment for the INPP decommissioning. The Building 117/1 D&D

activities will be performed in compliance with the radioactive waste management principles of the IAEA and in compliance with good practices in other European Union Member States.

The project will transfer to the INPP the modern D&D equipment, technologies and operating know-how, which can be used for other INPP decommissioning projects in the near future.

Summarizing the aforesaid it can be stated that no public discontent with the Building 117/1 D&D activities is expected to take place for the following reasons:

- The D&D project is inevitable and must be performed for imperative reasons of overriding public interest, including those of a social and economic nature;
- The D&D project is financed under the EBRD managed International Ignalina Decommissioning Support Fund and will provide the modern D&D equipment, technologies and operating know-how;
- Impact of D&D project activities on components of natural and social environment will be negligible and could be evident just at a close vicinity of the INPP site. No generation of physical or biological pollutants during D&D activities is foreseen;
- The D&D project will provide direct and indirect employment for local workers. The project will employ up to 30 people;
- The D&D project will provide training of the INPP personnel including training for use of software tools for D&D management.

4.7.3 IMPACT MITIGATION MEASURES

No impacts or evident changes of social and economical environment are foreseen. Therefore no impact mitigation measures are proposed. Moreover, this project will decrease the social and economic impacts of the INPP final closure by using the work force with a high skill level associated with work in the nuclear industry.

4.8 CULTURAL HERITAGE

4.8.1 INFORMATION ABOUT THE SITE

There are seven cultural heritage sites in the vicinity of the INPP: Petriskes settlement antiquities I, Petriskes mound, Petriskes settlement antiquities II, Grikiniskes settlement antiquities III, Grikiniskes settlement antiquities II, Grikiniskes settlement antiquities I and Stabatiskes manor place (Figure 4.8.1-1). Other valuable cultural heritage objects like Grazutes regional park (area 24 230 ha), Ceberaku or Pasamanes mound (cultural heritage code A1537) etc. are more distant.

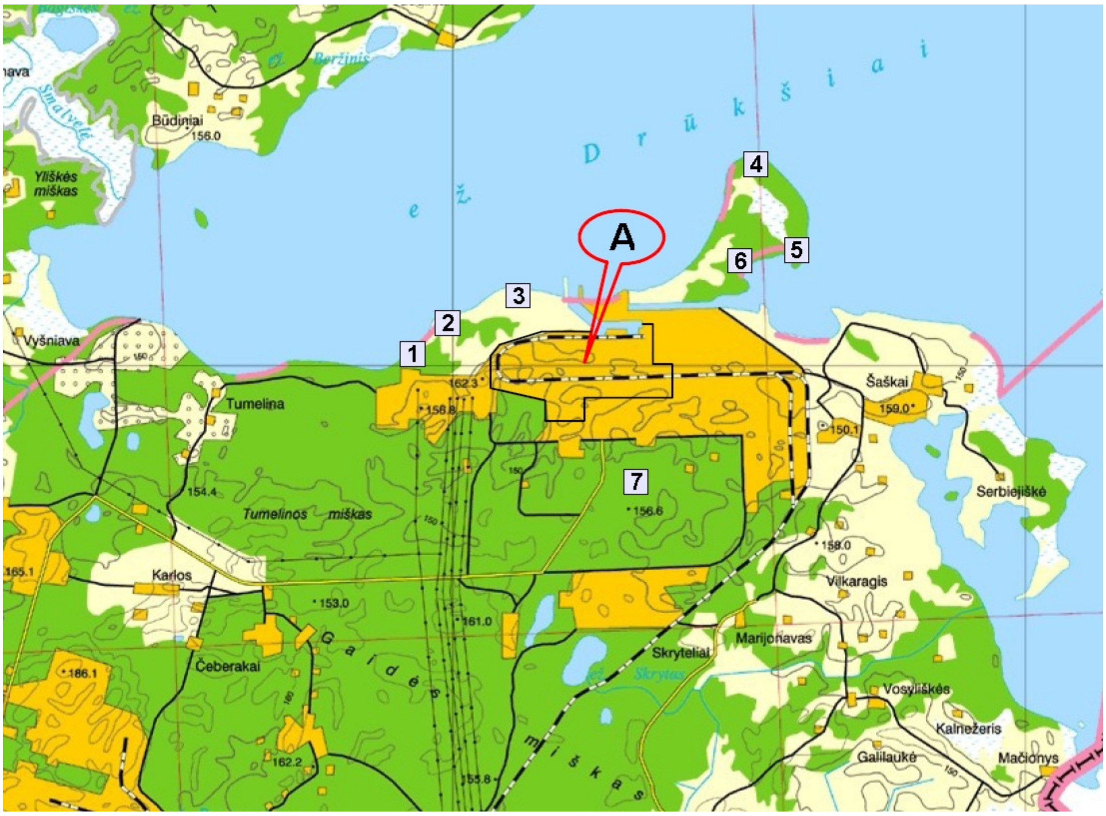

Figure 4.8.1-1 Cultural heritage objects in the vicinity of the INPP site: A – INPP site; 1 – Petriskes settlement antiquities I; 2- Petriskes mound; 3 – Petriskes settlement antiquities II; 4 – Grikiniskes settlement antiquities III; 5 – Grikiniskes settlement antiquities II; 6 – Grikiniskes settlement antiquities I; 7 – Stabatiskes manor place

4.8.2 POTENTIAL IMPACTS

The identified immovable cultural heritage objects and areas will not be affected by the dismantling and decontamination of the redundant equipment as they are located away from the building 117/1. There are no other sites of cultural heritage, ethnic or cultural conditions that could be negatively impacted by the proposed economic activity.

4.8.3 IMPACT MITIGATION MEASURES

There are no required mitigation measures relating to the protection of cultural heritage.

4.9 PUBLIC HEALTH

4.9.1 GENERAL INFORMATION

General information about population health indicators for the Ignalina NPP region (Visaginas municipality, Ignalina and Zarasai districts) is summarized in Table 4.9.1-1 and Figure 4.9.1-1.

Table 4.9.1-1 Population health indicators for the INPP region in 2007

Factor	Ignalina district	Zarasai district	Visaginas	INPP region
Registered morbidity per 1000 adults	1245*	1710*	2162*	1706*
Registered morbidity per 1000 children	2236*	2826*	3504*	2856*
Incidence of malignant neoplasms per 100000 pop	760	581	367	570
Prevalence of malignant neoplasms per 100000 pop.	2080*	2097*	1195*	1791*
Incidence of mental disorders per 100000 pop.	235	289	759	428
Prevalence of mental disorders per 100000 pop.	2094	6376	3058	3843
Admissions per 1000 pop.	180	131	200	170

* - 2005, data from Lithuanian Health Information Centre (www.lsic.lt)

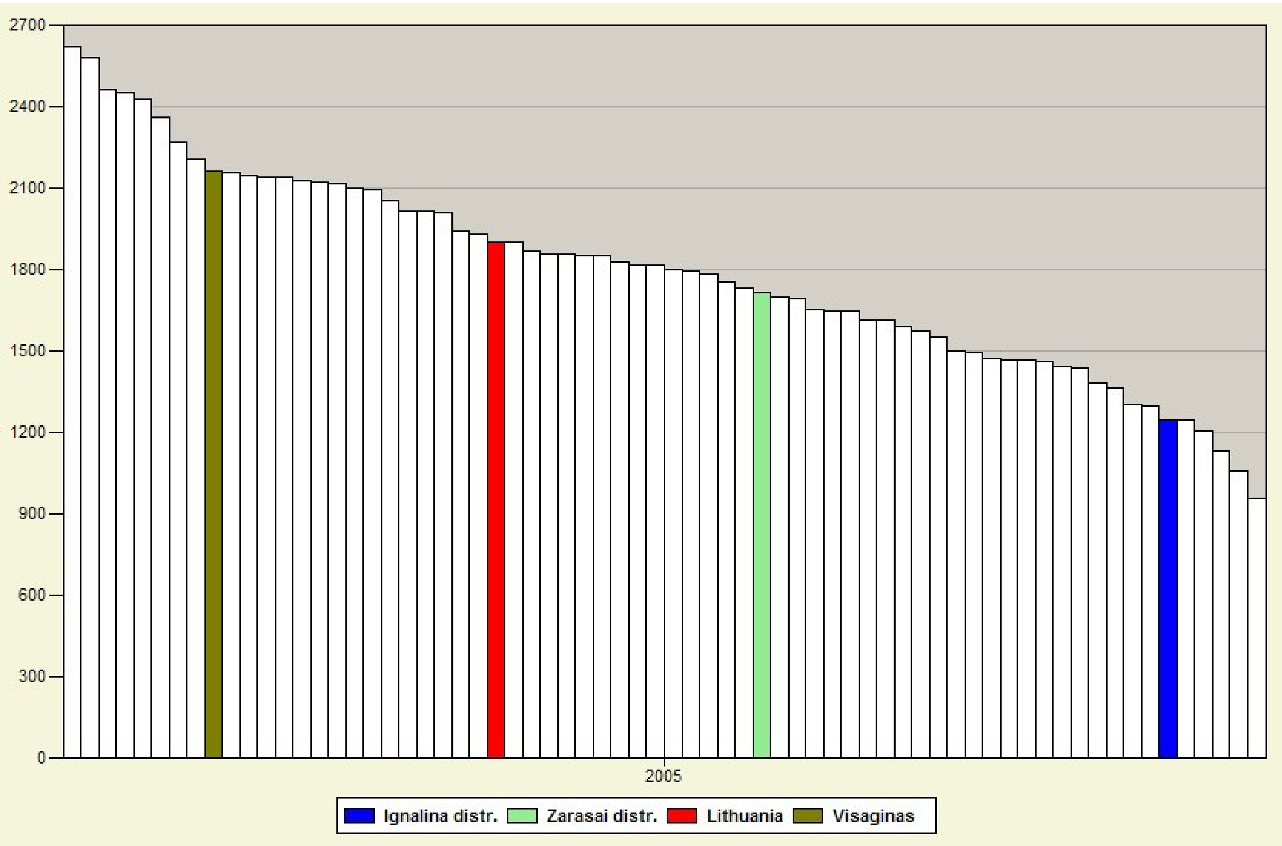

Figure 4.9.1-1 Registered morbidity per 1000 adults for Visaginas Municipality, Ignalina and Zarasai districts and Lithuania in 2005 (Lithuanian Health Information Centre (www.lsic.lt))

Death rate per 1000 population and percent of working age population for Visaginas municipality, Ignalina and Zarasai districts, Lithuania and Utena county in 2007 are presented in Figure 4.9.1-2 and Figure 4.9.1-3.

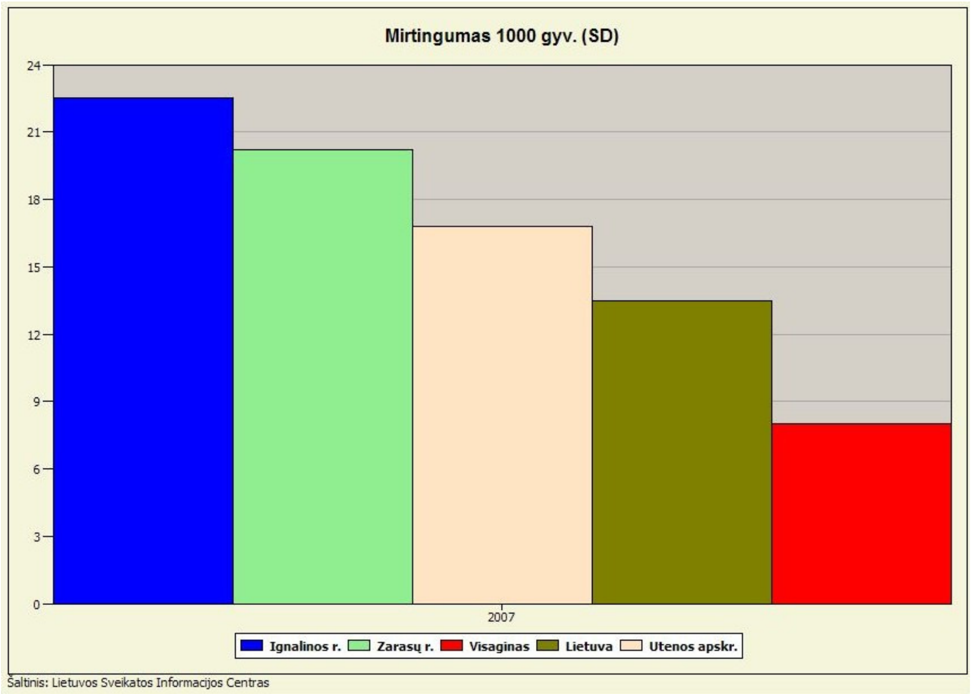

Figure 4.9.1-2 Death rate per 1000 population for Visaginas Municipality, Ignalina and Zarasai district, Lithuania and Utena county in 2007 (Lithuanian Health Information Centre (www.lsic.lt))

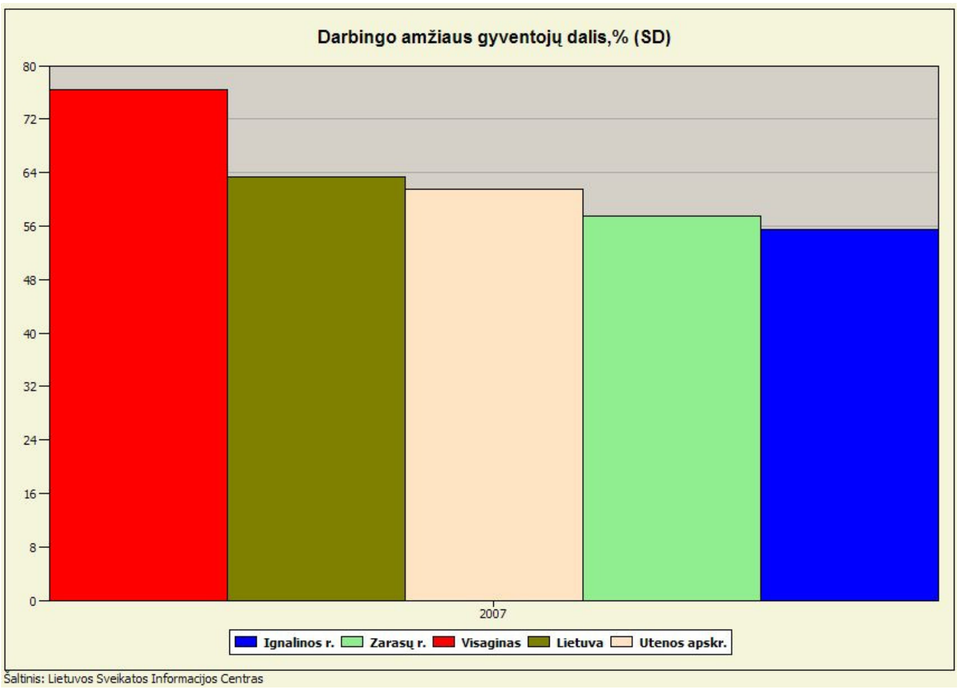

Figure 4.9.1-3 Percent of working age population for Visaginas Municipality, Ignalina and Zarasai districts, Lithuania and Utena county in 2007 (Lithuanian Health Information Centre (www.lsic.lt))

As can be seen from Figure 4.9.1-2 the death rate per 1000 population for town of Visaginas is lowermost in the whole country and the death rate per 1000 population for Ignalina and Zarasai districts is uppermost. This is not connected anyhow with operation of INPP; the reason is the age of population. As can be seen from Figure 4.9.1-3 the percent of working age population for town of Visaginas is uppermost in the whole country and the percent of working age population for Ignalina and Zarasai districts is one of the lowermost in Lithuania.

The main determinants of non-radiological impacts due to the proposed economic activity are scrutinized in Section 4.9.2. The radiological impacts on public health are presented in Section 4.9.3. The direct and indirect radiological and non-radiological impacts of the proposed economic activity on factors influencing the public health, possible impact of the building 117/1 D&D activities on public groups and assessment of impact features are summarized in Section 4.9.4.

4.9.2 NON-RADIOLOGICAL IMPACT ON PUBLIC HEALTH AND IMPACT MITIGATION MEASURES

The main determinants of non-radiological impacts due to the building 117/1 D&D activities are scrutinized in this Section. The factors with potential impact on public health are identified in accordance with the requirements of “Regulations for Impact on Public Health Assessment” [1] and the Impact Identification Matrix, which is worked out according to the EC funded study “Environmental Impact Assessment for the Decommissioning of Nuclear Installations” [2] and provided in Table 4.1.

4.9.2.1 Controlled Non-radiological Releases of Liquid and Gaseous Effluents

There will be no uncontrolled releases into the water component of the environment due to Building 117/1 D&D activities. Only the non-radioactive effluents from the INPP can be released to the household waste water sewerage. The household waste water from the INPP is transferred to “Visagino energija” under the agreement. The INPP surface water drainage system meets the requirements of the regulation [3].

The following airborne releases will be generated during flame cutting of the Building 117/1 redundant equipment: welding aerosol, carbon monoxide (CO) and nitrogen oxides (NO_x). During mechanical (using saw) cutting of the steel only steel dust will be produced. Localised ventilation systems will be set up at the cutting location in order to remove different chemical materials generated during cutting process. The ventilation systems will contain pre-filters and HEPA filters in order to clean the exhaust air prior its discharge to the atmosphere. Current ambient air pollutant levels in the environment of INPP will not be significantly enhanced by the planned D&D activities, c.f. chapter 4.2.2. Ground level concentrations of pollutants in ambient air will be below the limit values for the protection of human health [4], [5].

4.9.2.2 Incidental Non-radiological Releases of Liquids and Gases

Accidental spills of combustive-lubricating materials from vehicles during transportation of dismantled and decontaminated materials to the FRMF and Landfill Buffer Storage could potentially contaminate soil and groundwater at the INPP site. In case of accidental spilling of oil products during transport operations, the procedures established in regulation LAND 9-2002 [6] will be performed.

The risk of incidental / accidental non-radiological releases of gases’ are considered to be very small.

4.9.2.3 Noise and Vibrations

The Building 117/1 D&D activities are not an important source of noise or vibrations. Moreover, there is no inhabitant within the sanitary protection zone (in the distance of 3 km around INPP), so that there is no particular perception of noise or vibrations. This subject is not relevant for Building 117/1 D&D, apart for possible nuisances within the sanitary protection zone caused by the traffic of trucks transporting loads of waste to FRMF and Landfill Buffer Storage. Local traffic will be very low and temporary. Building 117/1 demolition works as well as D&D activities, which can raise a vibration, are not foreseen.

The exposure of workers to the risks arising from noise will meet requirements established in Lithuanian normative document [7], which is in compliance with Directive 2003/10/EC [8]. The exposure limit values and exposure action values in respect of the daily noise exposure levels and peak sound pressure are fixed at:

- Exposure limit values: $L_{EX, 8h}$ = 87 dB(A) and p_{peak}= 200 Pa (140 dB (C) in relation to 20 µPa) respectively;
- Upper exposure action values: $L_{EX, 8h}$ = 85 dB(A) and p_{peak} = 140 Pa (137 dB (C) in relation to 20 µPa) respectively;
- Lower exposure action values: $L_{EX, 8h}$ = 80 dB(A) and p_{peak}= 112 Pa (135 dB (C) in relation to 20 µPa) respectively.

When applying the exposure limit values, the determination of the worker's effective exposure shall take account of the attenuation provided by the individual hearing protectors worn by the worker. The exposure action values shall not take account of the effect of any such protectors [7, 8].

4.9.2.4 Electromagnetic Radiation

Electromagnetic radiation of industrial frequency (50 Hz) at workplaces will comply with the requirements of the Lithuanian Hygiene Standard HN 110:2001 [9].

When employees are working with PC (personal computers) or VDT (video-terminals) the lighting, heat surroundings and ergonomic requirements will comply with the requirements of the Lithuanian Hygiene Standard HN 32:2004 [10]. Electromagnetic radiation at workplaces will comply with the requirements of the Lithuanian Technical Standard TN 01:1998 [11].

4.9.2.5 Transport of Materials

Transportation of D&D items is foreseen by use of INPP existing trucks MAZ or equivalent with carrying capacity 20 000 kg. The necessary amount of transports (considering that D&D items are transported loaded into a 20 foot half height ISO standard containers) is estimated to be up to 60.

Infrastructure of roads at INPP site is developed enough to cope with such inconsiderable additional transport. A little intensification of traffic and slightly increased air pollution will be temporary and the affected area will only include the transportation route and its direct environment in a range of about 100 m. No adverse effect on the public health is foreseen due to additional transport at INPP site inside the sanitary protection zone.

4.9.2.6 Land Use Changes and Sanitary Protection Zone

There will be no land use changes and demolition of Building 117/1 as well as refill and earth movements. There will also be no changes of existing INPP sanitary protection zone due to the building 117/1 D&D activities.

4.9.2.7 Personnel Accidents and Operating Failures

Falls from height of employees working in building 117/1 will be prevented by design solutions including:

- Any working at height required will be carried out from suitable working platforms with handrails;
- Fall arrestors and harnesses will be employed.

Being struck by tools / equipment falling from height will be prevented by design solutions including:

- All working platforms and raised deck levels will be equipped with suitable toe boards around openings;
- Exclusion zones will be barriered off below working areas;
- Safety helmets will be worn.

Being struck / crushed / trapped by unsupported equipment will be prevented by design solutions including:

- Safe systems of work will be developed;
- All equipment will be suitably supported and retained during dismantling.

Burns and flash injury hazard from hot cutting techniques will be prevented while employees will wear suitable personal protective equipment.

Fume / asphyxiation hazards from hot cutting techniques will be prevented by design solutions including:

- All cutting operations will be carried out in ventilated areas;
- Monitoring of working conditions in potentially hazardous working locations and access routes.

Dropped load from electric overhead travel crane will be prevented by design solutions including:

- Crane installation will be suitably designed;
- Crane and lifting gear will be tested, certified and regularly inspected;
- Operators will be correctly trained and certified.

4.9.2.8 Fire and Explosion

Fire and explosion hazards from hot cutting techniques will be prevented by design solutions including::

- Safe methods of work will be developed;
- All pressure equipment will comply with ISO standards;
- All "tented" areas will be made from fire retardant materials.

4.9.2.9 Handling of Hazardous and Toxic Materials

Chemical hazard from existing materials in building 117/1 (e.g. lead / cadmium in paint) will be prevented by design solutions including:

- Appropriate personal protective equipment including heavy duty gloves will be worn;
- Respirators will be worn during the size reduction and decontamination operations so there will be no contact or ingestion of hazardous chemicals.

4.9.2.10 Conclusions

The Building 117/1 D&D activities will not produce significant impacts of a non-radiological nature, which could physically affect public health. The more detailed assessment of risks on public health arising from implementation the proposed economic activity is discussed in chapter 8.

4.9.3 RADIOLOGICAL IMPACT ON PUBLIC HEALTH AND IMPACT MITIGATION MEASURES

This chapter summarizes all assessed radiological impacts, considers their total effect and demonstrates ability for the proposed economical activity to meet compliance with radiation protection requirements in force. The chapter addresses radiological impacts potentially may arise under normal operation conditions of the proposed economical activity. Emergency situations are discussed in chapter 8 “Risk Analysis and Assessment”.

4.9.3.1 RADIATION PROTECTION REQUIREMENTS

Radiation Protection Requirements for Members of Personnel

The Republic of Lithuania hygienic norm HN 73:2001 [1] defines dose limits for workers:

- The limit for effective dose – 100 mSv in a in a consecutive 5 year period;
- The limit for annual effective dose – 50 mSv;
- The limit on equivalent dose for the lens of the eye – 150 mSv in a year;
- The limit on equivalent dose for the skin, limbs (hands and feet) – 500 mSv in a year. This limit has to be averaged over 1 cm^2 area of skin subjected to maximal exposure.

The INPP internal procedures on radiation protection foresee additional requirements which assure permanent control of radiation impact on personnel and implementation of the ALARA principle. The daily exposure of member of the personnel performing works in the supervised area normally is planned to assure the effective dose not exceeding 0.2 mSv. Higher daily doses may be allowed, however working activity shall be organized in accordance with special procedures. Annual exposure of the member of personnel is controlled to be below 20 mSv. Additional restrictions on permissible daily exposure are imposed and additional radiation monitoring provisions are foreseen for members of personnel which annual exposure have exceeded 20 mSv.

Radiation Protection Requirements for Members of General Public

The Republic of Lithuania hygienic norm HN 73:2001 [1] defines dose limits for members of the public:

- The limit for effective dose – 1 mSv in a year;
- In special circumstances limit for effective dose – 5 mSv in a year provided that the average over five consecutive years does not exceed 1 mSv in a year;
- The limit on equivalent dose for the lens of the eye – 15 mSv in a year;
- The limit on equivalent dose for the skin – 50 mSv in a year. This limit has to be averaged over 1 cm^2 area of skin subjected to maximal exposure.

In optimization of radiation protection the source related individual dose is bounded by a dose constraint. The dose constraint for each source is intended to ensure that the sum of doses to critical group members from all controlled sources remains within dose limit. The dose constraint for the members of public due to operation and decommissioning of nuclear facilities is 0.2 mSv per year [2].

If radionuclides are dispersed into environment by several pathways (e.g. by air and water paths) and the members of the same or different critical groups of population are impacted, the particular pathway resulting dose shall be limited in such a way that the total sum of doses from all pathways shall not exceed the dose constraint. The impact due to direct external ionizing irradiation shall be taken into account and the total dose (due to radioactive emissions and due to direct irradiation) to the critical group member of population shall not exceed the dose constraint.

The design, operation and decommissioning of nuclear object shall be such as to assure that the annual dose to the critical group members due to operation and decommissioning of nuclear facility including short time anticipated operational transients shall not exceed the dose constraint [3].

For comparison purpose it can be indicated that average value of annual effective dose to the Lithuanian inhabitants due to natural sources of ionizing radiation is 2.2 mSv. The main natural radiation sources and their average dose values are: indoor radon - 1 mSv, cosmic radiation – 0.35 mSv, soil (external radiation) – 0.06 mSv, construction materials indoors – 0.45 mSv, natural radionuclides in human body – 0.34 mSv. The average dose of world population due to natural radiation is 2.4 mSv per year. Comparison of established annual effective dose limits, dose constraint and dose from natural sources is presented in Figure 4.9.3-1. Data on natural exposure are taken from Lithuanian Radiation Protection Centre website (http://www.rsc.lt/index.php/pageid/313#4).

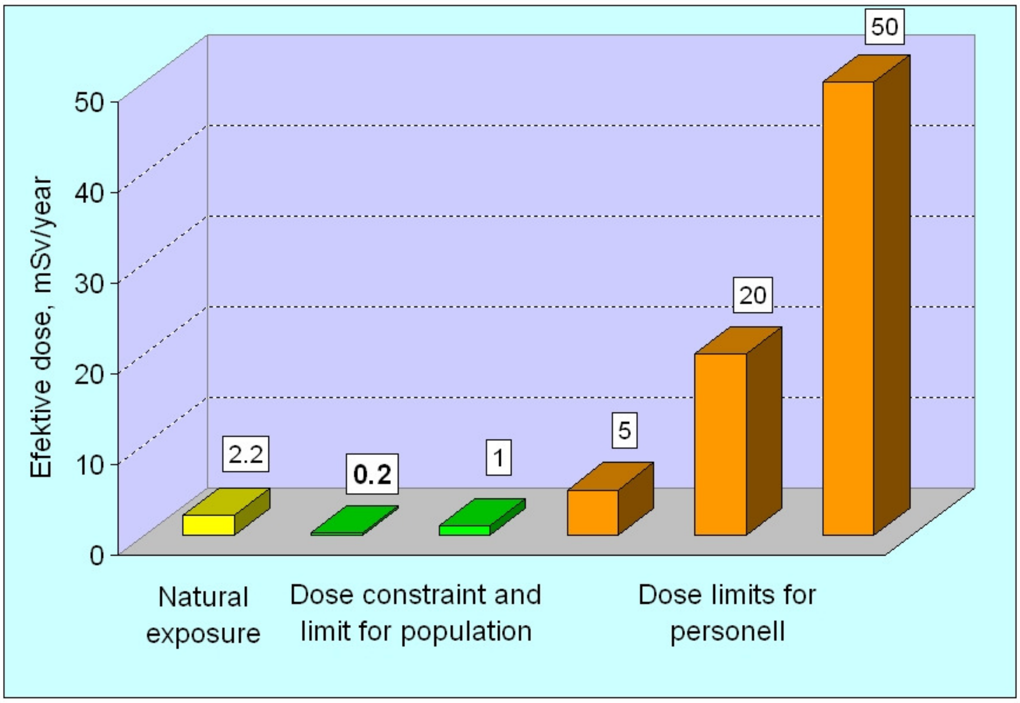

Figure 4.9.3-1 Annual effective dose limits, dose constraint and exposure from natural sources in Lithuania

4.9.3.2 POTENTIAL RADIOACTIVE IMPACT ON PUBLIC HEALTH

Potentially, radiological impact on public health may arise from following sources resulting from implementation of the proposed economical activity:

- Release of airborne radioactive materials into atmosphere from Building 117/1 may lead to dispersion of radioactivity outside the boundaries of INPP industrial site and to the public exposure;
- Opening and dismantling of internally contaminated equipment may lead to increase of radioactive fields inside the Building 117/1. The radioactive fields, if increased outside the boundaries of the INPP site, may lead to increase of the public exposure;

- Transport of D&D items and other radioactive waste, arising from the D&D activities, from Building 117/1 to waste management facilities on the INPP site may lead to increase of radioactive fields on the INPP site. The radioactive fields, if increased outside the boundaries of the INPP site, may lead to increase of the public exposure.

The identified impacts are estimated to be extremely low and therefore will not adversely change the existing radiological situation around the INPP site. It can be concluded that implementation of the proposed economical activity will not create impact on public health which should be considered as relevant from radiological safety point of view. Significance of each of identified potential radiological impact sources are discussed below.

Impact due to emission of radioactive materials into atmosphere

The radiation exposure of the critical group members of population in the environment of INPP resulting from the potential emission of radioactive material into atmosphere from Building 117/1 equipment D&D activity is assessed in chapter 4.2.3. The effective dose to the critical group member of population is calculated to be below 4×10^{-4} µSv. Annual dose constitutes a fraction of less than 2×10^{-6} from the established annual dose constraint, which equals to 200 µSv (or 0.2 mSv, c.f. radiation protection requirements above) and of less than 5×10^{-4} from the annual dose due to Unit 1 when it was in routine operation (0.9 µSv). The potential radiological impact on the environment components outside the INPP industrial site due to radioactive emissions is evaluated to be very low and therefore further is no more considered.

Impact due to increase of radioactive fields of ionizing irradiation

The dose rate field around the Building 117/1 is governed by irradiation from the aside located structure of the power unit 1. Dose rate values outside the Building 117/1 are higher than inside.

D&D of internally contaminated ECCS components may give local dose rate increase inside the premises of Building 117/1. The measured gamma dose rate from internal surface of ECCS pressurized tanks at level 0-1 m (maximal surface contamination) varies in range 3-12 µSv/h, c.f. chapter 2.1.5.2. The higher dose rates are to be expected from internal surfaces of pipework (especially from located in room 01) which contamination is higher as compare to the contamination of pressurized tanks. However the potential dose rate increase is not significant respect to dose rate values outside the Building 117/1. Limited amount and size of sources (during deplanting), self shielding (depends on stacking of dismantled elements prior decontamination) and building structure shielding effects can also be taken into consideration. The proposed economical activity will not adversely change the existing radiological situation outside the Building 117/1.

Impact due to transport of D&D items and other radioactive waste

All radioactive materials transfer operations performed by this proposed economic activity will take place within boundaries of the INPP industrial site. No radioactive waste transports outside the INPP site are planned.

It is expected that approximately 98% of the dismantled mass will constitute elements decontaminated to the free release conditions – i.e. to the conditions when material can be considered as non radioactive. Decontamination will be performed inside the Building 117/1. Transport of non radioactive material from Building 117/1 to the FRMF will not create radiological hazard.

The remaining 2% of the dismantled mass will be very low level radioactive waste (of class A) which finally has to be disposed off in the Landfill repository. The non compressible Landfill waste will be transported loaded into standard 20 foot half height ISO containers (c.f. chapter 2.3). The Landfill waste mass is estimated to be about 20 000 kg (c.f. chapter 2.1.5) which, also considering admissible vehicle load should fit at most into two of above indicated ISO containers. Dose rate from Landfill waste transport container in distance of 100 m and further can be considered as negligible (can be expected to be of order of 0.1 μSv/h and lower). Transport of two containers with very low level radioactive waste on the INPP site within 6 month period will not create any credible increase in annual dose to the population.

Most of the radioactive waste, produced due to the proposed D&D activities, will be very low level waste (c.f. Chapter 3). The non-compressible waste may be used as voids filler for the same containers with Landfill waste. Other types of radioactive waste (very low level compressible radioactive waste and low level radioactive waste) will be transported to appropriate waste management facilities on site using INPP existing radioactive waste transport means and procedures. The amounts of expected radioactive waste, resulting from this proposed economic activity, are low compared to the amounts of operational waste produced by INPP (in average INPP generates and transports to the storage facilities about 600 m^3 of solid very low level radioactive waste per year) and are covered by annual deviations in operational waste amounts. The proposed economical activity will not adversely change the existing radiological situation outside the INPP site.

4.9.3.3 CONSIDERATION OF POTENTIAL IMPACT ON PERSONNEL HEALTH

No significant impact on personnel (both directly involved into the proposed economical activity and other personnel on the INPP site) can be expected during implementation of the proposed economical activity. The detail estimation of personnel exposure for specific working places and operations and application of ALARA principle are tasks for the Basic design and Safety Justification Report. The EIA addresses main aspects influencing personnel safety with purpose to demonstrate that personnel exposure can be handled within permissible radiation safety limits.

The bounding value for collective dose to personnel due to inhalation of airborne activity is estimated to be below 2 mSv, c.f. chapter 4.2.3. The collective dose is low. The individual inhalation doses are to be lower collective dose. Conservatively it can be assumed that maximal individual dose is bounded by evaluated collective dose. The individual worker exposure of 2 mSv during several months of D&D activity is still low.

The radiological impact (due to inhalation, contamination) on personnel working within specific or confined working places like decontamination cell etc. will be limited by use of locally installed mobile ventilation units (c.f. chapter 2.2) and personal protective equipment (PPE). The concept of the proposed economical activity foresees using of PPE as protective gloves, overalls, respirators etc.

The premises of Building 117/1 are classified as category III rooms where personnel working time due to radiation safety reasons are not specially limited. The actual radiological conditions in the premises of Building 117/1 are considerably lower limiting requirements for category III rooms, c.f. chapter 2.1.4. Preparatory activity like installation of new equipment or arrangement of working places and deplanting of low contaminated items will not present significant radiological hazard. The personal protective equipment shall be used where necessary.

The D&D of internally contaminated ECCS components may give local dose rate increase. The measured gamma dose rate from internal surface of ECCS pressurized tanks at level 0-1 m (maximal surface contamination) varies in range 3-12 μSv/h, c.f. chapter 2.1.5.2. The dose rate still not exceeds limiting values set for category III rooms. The higher dose rates are to be expected from internal surfaces of pipework (especially from located in room 01) which contamination is higher as compare to the contamination of pressurized tanks. However the levels of dose rate and contamination are relatively modest and will readily allow the use of manually deployed techniques, subject to the application of personal protective equipment and consideration of ALARA principle.

The collection, transport and management of radioactive waste will be performed in accordance with the INPP safety procedures, using the existing INPP radioactive waste transport and management means. Such activity is already licensed and is successively performed at the INPP for years. No general changes in existing practice are expected. To this proposed economical activity related on site adaptations, if necessary, will be considered by Basic design and Safety Justification Report.

4.9.3.4 SANITARY PROTECTION ZONE

The proposed economical activity will be held within boundaries of INPP industrial site. The site is surrounded by the security fence. A 3 km radius sanitary protection zone (SPZ) is established around the INPP power units.

Potential radiological impact on environment components due to the proposed economical activity under normal operation conditions is evaluated to be very low. Therefore the radiological impact is screened out from further consideration as to be insignificant from radiological point of view. The proposed economical activity will not adversely change the existing radiological situation outside the Building 117/1. Reconsideration of existing INPP sanitary protection zone boundaries or its status is not necessary.

4.9.3.5 CUMULATIVE IMPACT ON PUBLIC HEALTH DUE TO PROPOSED ECONOMICAL ACTIVITY AND OTHER EXISTING AND PLANNED NUCLEAR FACILITIES IN THE INPP SANITARY PROTECTION ZONE

According to the INPP Final Decommissioning Plan [4] the INPP decommissioning process is split into several decommissioning projects (DP). Each of these DP is a process covering a particular field of activity, defining scope of works and their specific and providing input for organization of specific activity, safety analysis and environmental impact assessment. In order to ensure that environmental impact assessment is based on reliable and detailed information, what becomes available along with the progress in the particular DP, the EIA Program of INPP decommissioning [5] provides to develop EIA reports separately for each DP. Every EIA report of a subsequent DP shall take into account results of previous reports. Thus the overall environmental impact due to INPP decommissioning would be assessed and controlled on the basis of the latest information, and environmental impact mitigation measures would be adequate to the real situation.

The Building 117/1 equipment D&D is one of separate INPP decommissioning projects performed in accordance with the INPP Final Decommissioning Plan.

In addition to this proposed economical activity the INPP decommissioning project foresees construction of a new Interim Spent Nuclear Fuel Storage Facility (ISFSF), Solid Radioactive Waste Management and Storage Facility (SWMSF), very low-level radioactive waste disposal facility (Landfill repository) and low and intermediate level radioactive waste near-surface disposal facility. Future activities foresee to convert presently operated Bituminized Waste Storage Facility into a disposal facility. Liquid radioactive waste Cement Solidification Facility (i.e., for grouting of spent ion-exchange resins and filter aid deposits) was started to operate in year 2006. Solidified waste will be temporary stored in a new Temporary Storage Facility, constructed in the INPP industrial site. Later on, the waste will be disposed of in the low and intermediate level radioactive waste near-surface disposal facility. The decision has already been made concerning extension of the existing spent nuclear fuel storage facility. In year 2006 VATESI appended the license conditions and allowed to store additionally 18 CONSTOR RBMK-1500 casks in the storage facility. One more modification is planned, which would increase the storage capacity by additional 10 CONSTOR RBMK-1500 casks.

Furthermore, a possibility to construct a new nuclear power plant with total electricity production up to 3400 MW is under consideration.

Existing and planned nuclear facilities, located in the Ignalina NPP sanitary protection zone of 3 km radius are shown in Figure 4.9.3-2. Activity phases (operation, decommissioning, institutional surveillance, etc.) of the nuclear facilities are summarized in Figure 4.9.3-3.

Potential radiological impact on environment components due to the proposed economical activity under normal operation conditions is evaluated to be very low. The radiological impact is screened out from further consideration as to be insignificant from radiological point of view. The proposed economical activity will not adversely change the existing radiological situation outside the Building 117/1. Therefore no relevant interactions or negative cumulative effects with other existing and planned activities are foreseen. Impacts due to the final management and disposal of radioactive waste, relatively small amounts of which may arise from implementation of the proposed economical activity, are accounted by appropriate studies of the new Solid Radioactive Waste Management and Storage Facility (SWMSF), Very Low-Level Radioactive Waste Disposal Facility (VLLW Repository) and Low and Intermediate Level Radioactive Waste Near-Surface Disposal Facility. These studies consider particular and total effects on environment due to management of different radioactive waste streams resulting from decommissioning of INPP.

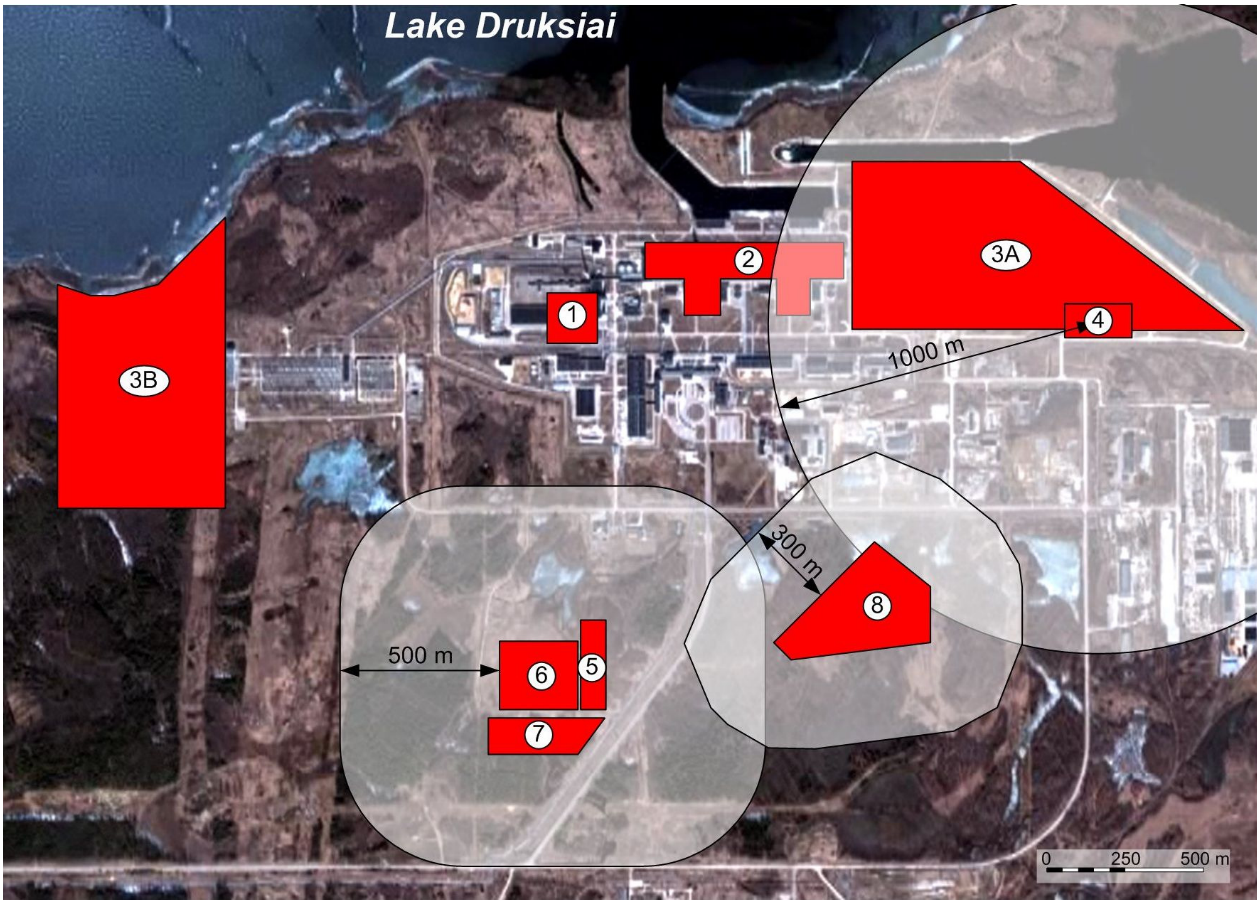

Figure 4.9.3-2 Existing and planned nuclear facilities, located in the Ignalina NPP sanitary protection zone of 3 km radius

(1) – Existing bituminized radioactive waste storage facility and new interim storage facility for solidified radioactive waste (spent ion-exchange resins and filter aid deposits). Both storage facilities are located inside the INPP industrial site and presently do not have their separate Sanitary Protection Zones (SPZ). During INPP decommissioning it is planned to convert bituminized waste storage facility into a disposal facility. A separate SPZ will be foreseen during development of EIA documents for this disposal facility.

(2) –Power Units of Ignalina NPP. The Building 117/1 is in about 20 m from the Power Unit 1. The INPP existing SPZ is an area of 3 km radius around the Power Units.

(3A) and (3B) – alternative sites for the newly planned NPP. The SPZ for the new NPP will be proposed during development of EIA documentation for this new NPP.

(4) – Existing Spent Nuclear Fuel (SNF) storage facility. The design of the storage facility defines a 1 km radius SPZ around this facility. SPZ of the storage facility falls within boundaries of INPP existing SPZ and presently is not allocated separately.

(5), (6) – The new interim SNF storage facility (ISFSF) and Solid radioactive Waste Treatment and Storage Facility (SWTSF). These nuclear facilities will be close to each other, their SPZ will overlap and the facilities will have a common security fence. EIA Reports foresee a common of about 500 m wide SPZ for the both facilities.

(7) – One of the proposed sites (southern) for very low-level radioactive waste disposal facility (Landfill). SPZ is not defined; preliminary proposals will be prepared during the development of EIA documents.

(8) – Disposal vaults of the planned low and intermediate level radioactive waste near-surface disposal facility in the Stabatiskes site. EIA Report defines SPZ as area enveloping 300 m distance from the disposal vaults. The layout of the facility is preliminary and shall be detailed during development of Basic design.

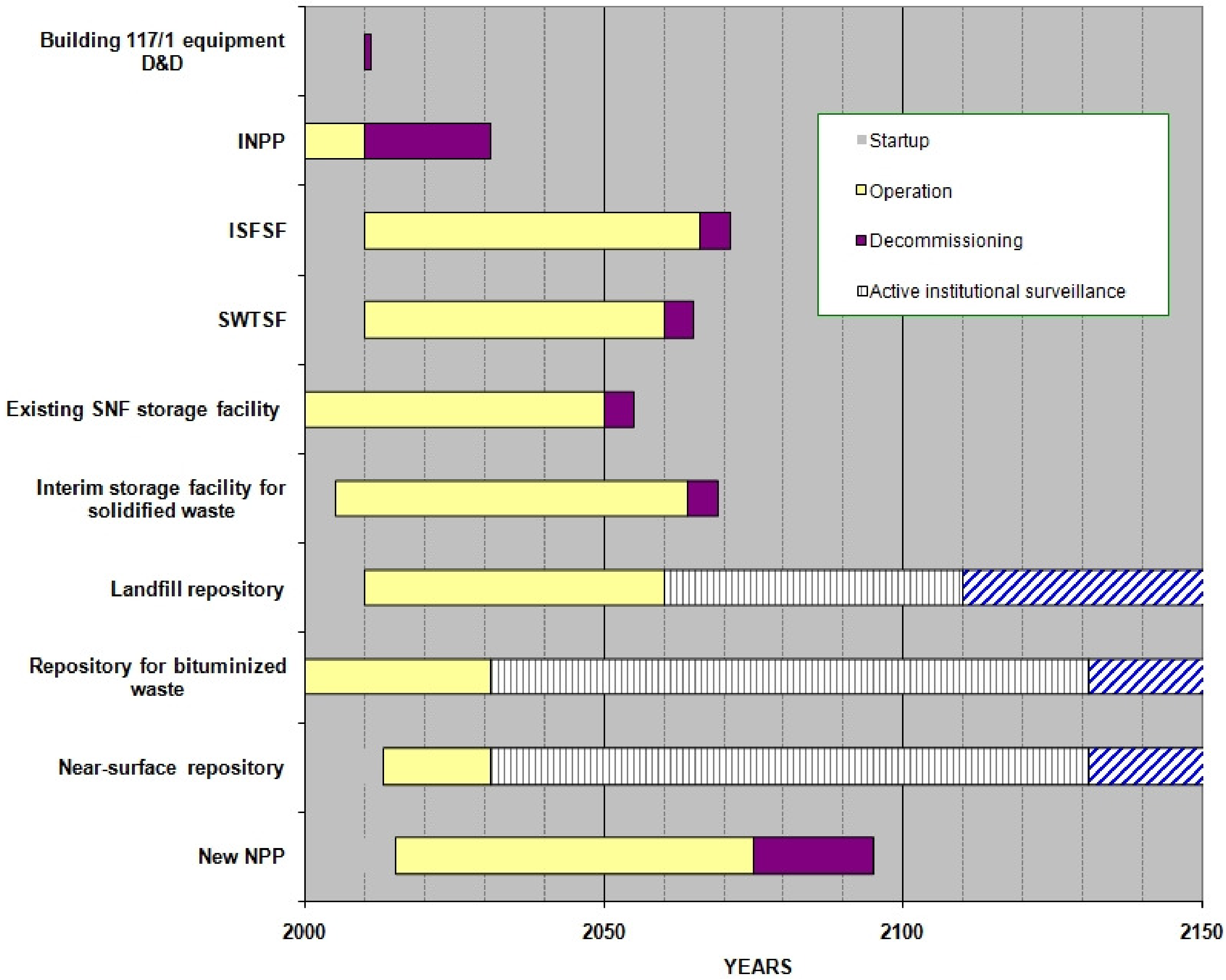

Figure 4.9.3-3 Main activity phases of the existing and planned nuclear facilities, located in Ignalina NPP existing sanitary protection zone of 3 km radius

The interim storage facility stored solidified radioactive waste (spent ion-exchange resins and filter aid deposits) packages are planned to be disposed in the near-surface repository for low and intermediate level radioactive waste. Therefore the operation period of the interim storage facility may be shorter than indicated in the Figure.

The new solid radioactive waste treatment facility (SWTSF) will treat waste until about 2030 (i.e., until the end of INPP decommissioning). Later on the waste will only be stored. The SWTSF short-lived waste storage buildings stored radioactive waste packages are planned to be disposed in the near-surface repository for low and intermediate level radioactive waste. Therefore the operation period of SWTSF short-lived waste stores may be shorter than indicated in the Figure.

The Building 117/1 equipment D&D activities are short as compare to other indicated projects. It is planned that performance of D&D works itself (when radiological impact potentially may be expected) will take approximately one year, i.e. will be started in the III quarter of 2010 and will be finished in the III quarter of 2011.

4.9.3.6 RADIOLOGICAL IMPACT MITIGATION MEASURES

No specific radiological impact mitigation measures in addition to those that planned by design concept are proposed.

The planned design solutions foresee multi barrier concept for localization, entrapment and collection of airborne radioactivity thus preventing any significant radioactive emissions into working environment and / or atmosphere.

The workers direct exposure shall be controlled and limited by workplace and individual monitoring, work planning with consideration of ALARA principle and use of personal protective means. All these means shall be foreseen by Basic design and are subject for Safety Justification Report. The increase of ionizing irradiation fields outside the structure of Building 117/1 is not foreseen.

The monitoring of actual radioactive emissions into working premises and atmosphere as well as radiological situation Building 117/1 equipment D&D shall be assured in accordance with regulations in force.

4.9.4 SUMMARY OF IMPACT ON PUBLIC HEALTH

4.9.4.1 Radiological and non-radiological impact

Following the Regulations for Impact on Public Health Assessment [1] the main factors and impacts of the proposed economic activity are identified and evaluated in this report. The direct and indirect impacts of the building 117/1 D&D activities on factors influencing the public health are summarized in Table 4.9.4-1.

Possible impact on public groups is summarized in Table 4.9.4-2.

Assessment of impact features is presented in Table 4.9.4-3 .

Table 4.9.4-1 Direct and indirect impacts of the proposed economic activity on factors influencing the health

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
1. Factors of behaviour and lifestyle (nutrition habits, alcohol consumption, smoking, consumption of narcotic and psychotropic drugs, safe sex and other)	Building 117/1 D&D activities	Not foreseen				The proposed economic activity will be implemented within existing INPP sanitary protection zone, where there is no permanently living population. Potential impact of physical nature can be expected in the vicinity of building 117/1 only. The INPP personnel will be used for D&D activities. The working conditions will be assured in accordance with requirements of regulations in force (see Sections 4.9.2 and 4.9.3).
2. Factors of physical environment						
2.1. Air quality	Traffic of heavy vehicles, airborne releases generated during flame cutting of the building 117/1 redundant equipment	Local air pollution	(-)	The ambient air quality will be directly affected by CO, NO_X, and dust emissions generated by flame and mechanical cutting and the road transfer of D&D equipment. All impacts will be temporary and reversible. Ground level concentrations of pollutants in ambient air will be below the the limit values for the protection of human health (see Section 4.2)	The affected area includes the transport route and its direct environment in a range of about 100 m. Due to low forecasted traffic levels the impact level of the emissions of the vehicles will be acceptable. Transportation will go in open air so that the natural air circulation will avoid the accumulation of significant concentrations of such substances.	Localised ventilation systems will be set up at the cutting location in order to remove different chemical materials generated during cutting process. The ventilation systems will contain filters in order to clean the exhaust air prior its discharge to the atmosphere.

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
2.2. Water quality	INPP household sewerage system and surface drain water system	Possible controlled slight pollution due to utilities type sewage release to environment.	(-)	The potable water will be supplied by "Visagino Energija". No new boreholes are foreseen. The Sventoji-Upininkai aquifer system rich with underground water is exploited by the Visaginas town waterworks. The quality of underground water of exploited aquifer complex is good not only in the waterworks but also in all region and its changes happened in the waterworks are minimal. Changes are not forecasted.	The INPP sewage water system follows the requirements of normative document [2]. The INPP surface drain water collection system follows the requirements of normative document [3] (see Section 4.1). In case of accidental spilling of oil products during transport operations, the procedures established in regulation LAND 9-2002 [4] will be performed (see Section 4.3).	Survey boreholes (wells) for monitoring underground run-off water are installed at the INPP site as part of required environmental monitoring (see Chapter 7 "Monitoring").
2.3. Food quality	Building 117/1 D&D activities	Not foreseen				
2.4. Soil	Building 117/1 D&D activities	Slight physical (mechanical) impact on topsoil around the building 117/1 due to loading and transportation of dismantled equipment	(-)	A slight mechanical impact on topsoil around the building 117/1 will be temporary.	Topsoil layer on the site around the building 117/1 will be re-established and planted as appropriate after finishing the D&D works (see Section 4.3).	In case of accidental spilling of oil products during transport operations, the procedures established in regulation LAND 9-2002 [4] will be performed.
2.5. Nonionizing radiation	Building 117/1 D&D activities	Not foreseen			Electromagnetic radiation of industrial frequency (50 Hz) at workplaces will comply with the requirements of the	When employees are working with PC (personal computers) or VDT (video-terminals) the lighting, heat surroundings

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
					Lithuanian Hygiene Standard HN 110:2001 [5] (see Section 4.9.2.4).	and ergonomic requirements will comply with the requirements of the Lithuanian Hygiene Standard HN 32:2004 [6]. Electromagnetic radiation at workplaces will comply with the requirements of the Lithuanian Technical Standard TN 01:1998 [7].
2.6. Ionizing radiation	Building 117/1 D&D activities.	Not foreseen		The proposed economical activity will not adversely change the existing radiological situation outside the Building 117/1. The radiological impact is screened out from further consideration as to be insignificant from radiological point of view (see Section 4.9.3).	No specific radiological impact mitigation measures in addition to those that planned by design concept are proposed. Around the INPP site, the sanitary protection zone is established, in which there is no permanent inhabitants and economic activities are limited. Monitoring of the ionizing radiation impact and possible changes in the environment will be performed (see Chapter 7).	The planned design solutions foresee multi barrier concept for localization, entrapment and collection of airborne radioactivity thus preventing any significant radioactive emissions into working environment and / or atmosphere.
2.7. Noise	Building 117/1 D&D activities	Traffic of trucks transporting loads of waste to FRMF and Landfill Facility.	(-)	There is no inhabitants within the sanitary protection zone (in the distance of 3 km around INPP), so that there is no particular perception of noise. Local traffic will be very low and temporal (see Section 4.9.2.3).	The noisy activities will be carried out during daytime only.	Demolition of the building 117/1 is not foreseen.
2.8. Home conditions	Building 117/1 D&D	Not foreseen				

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
	activities					
2.9. Safety	Building 117/1 D&D activities	Increase of the radiation safety	(+)	The building 117/1 D&D activities will increase radiation safety and reduce the risk of possible accidents compared with the existing situation.	All radioactive materials will be managed according to the Lithuanian legislation and regulations, management principles of IAEA and in compliance with good practices in other European Union Member States (see Chapters 2 and 3).	
2.10. Means of communication	Building 117/1 D&D activities	Controlled slight impact on the environment	(-)	Possible temporary traffic increase within the sanitary protection zone (see Section 4.9.2.5).	The transportation of dismantled materials will be carried out during daytime only.	There is no inhabitants within the sanitary protection zone
2.11. Territory planning	Building 117/1 D&D activities	Not foreseen		There will be no land use or INPP sanitary protection zone changes due to the building 117/1 D&D activities (see Section 4.9.2.6).		
2.12. Waste management	Building 117/1 D&D activities and waste management	Controlled slight impact on the environment	(-)	Waste amounts generated by building 117/1 D&D activities are very small (see Chapter 3). Small changes are only forecasted.	Waste will be managed in accordance with the requirements of waste management legislation and regulations in force and Permission on integrated prevention and control of pollution (see Chapters 2 and 3).	INPP decommissioning projects will reduce ecological impacts resulting from INPP operation.
2.13. Power appliance	Building 117/1 D&D activities	Not foreseen				
2.14. Risk of misadventures	Building 117/1 D&D activities	Not foreseen				
2. 15. Passive smoking	Building 117/1 D&D activities	Not foreseen				

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
2.16. Other	Building 117/1 D&D activities	Not foreseen				
3. Social and economic factors						
3.1. Culture	Building 117/1 D&D activities	Not foreseen				
3.2. Discrimination	Building 117/1 D&D activities	Not foreseen				
3.3. Property	Building 117/1 D&D activities	Not foreseen				
3.4. Income	Infusion of new capital into the region economy	Increase of population income	(+)	The proposed economic activity represents the EU direct investment for the INPP decommissioning. (see Section 4.7).		Detailed Design is carried out by the VT Nuclear Services Ltd together with NUKEM Technologies GmbH and LEI. For meetings at INPP the foreigners fly to Lithuania, stay in hotels and increase local income.
3.5. Education possibilities	Building 117/1 D&D activities	Not foreseen				
3.6. Employment, labour market, business opportunities	Building 117/1 D&D activities	Workplace creation	(+)	The project will employ up to 30 people. The INPP personnel that will be released from INPP operation and maintenance (including post-shutdown activities) will be used (see Section 4.7).		
3.7. Criminality	Building 117/1 D&D activities	Not foreseen				
3.8. Leisure, recreation	Building 117/1 D&D activities	Not foreseen				
3.9. Movement	Building 117/1 D&D activities	Not foreseen				

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
3.10. Social security (social contact and welfare)	Building 117/1 D&D activities	Not foreseen				
3.11. Sociality, sociability, cultural contact	Building 117/1 D&D activities	Not foreseen				
3.12. Migration	Building 117/1 D&D activities	Employment reduces emigration	(+)	Small changes (see Section 4.7).		
3.13. Family constitution	Building 117/1 D&D activities	Not foreseen				
3.14. Other	Building 117/1 D&D activities	Not foreseen				
4. Professional risk factors						
4.1 Chemical	Building 117/1 D&D activities	Not foreseen				
4.2. Physical	Building 117/1 D&D activities, emergency situations	Ionizing radiation	(-)	Risk analysis of possible emergency situations during the building 117/1 D&D activities is presented in Chapter 8.	Risk of the majority emergency situations can be eliminated or reduced by appropriate technical solutions.	Possible personnel exposure during emergency situations can be controlled and limited.
4.3. Biological	Building 117/1 D&D activities	Not foreseen				
4.4. Ergonomic	Building 117/1 D&D activities	Not foreseen				
4.5. Psychosocial	Building 117/1 D&D activities	Not foreseen				
4.6. Manual work	Building 117/1 D&D activities	Not foreseen				
5. Psychological factors						
5.1. Aesthetical appearance	Building 117/1 D&D activities	Impact on landscape	(-)	Slightly higher traffic on the roads of sanitary protection		Demolition of the building 117/1 is not foreseen.

Factors influencing the health	Kind of activity or means, contamination sources	Impact on factors influencing the health	Impact on health: positive (+) negative (-)	Forecasted changes of the analyzed indicators	Possibilities to mitigate (to eliminate) the negative impact	Comments and remarks
				zone during transportation of materials and waste will not change a visual impact.		
5.2. Comprehensibility	Building 117/1 D&D activities	Not foreseen				
5.3. Capability to hold the situation	Building 117/1 D&D activities	Not foreseen				
5.4. Significance	Building 117/1 D&D activities	Not foreseen				
5.5. Possible conflicts	Building 117/1 D&D activities	Possible population discontent and distrust in Latvia and Belorussia.	(-)	Such a psychological impact is stipulated by changes in existing nuclear practice (shutdown and decommissioning of INPP), which results in construction of new nuclear objects such as ISFSF, SWMSF, Near Surface Repository, Landfill repository and others.	Psychological impact can be mitigated explaining necessity, goals and benefits from building 117/1 D&D activities.	
6. Social and health services (acceptability, suitability, succession, efficiency, protection, availability, quality, self-help technique)	Building 117/1 D&D activities	Not foreseen				

Table 4.9.4-2 Possible impact of building 117/1 D&D activities on public groups

Public groups	Kind of activity or means, contamination sources	Group size	Impact: positive (+) negative (-)	Comments and remarks
1. Public groups (local population) in the zone of activity impact	Ionizing radiation	There are no permanently living population in the sanitary protection zone and economical activity is limited as well.		The planned design solutions foresee multi barrier concept for localization, entrapment and collection of airborne radioactivity thus preventing any significant radioactive emissions into working environment and / or atmosphere. The proposed economical activity will not adversely change the existing radiological situation outside the Building 117/1. The radiological impact is screened out from further consideration as to be insignificant from radiological point of view
2. Personnel	Ionizing radiation	Personnel of INPP	(-)	The planned design solutions foresee multi barrier concept for localization, entrapment and collection of airborne radioactivity thus preventing any significant radioactive emissions into working environment and / or atmosphere. The personnel direct exposure shall be controlled and limited by workplace and individual monitoring, work planning with consideration of ALARA principle and use of personal protective means.
3. Uses of activity products	Undiscriminated			
4. Persons with slender income	Undiscriminated			
5. The jobless	Undiscriminated			
6. Ethnical groups	Undiscriminated			
7. Persons sick with same diseases (dependence on drugs, alcohol etc.)	Undiscriminated			
8. Disables	Undiscriminated			
9. Single persons	Undiscriminated			
10. Refugees, emigrants and persons seeking political asylum	Undiscriminated			
11. The homeless	Undiscriminated			
12. Other population groups (arrestees, persons of special occupations, manual hard workers etc.)	Undiscriminated			
13. Other groups (single persons)	Undiscriminated			

Table 4.9.4-3 Assessment of features of impacts

Impact induced by factor	**Impact features**									**Comments and remarks**
	Number of persons under the impact			**Evidence (possibility), strength of the evidentiary material**			**Duration**			
	Up to 500 persons	**501–1000 persons**	**More then 1001 persons**	**Clear**	**Probable**	**Possible**	**Short (up to 1 y)**	**Medium (1–3 y)**	**Long (more then 3 y)**	
1. Ionizing radiation	X					X	X			Possible local impact to INPP personnel directly involved into D&D activity. Exposure will not exceed limits prescribed by radiation protection requirements
2. Generation of dust and local air pollution	X				X		X			
3. Controlled slight pollution due to utilities type sewage release to environment			X		X		X			
4. Soil	X					X	X			
5. Noise	X					X	X			
6. Waste management			X	X					X	
7. Impact on landscape	X					X	X			

5 POTENTIAL IMPACT ON NEIGHBORING COUNTRIES

Two countries, i.e. the Republic of Belarus and the Republic of Latvia, are relatively close to the INPP site. The state border Lithuania–Belarus is in about 5 km to the east and southeast from the INPP Power Units. The state border Lithuania–Latvia is in about 8 km to the north from the INPP Power Units.

Other countries are at a distance of at least hundred kilometers away from the INPP site and will not be affected by the proposed economic activity.

5.1 GENERAL INFORMATION ON NEIGHBOURING COUNTRIES

The Daugavpils region of Latvia and the Braslav region of Belarus are in the immediate vicinity of the INPP (Figure 5.1-1).

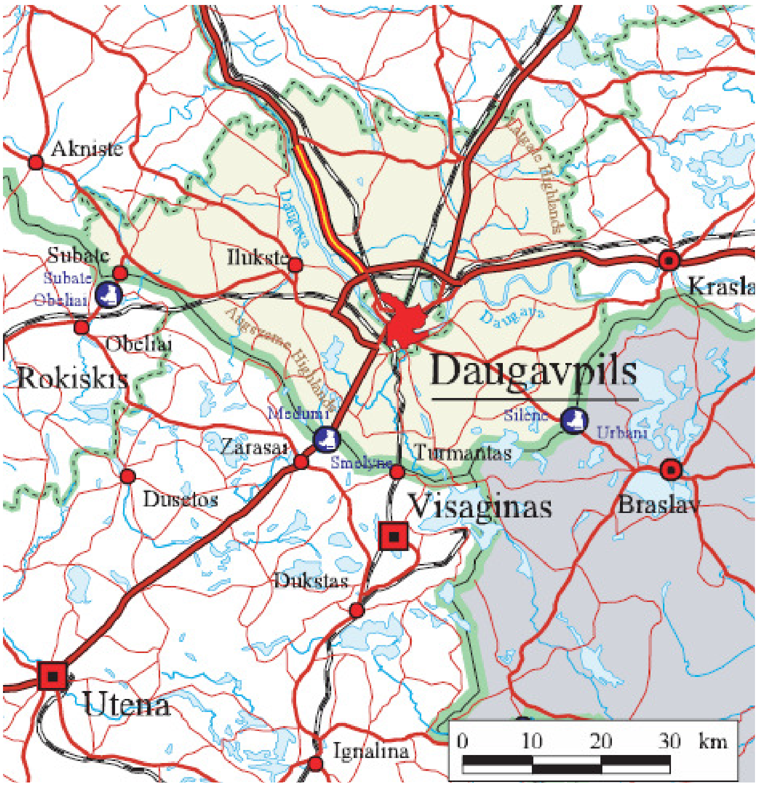

Figure 5.1-1 The Daugavpils region of Latvia and the Braslav region of Belarus

5.1.1 Daugavpils Region

Daugavpils region borders with Lithuania and Belarus. Total area of the Daugavpils region is 2598 km^2.

Land use of the region is as follows: farm lands – 48 %, wooded areas – 34 % and other uses – 18 %. However, agriculture does not significantly contribute to the economic output of the region, as Daugavpils region can be considered as an industrial one. Though there is a lot of land fit for cultivation, the conditions for farming are not very advantageous. The hilly terrain is not conducive to cultivating large fields.

Total population of the Daugavpils region is 159 000 (population census in 2000). Population density is 61 inhabitants per km^2. Daugavpils, the second big city in Latvia after Riga, is an independent structural unit with 115 300 inhabitants in 2000 and 112 000 in 2004. In the region there are 24 small rural areas and 2 towns (Ilukste – 3 177 inhabitants and Subate – 1 013 inhabitants). Approximately 75 % of the inhabitants of the Daugavpils region live in urban areas. Population density in rural areas is low and the population is rather old.

There are good road and rail connections from Daugavpils region to Riga and also with Lithuania, Belarus and Russia. Most important are the Warsaw-Vilnius-Daugavpils-St Petersburg connection and the railroad to Riga. The national major road Riga-Daugavpils, as well as the road connection to Zarasai in Lithuania and the route Daugavpils-Rezekne-Pskov in Russia have intemational significance.

A number of historical monuments provide good background for the development of tourism. The most popular objects in the region are Daugavpils fortress from the 17th century, Peter-Paul Cathedral, a fortress from the beginning of the 19th century and Vaclaiciena Palace. One unique object is the Duke Jacob's Channel in Asare (500 m long), built in 1667–1668 to link the two rivers, Vilkupe and Eglaine, to connect Daugava and Lielupe water routes.

Latvia's largest river, the Daugava flows through the region from Belarus towards the Gulf of Riga. The length of the Daugava river is 1040 km (367 km in the territory of the Republic of Latvia). Watershed area is 87 900 km^2; average water yield is 678 m^3/s.The Daugava river meanders throughout all the territory of the Daugavpils region, making 10 loops from Kraslava to Krauja and running calmly from Liksna and Nicgale. There are 194 lakes in Daugavpils region. Some lakes (Skujines, Medumu, Bardinska, Sventes etc.) are the nature reserves.

Daugavpils region has plenty of attractive natural landscapes. The Daugava's stretch from Kraslava to Daugavpils, where the river flows in a primeval hollow, which is almost 40 metres deep, is sometimes called the Switzerland of Latgale. Two significant highland areas – the Augszeme and Latgale highlands are located in Daugavpils region. Latvia's biggest boulder (174 m^3) is in Nicgale.

5.1.2 Braslav Region

Braslav region is administrative part of Vitebsk district. The only town in the region is Braslav with 10 thousand inhabitants. Other settlements are Vidzy, Pliusy and smaller villages (Figure 5.1-2). Braslav town is on a shore of lake Driviaty, in a distance of 30 km from railway station Druia, 220 km from Minsk and 238 km from Vitebsk. There are factories of building materials, greengrocery production etc. in the town.

National park "Braslav Lakes" occupies 69.1 thousand hectares or about one third of Braslav region territory. The most picturesque and precious areas around the Braslav town forms a core of the national park. Extension of the park from north to south is 56 km and the width varies from 7 to 29 km. There are more than 60 lakes in the national park; they occupy 17 % of its territory. The first-rate lakes are Driviaty, Snudy, Strusto, Boginskoie (Figure 5.1-3). The lake Volos South is the deepest in the park and region; it is as deep as 40.4 m.

Figure 5.1-2 The Braslav region of Belarus

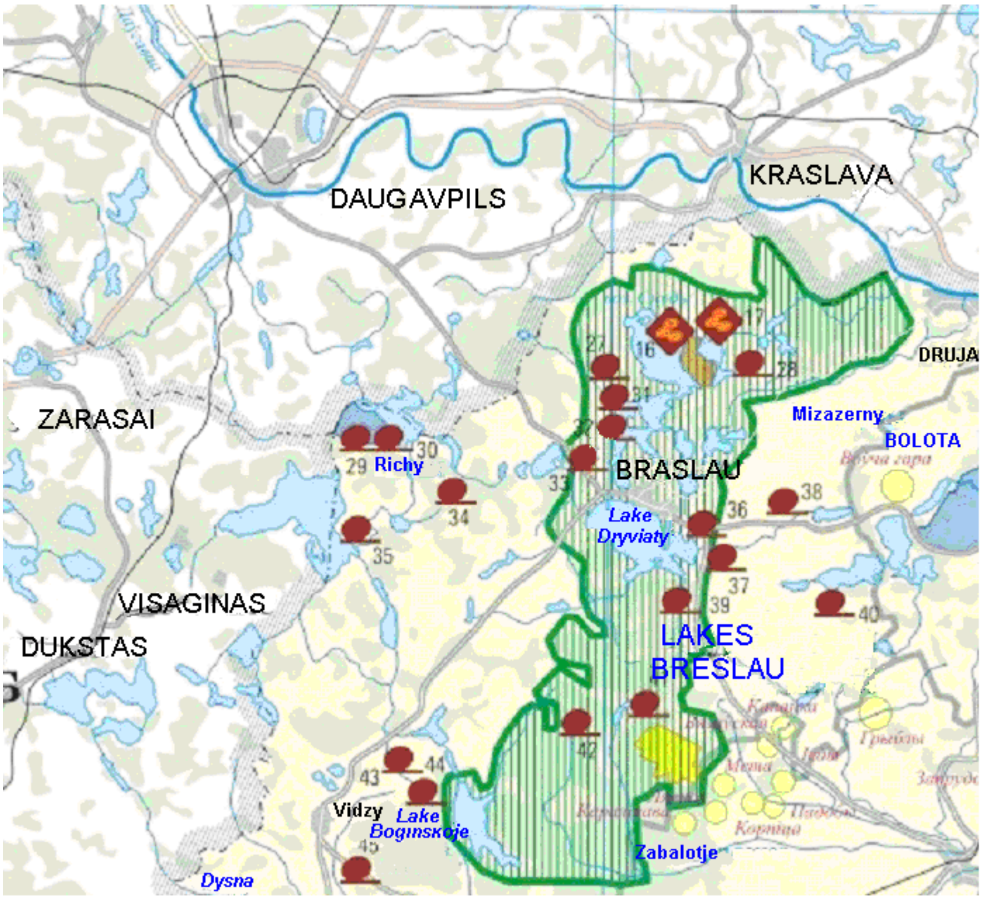

Figure 5.1-3 The national park “Braslav Lakes”

There are 4 functional zones in the national park “Braslav Lakes”:

- The reserved zone – 3452 hectares (4.9 %). This zone is in the most precious area of forest tract Boginskoie. The purpose of the reserved zone is preservation in untouched condition of typical and unique ecosystems and a gene pool of flora and fauna;
- The zone of controllable use – 27746 hectares (39.0 %). The purpose of this zone is studies of restoration, moving forces and trends of inviolate ecosystems;
- The recreational zone – 12103 hectares (17.0 %). This zone is assigned for allocation of units and buildings for rest and tourism, for actions on cultural work among the masses and for car parking management;
- The zone for economical activity – 25815 hectares (36.3 %). This zone is assigned for allocation of park visitors’ service units, living quarters and for economical activities.

The territory of national park “Braslav Lakes” presents the most peculiar natural complex of the Republic of Belarus. Unique combination of hills, lakes, marshlands and river valleys make this land extraordinary picturesque.

The typical forest inhabitants are elk, wild boar, deer, squirrel, mountain hare, brown hare, fox etc. The rare species from the Red Book of Belarus are badger, lynx and brown bear. There are about 200 species of birds in the national park “Braslav Lakes”. The rare species are black stork, crane, herring gull, ptarmigan, dunlin etc.

5.2 POTENTIAL NON-RADIOLOGICAL IMPACT AND IMPACT MITIGATION MEASURES

5.2.1 Water

There will be no uncontrolled discharges into the environment from the building 117/1 D&D activities. The INPP sewage water is released into existing sewage system in controlled manner and in accordance with the requirements of normative document [1]. The impact on surface water and groundwater by traffic-related substances is considered insignificant due to low forecasted traffic levels, low volume of potential release and distance to these sensitive receptors. Oil removers (mechanical) are installed just at the outlet of industrial-storm water to the lake Drisviaty (Druksiai). The INPP site surface water drainage system follows the requirements of normative document [2].

The Visaginas town waterworks is in about 3 km to the southwest from the INPP. The water is extracted from Sventoji–Upininkai aquifer complex of upper and middle Devonian formations. INPP site is outside the boundaries of the Visaginas town waterworks sanitary protection zone [3]. Conservative evaluations of the possible migration of contamination in the water component show that INPP can not substantially affect the quality of underground water of the Visaginas town waterworks [4]. The waterworks in the territories of Braslav region of Belarus and Daugavpils region of Latvia are considerably more distant in comparison with Visaginas town waterworks.

The building 117/1 D&D activities will not affect the surface water run-off and groundwater quality neither in the territory of Lithuania, nor in the territories of Braslav region of Belarus and Daugavpils region of Latvia.

The INPP site is surrounded by an existing network of groundwater monitoring boreholes. The underground water monitoring programme [5] is developed in accordance with normative document [6] (see Chapter 7 “Monitoring”).

5.2.2 Environmental Air (Atmosphere)

The following airborne releases will be generated during flame cutting of the building 117/1 redundant equipment: welding aerosol (including manganese oxides), carbon monoxide (CO) and nitrogen oxides (NO_x). During mechanical (using saw) cutting of the steel only steel dust will be produced. Localised ventilation systems will be set up at the cutting location in order to remove different chemical materials generated during cutting process. The ventilation systems will contain filters in order to clean the exhaust air prior its discharge to the atmosphere. Ground level concentrations of pollutants in ambient air will be below the limit values for the protection of human health [7], [8].

Mobile sources, such as the vehicles during the transportation of dismantled and decontaminated materials, will not cause significant atmospheric emissions. Due to low forecasted traffic levels the impact level of the emissions of the vehicles will be acceptable. The affected area will only include the transportation route and its direct environment in a range of about 100 m.

In summary, no significant adverse effect on the environment in the territories of Braslav region of Belarus and Daugavpils region of Latvia is to be expected from air pollutant emissions.

5.2.3 Soil

The building 117/1 D&D activities will be carried out within the boundaries of the existing industrial site. The site does not contain valuable fertile layer of the soil. No significant impacts will occur to the soils and the vegetation outside of the footprint of the INPP site.

The building 117/1 D&D activities do not involve the use of chemical reagents that, in case of accidental releases, could contaminate the soil. In case of accidental spilling of oil products during transport operations, the procedures established in regulation LAND 9-2002 [9] will be performed.

5.2.4 Underground (Geology)

Since no construction works, new foundations, refill and earth movements are planed there will be no additional influence on the geological ground structure.

Rules on underground water protection from contamination with dangerous substances [10] will be met while no dangerous substances or sewage will be released directly (without passing through the soil or subsoil) or indirectly (passing through the soil or subsoil) during building 117/1 D&D project implementation. Underground cavities will not be used for storage or disposal of any toxic substances.

The net of survey boreholes (wells) for monitoring underground run-off water is installed throughout the INPP site as part of required environmental monitoring [5, 6].

The building 117/1 D&D activities will not have any impact on the underground in the territories of Braslav region of Belarus and Daugavpils region of Latvia.

5.2.5 Biodiversity

No unique bird ecosystems or mapped critical habitats occur at the INPP site. Main impact during the building 117/1 D&D activities will be the nuisance of breeding birds by the transportation vehicles in the sanitary protected zone due to exhaust fumes, noise and visual irritations. The main impact mitigation measure is that noisy activities will be carried out during daytime only.

Building 117/1 D&D activities will produce no noise that will be perceptible at the territories of Braslav region of Belarus and Daugavpils region of Latvia since they are located at least 6 km from the INPP site.

So, there will be no impact created on biodiversity component of the environment of the Daugavpils region and the reserved zones in the national park "Braslav Lakes", which preserve in untouched condition typical and unique ecosystems and gene pool of flora and fauna of Belarus.

5.2.6 Landscape

Demolition of building 117/1 is not foreseen in the project. Dismantling and decontamination of the redundant equipment in the building 117/1 will not change the landscape characteristics of the INPP site. There are also foreseen no impacts on residential and recreational areas in the vicinity of the site.

5.2.7 Ethnic and Cultural Conditions, Cultural Heritage

Building 117/1 D&D activities will have no interaction with ethnic and cultural conditions, immovable cultural heritage objects and areas of Latvia and Belarus.

5.2.8 Social and Economic Environment

The building 117/1 D&D activities will be distant from permanently living population of Latvia and Belarus. No impacts or evident changes of social and economical environment are foreseen.

The building 117/1 D&D activities will not produce any significant impacts of conventional (non radiological) nature, which could physically affect components of the environment and public health of Belarus and Latvia. The conventional impacts might be detected only in close vicinity to the INPP and impact sources (i.e. airborne emissions etc.) will be held within permissible limits.

The building 117/1 D&D activities will be performed in accordance with the modern environmental requirements using state-of-the-art technologies. The proposed economic activity represents the EU direct investment for the INPP decommissioning. The building 117/1 D&D activities will be performed in compliance with the radioactive waste management principles of the IAEA and in compliance with good practices in other European Union Member States.

The project will transfer to the INPP the modern D&D equipment, technologies and operating know-how, which can be used for other INPP decommissioning projects in the near future.

However, population discontent and distrust is possible in Latvia and Belarus. Such a psychological impact is stipulated by changes in existing nuclear practice (shutdown and decommissioning of INPP), which results in construction of new nuclear objects such as interim spent fuel storage facility, solid waste management and storage facility, landfill repository and others.

Psychological impact can be mitigated explaining necessity, goals and benefits from proposed economic activity:

- The building 117/1 D&D project is inevitable and must be performed for imperative reasons of overriding public interest, including those of a social and economic nature;
- The D&D project is financed under the EBRD managed International Ignalina Decommissioning Support Fund and will provide the modern D&D equipment, technologies and operating know-how;
- The calculations and assessments performed in this EIA Report have clearly shown that the building 117/1 D&D activities will not produce significant impacts, neither of radiological nature nor of non-radiological nature, which could physically affect public health and environment.

Building 117/1 D&D activities will be carried out under the strict control of national regulatory authorities. These government institutions enforce state regulations that are based on the European Union practices, as well as on guidelines and conventions established by international organisations, such as the International Atomic Energy Agency (IAEA).

5.3 POTENTIAL RADIOLOGICAL IMPACT AND IMPACT MITIGATION MEASURES

By the normal operation of this proposed economic activity the radiological impact on the environment of neighboring countries potentially could be produced by the spread out of airborne activity released from Building 117/1 during equipment D&D. Other potential radiological impact sources could be increase of direct irradiation from Building 117/1 structure and from on-site transported packages containing radioactive material. The radiological impact due to the spread out of airborne activity as well as due to direct irradiation depends on the proximity to the impact sources.

No release of activity into the water component of the environment from the proposed economical activity under normal operation conditions is planned, cf. chapter 4.1. A radiological impact on the "water" component of the environment under normal operation conditions of the proposed economical activity is therefore not expected. The INPP site is equipped with survey boreholes (wells) for monitoring the groundwater quality.

The proposed economical activity will not create radiological impact on neighboring countries public health. As criterion for radiological impact insignificance the dose limit applicable to exempted practices can be used. Practices and sources within the practices may be exempted if the annual effective dose expected to be incurred by any member of the public due to the exempted practice or source is of the order of 10 μSv or less [11], [12].

The radiation exposure of population resulting from the potential emission of radioactive material into atmosphere is assessed in chapter 4.2.3. The effective dose to the critical group member of population in the environment of INPP is calculated to be below 4×10^{-4} μSv. Annual dose constitutes a fraction of less than 4×10^{-5} from the dose limit applicable to exempted practices. The potential exposure of population in the neighboring countries will be lower due to more distant location from the emission source. The potential radiological impact is evaluated to be very low and therefore further is no more considered.

Analysis of expected changes in radiological fields provides conclusion that the proposed economical activity will not adversely change the existing radiological situation outside the INPP site, c.f. chapter 4.9.3. Therefore no additional radiological impact on population of neighboring countries could be expected due to the proposed economical activity.

6 ANALYSIS OF ALTERNATIVES

The dismantling and decontamination of the equipment within Building B117/1 and the Helium Make-up Station needs to follow a defined strategy in order to be achieved in the most efficient and cost effective manner.

A number of alternatives have been identified during the project work and these are all described in this chapter. The majority of these alternatives have been considered during a quantitative assessment process in order to identify the preferred strategy option which is developed into the D&D Basic Design.

6.1 SUPPORTING DOCUMENTS AND INVESTIGATIONS

A number of underpinning activities have been carried out during the early stages of the design process and these are supplemented by supporting documents. Each of these underpinning activities has identified particular techniques or equipment that is either necessary or a preferred alternative thus greatly reducing the number of variables to be considered and hence the number of possible alternatives has been reduced as far as possible at this stage.

The following underpinning activities have been undertaken and their findings are found in detail in the D&D strategy documents produced for this project:

- Dismantling & Decontamination, Identification of Options [1] – This report identified all the feasible alternatives for size reduction and decontamination techniques and filtered out those which were not of significant use on the project;
- Dismantling & Decontamination, Optioneering [2] – This process built on the output of [1] and provided a scored qualitative Multi Attribute Decision Analysis (MADA) for the remaining alternatives and identified preferred techniques;
- Materials Handling & Transportation Options [3] – This report identified the feasible alternatives for materials and waste handling techniques;
- HAZOP 1 [4] – This process identified the relevant safety issues for the preferred alternatives identified in [2]. The output of the process identifies safety measures required and can be used to assess additional costs related to each technique in order to make it safe to implement. Later on, the HAZOP 2 study [5] revised and updated findings of previous report.

This chapter is based on the findings of these investigations and will, in turn, be used as the basis for a quantitative assessment of the remaining alternatives.

6.2 "ZERO" ALTERNATIVES

6.2.1 PASSIVE SAFE STORAGE

This alternative is based on the UK "Safestore" policy for Magnox reactors and would involve leaving building B117/1 in a state of passive safe storage for an extended period in order for radioactivity levels to decay naturally to free release levels.

Typically for this type of the safestore strategy, Co-60 / Cs-137 contamination periods of 15–40 years have been considered for decay storage of various Magnox primary circuit components (although this figure has not been calculated for Building 117/1 D&D equipment and these Magnox component periods also allow for tritium decay).

This strategy is designed to strike a balance of cost & dose benefit of not dismantling contaminated equipment against a cost for storage preparation and an ongoing cost for building maintenance.

This alternative contradicts the Government Resolution No. 1848 [6] on the immediate dismantling of INPP Unit 1.

6.2.2 DISPOSAL WITHOUT DECONTAMINATION (INTACT)

Another alternative considered for some UK reactor components, such as the Windscale Advanced Gas cooled Reactor heat exchangers, is to remove them intact and dispose of them at a waste repository without decontamination.

This option can, again, be used to reduce dose uptake to workers by removing the need for size reduction or decontamination activities. However, these advantages must be weighed against the extremely low volumetric efficiency of such disposal and the failure to achieve any material recycling.

Although this is a valid alternative it is not perceived as one which fits well with Technical Specification [7] and VATESI requirements.

6.2.3 DISPOSAL WITHOUT DECONTAMINATION (SIZE REDUCED)

A further alternative frequently considered as a baseline option for cost purposes is to size reduce the plant and equipment in order to increase the volumetric efficiency of disposing of it as waste but not to attempt decontamination.

This option allows avoiding the costs of labour, operation and treatment of radioactive waste, produced during decontamination, and weighs them against the increased radioactive waste disposal cost.

Although this option is unlikely to meet the INPP Technical Specification [7] and VATESI requirements, it can be used as a baseline cost to assess the viability of decontamination in relation to cost benefit.

This option may in fact be employed as a matter of course on a limited scale for small items not able to be readily monitored to free release levels (e.g. small bore tubes and gauges). In these cases the material may be disposed of immediately upon receipt at the workshop with an option of using a steel baler to achieve volume reduction.

6.3 LOCATION ALTERNATIVES

The location of the Building 117/1 is already predefined; however for the size reduction and decontamination of ECCS pressurized tanks two location alternatives have been analyzed: size reduction and decontamination ex-situ and size reduction and decontamination in-situ.

6.3.1 SIZE REDUCTION AND DECONTAMINATION EX-SITU

The roof of Building B117/1 could be replaced with a new, sectional, removable roof in order to allow the ECCS pressurized tanks to be removed intact from the building and transported to a new purpose built size reduction and decontamination facility.

This strategy would need to form part of a site-wide size reduction and decontamination strategy as economies of scale are required to make the new facility financially viable, i.e. the new facility would be designed to carry out all the decontamination required for decommissioning of both Units.

Considered for ECCS pressurized tanks in isolation, it would not be financially viable and hence will not meet the INPP Technical Specification [7] expectations.

6.3.2 SIZE REDUCTION AND DECONTAMINATION IN-SITU

This option introduces an entire genre of sub-options which have been reduced by the underpinning activities described in Section 6.1. The remaining sub-options are described in Section 6.4.

Due to the findings of the underpinning activities, a number of additional options have been precluded for the following reasons:

- Size reduction of small pipes was recommended by [1] to be conducted using a 'tool kit' of techniques and an individual technique should not be specified at this stage. Hence, all strategies must be assumed to use the same techniques for size reduction of small pipes at this stage;
- Size reduction of large pipes was recommended by [2] to be conducted using a 'tool kit' of techniques and an individual technique should not be specified at this stage. Hence, all strategies must be assumed to use the same techniques for size reduction of large pipes at this stage;
- Size reduction of general items (e.g. floor sections) and valves was recommended by [2] to be carried out using the same 'tool kit';
- Size reduction of the ECCS pressurized tanks was recommended by [2] to be carried out by either Milling Cutter, Gas Cutting or Plasma Cutting (very close scoring for all 3 options on MADA analysis);
- Decontamination of the majority of material was recommended by [2] to be carried out using either Vacuum Blasting or Wheel Abrator (wire brushing subsequently was rejected due to issues with contamination spread and airborne contamination). Note: for some complex items such as valve bodies it may be necessary to carry out very small scale chemical decontamination;
- Transport of material to Free Release Measurement Facility (FRMF) is to be determined following issue of [3] but is assumed to be the same method for each Strategy option in order to remove an additional variable.
- Transport / handling of material in the building has been shown from [3] to have so few options that it can be assumed to be the same across all the Strategy options;
- Transport options of waste / material to Landfill Buffer store and FRMF are assumed to be the same for each option as the preferred option will be determined from [3].

Hence, the following list of possible technological alternatives has been rationalised as far as possible at this stage.

6.4 ALTERNATIVES OF TECHNOLOGICAL SOLUTIONS

In these alternatives the following sequence would be followed [8]:

- Dismantle basement areas of Building 117/1 using 'tool kit' of techniques in order to provide buffer storage and workshop areas (including pipe removal);
- Construct decontamination workshop and related infrastructure (including crane);
- Decontaminate and export the pipes in buffer storage;
- Dismantle & decontaminate small systems and items in Building 117/1;
- Size reduce, decontaminate & export the ECCS pressurized tanks;

- Clean-up top floor level and remove floor sections;
- Clean up intermediate floors and remove floor sections;
- Clean up basement areas and remove D&D equipment;
- Remove crane.

The dismantling of Helium Make-up Station can take place in parallel to any of the above activities.

6.4.1 PLASMA CUT VESSELS, VACUUM BLAST DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Plasma cutting;
- Decontamination of equipment; Vacuum Blasting.

6.4.2 PLASMA CUT VESSELS, WHEEL ABRATOR DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Plasma cutting;
- Decontamination of equipment; Wheel Abrator (centrifugal blasting).

6.4.3 GAS CUT VESSELS, VACUUM BLAST DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Oxy-propane cutting;
- Decontamination of equipment; Vacuum Blasting.

6.4.4 GAS CUT VESSELS, WHEEL ABRATOR DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Oxy-propane cutting;
- Decontamination of equipment; Wheel Abrator (centrifugal blasting).

6.4.5 MILLING CUTTER CUT VESSELS, VACUUM BLAST DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Milling cutter;
- Decontamination of equipment; Vacuum Blasting.

6.4.6 MILLING CUTTER CUT VESSELS, WHEEL ABRATOR DECONTAMINATION

The features of this technological alternative sub-option are:

- Size reduction of small systems; Tool Kit;
- Size reduction of large systems; Tool Kit;
- Size Reduction of ECCS pressurized tanks; Milling cutter;
- Decontamination of equipment; Wheel Abrator (centrifugal blasting).

6.5 FINAL SELECTED OPTION

All the remaining technological alternatives were taken forward for quantitative assessment [9]. This assessment has shown that the main technological alternative for cutting is flame cutting. Flame cutting (oxy-propane / oxy-acetylene) is suited to cutting of items 80 mm thick. The use of flexible magnetic or suction pad mounted track systems allows relatively low dose exposure due to rapid set-up times. The main advantages of the technique are high cutting speed combined with low capital costs. However, fire / explosion hazards and ventilation requirements must be adequately addressed.

The quantitative assessment [9] has shown that the main technological alternative for decontamination is vacuum blasting. This relatively new technique is a development of dry abrasive blasting. The equipment consists of a dry abrasive blasting nozzle mounted within a localised vacuum extraction hood. The system reduces or prevents the release of airborne dust and contamination from the point of application and can readily be manually deployed. The vacuum retrieval system allows waste material to be transported directly into a waste package or the inclusion of a shot recycling system can allow separation of reusable shot.

In greater detail the final selected D&D option is described in Chapter 2.

7 MONITORING

7.1 SUPPORTING DOCUMENTS AND INVESTIGATIONS

Since startup of operation the INPP performs monitoring of environment within 30 km radius monitoring zone around the power units. The monitoring is performed in accordance with regulatory approved environment monitoring program. The monitoring program is originated on the base of Lithuanian radiation protection standards [1], Lithuanian legislation and regulations on environment monitoring [2], [3] and regulatory documents on the environment [4], [5]. Monitoring data is being summarized and submitted to competent institutions annually.

The INPP Environment Monitoring Programme [6] specifies requirements for:

- Monitoring of water quality in the lake and of groundwater (physical – chemical parameters);
- Monitoring of radionuclide concentration in the air and atmospheric fallouts;
- Monitoring of radioactivity of sewage and drainage water from the INPP site;
- Monitoring of radionuclide release into the air;
- Meteorological observations;
- Monitoring of radionuclide concentration in the lake and underground water;
- Dose and dose rate monitoring in the sanitary protective area (3 km) and radiation control area (30 km);
- Monitoring of radionuclide concentration in the fish, algae, soil, grass, sediments, mushrooms, leaves;
- Monitoring of radionuclide concentration in food products (milk, potatoes, cabbage, meat, grain-crops).

The chemical content of sewage (domestic) discharges from the industrial site of INPP is controlled by "Visagino energija".

The radiological measurements performed according to the INPP current environment monitoring Programme [6] are summarized in Table 7.1-1.

Table 7.1-1 Summary of radiological measurements performed according to the INPP environment monitoring Programme [6]

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
1.	Liquid discharges into the environment	7	Total β activity	Radiometric	1 per week – service water taken by Reactor Units 1,2; water, discharged by reactor and turbine compartments; water, discharged from Bld. 150; 1 per month – service water after the heat exchangers; At every discharge – water from special laundry.	0.1 to 1.85×10^{8} Bq/l depending on measuring object
			Volumetric activity of radionuclides	Spectrometric	1 per month – water, discharged by reactor and turbine compartments; service water after the heat exchangers; water, discharged from Bld. 150, pit of corridor 003 (D1, D2); At every discharge – spent water from Bld. 150.	$0.74\div1.85\times10^{8}$ Bq/l
			Sr-89, Sr-90	Radiometric	1 per month – water, discharged by reactor and turbine compartments.	$0.1\div3\times10^{3}$ Bq/l
			Total α activity	Radiometric	1 per month – water, discharged from Bld. 150.	$0.01\div10^{3}$ Bq/l
2.	Emission of gases and aerosols into atmosphere	7	Total β activity	Radiometric	From 1 time per day to 1 time per quarter depending on filter exposition duration.	from 2.4×10^{-8} to 1.85×10^{7} Bq/l depending on measuring object
			Total α activity	Radiometric	1 per month – releases of gases/aerosols from reactors 1,2 through vent stack.	$0.01\div10^{3}$ Bq/l
			Volumetric activity of radionuclides of radioactive noble gases	Spectrometric	1 per day – releases of gases/aerosols from reactors 1,2 through vent stack; 1 per week – releases due to residual heat during repair of reactors 1,2; 1 per week – releases of gases/aerosols from Bld. 150 through installation 153.	$1.85\div3.7\times10^{5}$ Bq/l

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
			Volumetric activity of radionuclides of radioactive aerosols	Spectrometric	1 per day, per week and per month – releases of gases/aerosols from reactors 1,2 through vent stack; 1 per week – releases from Bld. 150 through installation 153, releases due to residual heat during repair of reactors 1, 2; 1 per month – from Bld. 130, from Bld. 156; 1 per quarter – from Bld. 157.	from 2.5×10^{-6} to 6.7×10^{3} Bq/l depending on measuring object
			Sr-89, Sr-90	Radiometric	1 per month – releases of gases/aerosols from reactors 1,2 through vent stack, from Bld. 130, from Bld. 156, from Bld. 159.	$0.1\div3\times10^{3}$ Bq/l
			I-131	Spectrometric	1 per day, per week, per month – releases of gases/aerosols from reactors 1,2 through vent stack; 1 per week – releases from Bld. 150 through installation 153, releases due to residual heat during repair of reactors 1,2.	from 2.4×10^{-7} to 26 Bq/l depending on measuring object
			H-3, C-14	Radiometric	Releases of gases/aerosols from reactors 1,2 through vent stack. Depending on carrying out of IAEA project LIT/9/005	
			Total β activity	Radiometric	1 per day – water of heating networks.	$0.1\div3\times10^{3}$ Bq/l
			Volumetric activity of radionuclides	Spectrometric	1 per two weeks– water from installation 141; 1 per quarter – water of heating networks.	$0.74\div1.85\times10^{8}$ Bq/l
3.	Water from heat power station in Bld. 119	2	Activity of γ nuclides	Spectrometric	3 times per month – atmospheric air at points of permanent surveillance; and 1 per month – atmospheric precipitation at points of permanent surveillance and industrial site.	$1.5\times10^{-6}\div15$ Bq/m^3
			Sr-90	Radiometric	2 times per year (in winter and summer) - atmospheric air at points of permanent surveillance.	$3\times10^{-5}\div3\times10^{2}$ Bq/m^3

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
4.	The air and atmospheric precipitation	9	Activity of γ nuclides	Spectrometric after evaporation	20 times per month (on working days) – discharge of technical water and water of intake channel; 1 time per 10 days – sewage water, water of industrial site PLK-1,2, PLK-3, PLK-SFSF; 1 per month – water from channel surrounding landfill of industrial waste, drainage water of INPP industrial site; 1 per quarter (in January, April, July, October) – water of heating networks; 2 times per year (in spring, autumn) – water of surveillance boreholes in the industrial site and area of SFSF; 4 times per year (in February, May, August, November) – potable water from water supply (watering-place), potable water from wells in Tilze and Gaide; 1 per year (in summer) – water of Druksiai lake; 1 per year (in winter) – snow at points of permanent surveillance, sampling points of precipitation of industrial site and SFSF site.	1×10^{-3}÷0.3 Bq/l
			Sr-90	Radiochemical segregation	2 times per year (in spring, autumn) – discharge of technical water and water of intake channel, sewage water, water of surveillance boreholes in the industrial site and area of SFSF; 1 per year (in summer) – water of Druksiai lake; 1 per year (in winter) – water of heating networks, water from channel surrounding landfill of industrial waste, snow at points of permanent surveillance, sampling points of precipitation of industrial site and SFSF site, water of industrial site PLK-1,2, PLK-3, PLK-SFSF, drainage water of INPP industrial site.	0.3 Bq/l
5.	Aquatic environment of	104	Activity of Pu isotopes	Radiochemical segregation	2 times per year (in spring, autumn) – discharge of technical water and water of intake channel.	1×10^{-2} Bq/l

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
	INPP		H-3	Without concentration, by filtering	1 per month – discharge of technical water , sewage water, sampling points of precipitation of industrial site and SFSF site, water of industrial site PLK-1,2, PLK-3, PLK-SFSF; 1 per quarter – water from channel surrounding landfill of industrial waste; 2 times per year (in spring, autumn) – water of surveillance boreholes in the industrial site and area of SFSF; 4 times per year (in February, May, August, November) – potable water from wells in Tilze and Gaide.	3 Bq/l
			Total α activity	Concentrated sample	4 times per year (in February, May, August, November) – potable water from water supply (watering-place), potable water from wells in Tilze and Gaide.	0,1 Bq/l
			Total β activity	Concentrated sample	4 times per year (in February, May, August, November) – potable water from water supply (watering-place), potable water from wells in Tilze and Gaide.	0,01 Bq/l
			γ radiation dose rate	Radiometric	4 times per year (in February, May, August, November) – in the dump of construction materials and on the roads. 1 times per quarter – dose rate from SPD-1, SPD-2 equipment, clothes, shoes and machinery;	1×10^{-6}–1×10^{-1} Sv/h
					Constantly – SkyLink system.	2×10^{-8}÷10 Sv/h
6.	Monitoring of radiation dose and dose rate	86 Location of TLD is presented in Figure 7.1-1	γ radiation dose	Radiometric, TLD	2 times per year (in spring, autumn) – dose at locations of TLD in SPZ and SA.	2.5×10^{-4}÷5 Sv
			Activity of γ nuclides	Without concentration	1 per month	15 Bq/kg
			Activity of Pu isotopes	Radiochemical segregation	2 times per year (in spring, autumn)	300 Bq/kg

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
7.	Sludge from storage area	1	Activity of γ nuclides	Dried, concentrated sample. Spectroscopic	1 per quarter – in discharge channel of industrial site PLK-1, PLK-3, SFSF site, PLK-SFSF, downstream purification plant.	3 Bq/kg
			Activity of γ nuclides of upper layer (2 cm)	Dried, concentrated sample. Spectroscopic	1 per year (in spring) – at sampling points of Druksiai lake.	15 Bq/kg
8.	Bottom sediments of Druksiai lake	10 Sampling points in Lake Druksiai are indicated in Figure 7.1-2	Sr-90 in upper layer (2 cm)	Burning and radiochemical segregation	1 per year (in spring) – at sampling points of Druksiai lake.	30 Bq/kg
			Distribution profile of gamma nuclides (3-10 cm)	Radiochemical segregation	1 time in 5 years – at sampling points of Druksiai lake.	15 Bq/kg
			Distribution profile of Pu isotopes (3-10 cm)	Radiochemical segregation	1 time in 5 years – at sampling points of Druksiai lake.	300 Bq/kg
			Activity of γ nuclides	During drying Spectroscopic	1 times per quarter – in discharge channel of industrial site PLK-1, PLK-3, SFSF site, PLK-SFSF, downstream purification plant; 1 per year (in summer) – at sampling points of Druksiai lake.	3 Bq/kg
			Sr-90	Burning and radiochemical segregation	1 per year (in autumn) – in discharge channel, downstream purification plant; 1 time in summer– at sampling points of Druksiai lake.	3 Bq/kg

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
9.	Aquatic vegetation of Druksiai lake	11 Sampling points in Lake Druksiai are indicated in Figure 7.1-2	Activity of γ nuclides	Concentrated /not concentrated sample depending on measuring object	1 per month – milk in Tilze; 1 per month (from May to October) – pasture grass at points of permanent surveillance an in Grikeniskiu peninsula; 2 times per year (in spring, autumn) – fish of Druksiai lake; 1 per year (in summer) – organisms of aquatic environments (mollusks); 1 per year (in August) – cabbage in Tilze; 1 per year (in September) – potatoes in Tilze; 1 per year (in autumn) – soil at points of permanent surveillance an in Grikeniskiu peninsula, mushrooms and moss at locations of Vilaragis, Grikeniskes, Tilze, Gaide, Visaginas, roe deer meat in the radius of 10 km around INPP, grain crops (rye and oats) in Tilze, meat (pork, beef) in Tilze and at location of Turmantas.	3 Bq/kg
			Sr-90	Radiochemical segregation	1 per month (from May to October) – pasture grass at points of permanent surveillance an in Grikeniskiu peninsula.	3 Bq/kg
10.	Foodstuff, plants, soil	34			1 per year (in spring) – fish of Druksiai lake; 1 per year (in summer) – organisms of aquatic environments (mollusks); 1 per year (in August) – cabbage in Tilze; 1 per year (in autumn) - milk in Tilze.	0.3 Bq/kg
			Activity of α nuclides	Radiochemical segregation	1 per year (in autumn) – soil at points of permanent surveillance an in Grikeniskiu peninsula.	30 Bq/kg

No.	Component of monitoring	Number of measuring points	Measured parameters	Measuring method	Monitoring object / location and periodicity	Measuring limits / detecting limit*)
					1 per year (in summer) – organisms of aquatic environments (mollusks).	3 Bq/kg

*) In the table indicated detective limit and it is the lowest measuring activity of the sample with 95% trustiness. The lower activities may measure with lower trustiness. Also, samples of the same type may by different composition (for e.g. samples of soil may be different consists of granulometric) therefore detective limits of samples will be different. In the table there are conservative (maximum) meanings of the detective limits.

In the table:

Bld. 150 – is liquid radioactive waste treatment and bitumising building in INPP;

D1, D2 – INPP 1 and 2 reactors control, electrical and deaerator rooms;

Installation 153 - venting stack of the radioactive waste reprocessing building 150;

Bld. 130 – repair building in INPP;

Bld. 156 – special laundry in INPP;

Bld. 157 – intermediate- and high-level waste storage in INPP;

Bld. 159 – cars wash building in INPP;

PLK-1,2, PLK-3 – industrial drainage outputs from INPP to lake Druksiai;

PLK-SFSF – industrial drainage output from SFSF site to lake Druksiai;

SPD-1,2 – militarized fire stations of INPP.

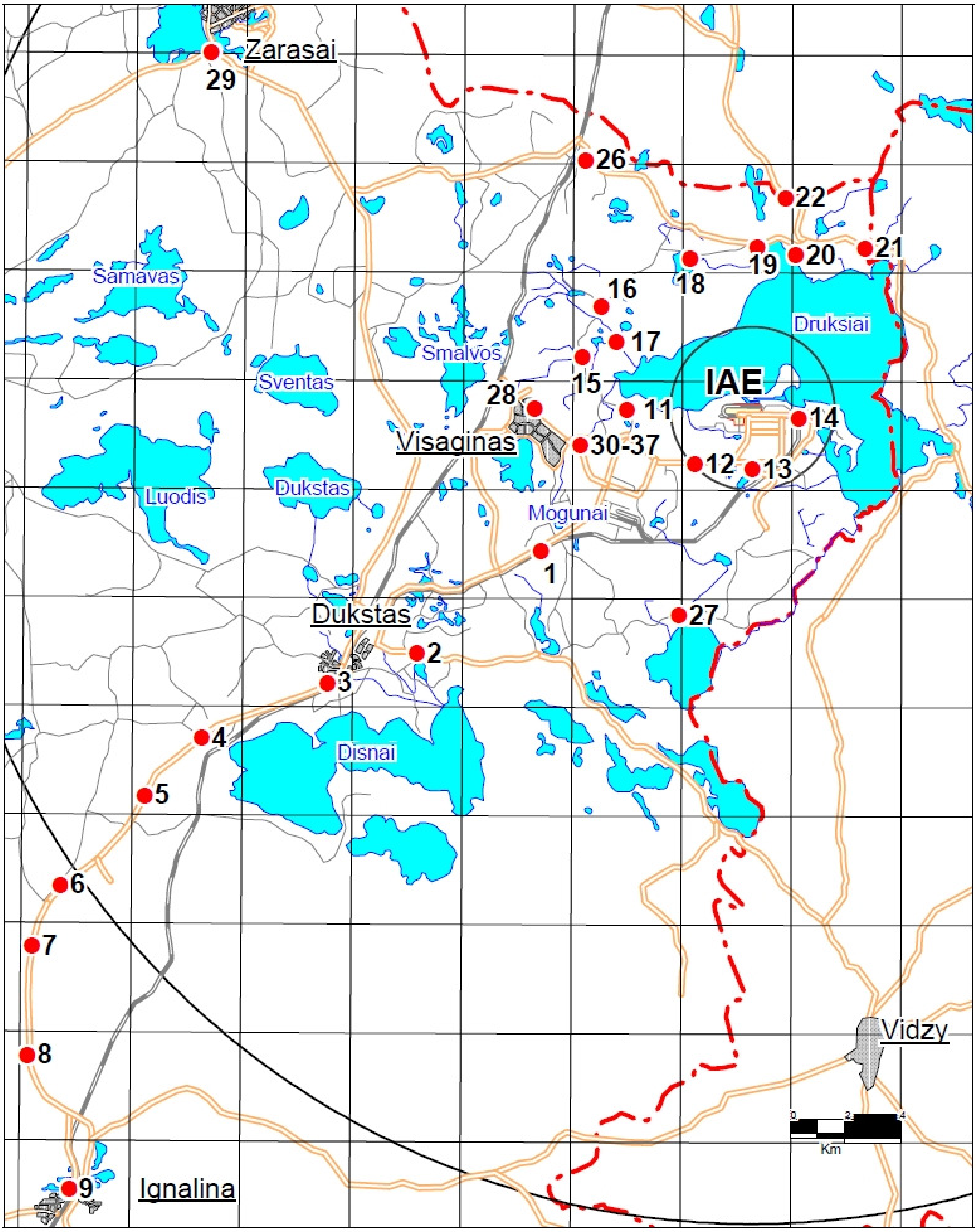

Figure 7.1-1 Location of thermoluminescent dosimeters around the INPP [6]

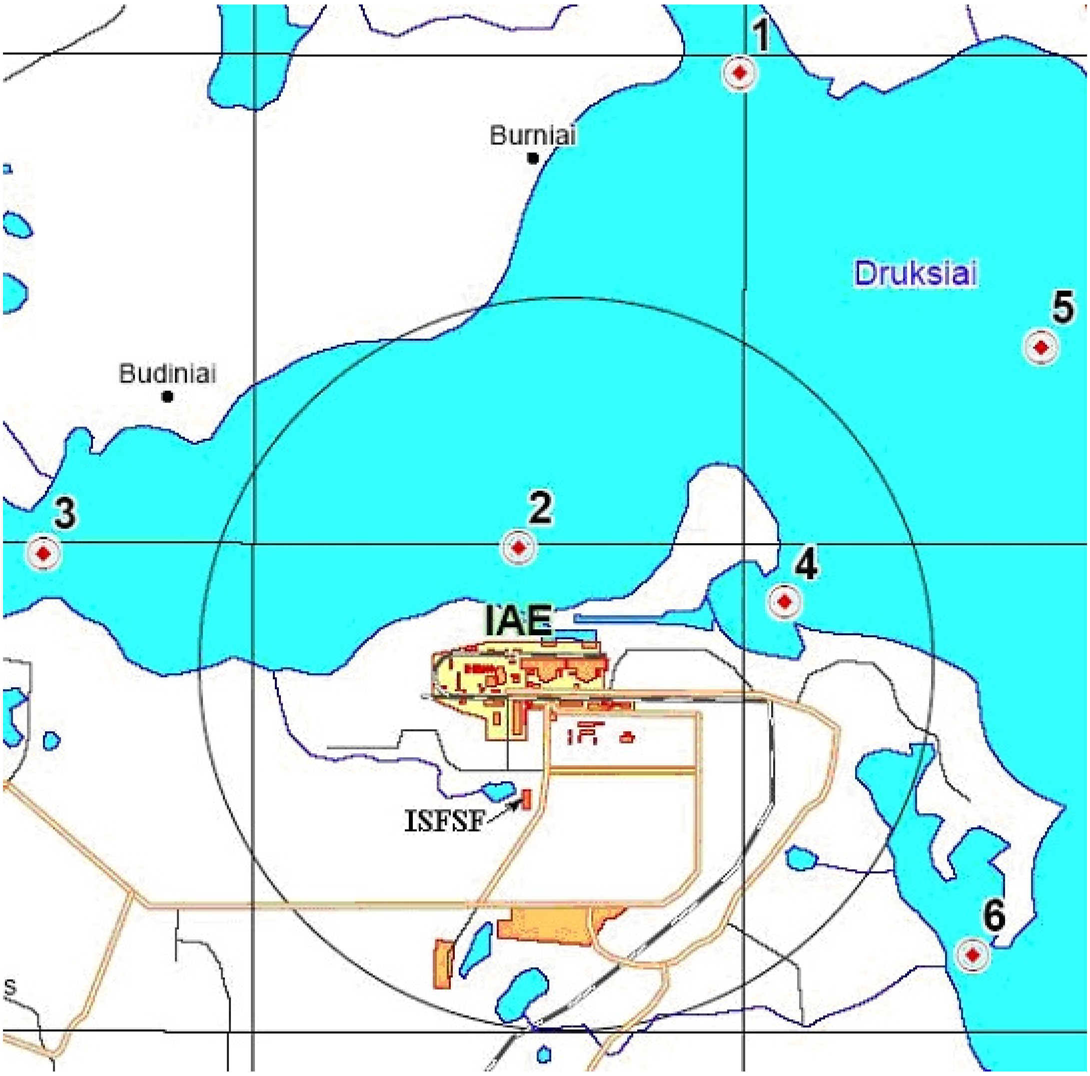

Figure 7.1-2 Sampling positions in Lake Druksiai [6]

7.2 UPDATING OF THE INPP MONITORING PROGRAM DUE TO BUILDING 117/1 DECONTAMINATION AND DISMANTLING

The updating of the INPP monitoring program [6] due to building 117/1 decontamination and dismantling activities is shown in Table 7.2-1. The required additional monitoring and means of measuring are also shown in Table 7.2-1.

Table 7.2-1 Updating of the INPP environment monitoring program due to building 117/1 decontamination and dismantling activities

No.	Monitoring Object	Requirements	Required additional monitoring	Comments
1	Meteorological observations in the INPP region	Clause 41 of [4]	Not required	It is taken into consideration that meteorological observations are already realized by INPP. The existing monitoring system allows measuring meteorological parameters up to a height of 40 m and calculating radionuclides propagation for all operating conditions and measured meteorological conditions. The system is sufficient for meteorological monitoring of building 117/1 as the effective release height will be below 200 m.
2	Radioactive releases from the INPP	Clauses 43 to 46 of [4]	Additional monitoring of the radioactive releases from the building 117/1 ventilation system	Means of measuring the amount of radionuclides in effluents during normal operation and under accident conditions will be provided, including means of measuring the flow of diluting media, especially air at the exhaust (stack). For in-time evaluation of radiological impact to the population and the environment during operation and accidents all the data from the radiation monitoring system will be directly sent to the INPP central monitoring board in building 101/1 using data line of the building 117/1 assessment and control system. The building 117/1 data will be integrated to the existing INPP monitoring system providing capability for overall assessment of radiation safety at INPP and environment.
3	Radionuclides concentration in the air	Clause 54 of [4]	Not required	Monitoring is already performed periodically by sampling and sample measurement in the laboratory.
4	Radionuclides concentration in the precipitation	Clause 54 of [4]	Not required	Monitoring is already performed periodically by sampling and sample measurement in the laboratory.
5	Radionuclides concentration in the aquatic environment	Clause 55 of [4]	Not required	It is taking into consideration that monitoring of chemical parameters (harmful substances) of the lake Druksiai, monitoring of the water quality of the lake Druksiai and monitoring of drainage to the lake Druksiai are already realized by INPP.
6	Radionuclides	Clauses 4 and	Not required	Observation wells for groundwater

No.	Monitoring Object	Requirements	Required additional monitoring	Comments
	concentration in the water of the observation wells	12.5 of [7] Clause 54 of [4]		monitoring are already installed at INPP site in accordance with the Groundwater Monitoring Program
7	Chemical content of the water of the observation wells	Clause 12 of the document [7]	Not required	Observation wells for groundwater monitoring are already installed at INPP site in accordance with the Groundwater Monitoring Program
8	Radionuclides concentration in the soil	Clause 54 of [4]	Additional monitoring of the soil samples around the building 117/1	After the shutdown of Unit 2 (31/12/2009), there will be, practically, no releases of short-lived nuclides into the environment. Further, taking into account the age of the accumulated solid waste when the retrieval and processing activities will start, the contribution of the short-lived nuclides (Mn-54, Co-58, Fe-55, Cs-134.) to the global releases will be quite low. Actually, the spectrum of the nuclides to be analyzed in the soil samples (and in the environment at large) will progressively change after 2010. This must be taken into account in the monitoring program.
9	Radionuclides concentration in the bottom sediments	Clause 55 of [4]	Not required	It is taking into consideration that necessary measurements are already realized by INPP.
10	Radionuclides concentration in the plants and food products	Clause 54 of [4]	Not required	It is taking into consideration that necessary measurements are already realized by INPP.
11	Dose rate, dose	Clause 51 of [4]	Not required	The online detectors are already positioned at specific points. When evaluating the TLD it is possible to create a dose rate profile for the INPP site fence in each direction.
12	Release of hazardous gases due to use of oxy acetylene cutting in building 117/1		Oxygen and gas monitoring is necessary	Multi gas detectors will be installed.

8 RISK ANALYSIS AND ASSESSMENT

Emergency situations (emergencies) potentially resulting from the proposed economic activity are addressed in this chapter of the EIA Report with the purpose to demonstrate that the planned activity by virtue of its nature and environmental impacts may be carried out. Therefore, hazards and factors, which could potentially cause an impact on the environment, are subjects of investigation and assessment.

The risk analysis of potential emergency situations is performed in accordance with the requirements of the Recommendations for the Assessment of the Potential Accident Risk of the Proposed Economic Activity [1]. The risk analysis as presented in this EIA Report discusses main risks which may arise from the conceptual solutions of the proposed economic activity. Hazards and risks may be further detailed and investigated depending on particular design solutions (arrangement and specific of selected equipment, organization of work performance etc.). Therefore risk analysis as presented in this EIA Report shall be considered as preliminary and does not substitute necessity for a more sophisticated and detailed hazard analysis which has to be based on actual design solutions. A detailed risk and reliability analysis shall be performed during the Basic Design and shall be considered in the Safety Justification Report.

The risks from external natural (e.g. earthquake, flooding, extremely weather conditions etc.) and external man induced (e.g. missiles, external fire, airplane crash etc.) hazards are not analyzed in the EIA Report. The proposed economic activity will not reduce safety level against external hazards as presently assured by the building structure and its related services (building and site storm water drainage systems, lightning protection etc.). The systems and installations foreseen to be dismantled and removed from the building were not designed to provide any support to the building. Loads on the building structure from the planned new crane (EOTC) in the Main Hall are foreseen by original building design. Finally, the D&D activity will lead to overall reduction of the risk level due to continuous reduction of the radioactive material in the Building 117/1.

The potential risks resulting from the proposed economic activity are subdivided into risks expected under normal operation conditions of the proposed economic activity and risks may arise as result of equipment malfunction, accident situations etc. The risks are analyzed and summarized in Table 8-1 and Table 8-2 respectively. The tables' structure and the content follow the recommendations of the normative document [1]. The requirements for the classification of the consequences of a potential accident (for life, environment and property), the accident development speed and the probability of accident occurrence are explained in Table 8-3. More detailed explanations can be found in [1].

The risks expected under normal operation conditions of the proposed economic activity, c.f. Table 8-1, can be managed by appropriate design and work organization solutions. As the irradiation dose rate and radioactive contamination levels are relatively modest, the general hazards typical for construction / dismantling activity (work at height, use of hot cutting and mechanical cutting technique etc.) prevails. Particular attention shall be placed on work safety in confined spaces.

In case of accidents, c.f. Table 8-2, potentially most impacted are the personnel performing D&D activity inside the Building 117/1 and the internal premises of the building. Impact consequences can be mitigated by use of personal protective equipment (PPE) together with appropriate design and work organization means.

The environment outside the Building 117/1 is protected against the release of airborne activity by double ventilation barrier – mobile filtration units (MFU), which filters activity at the place of its generation and upgraded building ventilation system, which assures whole building air exchange.

Both systems are of the same efficiency. The upgraded building ventilation system will also prevent emission of radioactivity into environment if local MFU fails or in case of accident with direct release of activity into building environment. Calculations of potential radiological consequences on environment, c.f. chapter 4.2.3.2, consider operation of single ventilation system and maximal source term for activity release. Potential impact is evaluated to be very low and is screened out from further consideration as to be insignificant from radiological point of view.

As discussed in chapter 2, most of deplanted items (expected about 98% from total mass) will be decontaminated to the free release conditions. Transport of these items does not present radiological risk for environment.

Other radioactive waste arising from the proposed economic activity will be either of very low or low activity. Very low level waste will be transported into to the buffer storage of Landfill facility. Low level (LL) waste will be managed using INPP already licensed waste handling procedures and waste management technologies. Consequences of transport accident with dispersion of activity are classified as limited (simple contamination, localized effects) due to low activity of the waste and limited amount of easily dispersible activity per waste package and container. On site impact consequences mitigation measures can be implemented immediately to localize effect on environment and to collect dispersed waste. The expected amounts of LL waste are relatively small as compare to amounts of operational waste which is also transported on the site. Therefore additional risk arising from transport of radioactive waste from Building 117/1 will not significantly change present risk level resulting from transport of radioactive waste on INPP site.

Table 8-1 Main hazards and risks arising under normal operation conditions of the proposed economic activity

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction, internal transport, decontamination	Radioactive contamination	External radiation dose rate increase due to partial loss of shielding, presence of hot spots	Personnel	Exposure of personnel	1	1	1	3	5	A	Permanent monitoring of dose rate in working environment; Forward monitoring for presence of hot spots; Apply ALARP principles of time, distance and, if necessary, shielding; Operator training.	Dose rate and contamination levels are relatively modest; Risk level can be appropriately reduced by design and work organization solutions
Building 117/1, equipment and installations to be D&D	Interim storage of deplanted items	Radioactive contamination	External radiation dose rate increase due to concentration of deplanted items with reduced shielding capabilities	Personnel	Exposure of personnel	1	1	1	3	5	A	Appropriate stacking of dismantled items (use self shielding) Permanent monitoring of dose rate in working environment; Use of appropriate signage and prevention of access where required;	Risk level can be appropriately reduced by design and work organization solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction, decontamination	Radioactive contamination	Generation of airborne activity	Personnel, environment, population	Exposure of personnel, contamination of environment, exposure of population	1	1	1	3	5	A	Contamination in air monitoring to be utilized; Suitable ventilation & filtration systems (locally at working places and for emissions into environment); RPE to be used if airborne contamination present; Operator training.	Dose rate and contamination levels are relatively modest; Assessment of potential consequences on environment (c.f. chapter 4.2.3) shows that only negligible impact can be expected; Risk level can be reduced to appropriate level by design and work organization solutions.
Building 117/1, equipment and installations to be D&D	Internal transport, interim storage (stacking, moving etc.) of deplanted items	Radioactive non fixed surface contamination	Generation of airborne activity, cross contamination	Personnel, internal premises	Exposure of personnel, contamination of premises	1	1	1	3	5	A	Dismantled contaminated items will be wrapped into polyethylene (e.g. ECCS pipe ends, pressurized tank segments etc.)	The building ventilation system with HEPA will prevent emission of radioactivity into environment.
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction, internal transport, decontamination	Radioactive contamination	Inadvertent ingestion	Personnel	Exposure (ingestion dose) of personnel	1	1	1	5	4	A	No eating, drinking or smoking within controlled area; Suitable PPE (gloves etc); Operator training.	Risk level can be reduced to appropriate level by design and work organization solutions.

Object	**Operation**	**Hazard**	**Risk type**	**Threatened object**	**Consequences**	**Seriousness**				**Risk level**		**Preventive and mitigation measures**	**Remarks**
						L	**E**	**P**	**S**	**Pb**	**Pr**		
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction, internal transport, decontamination	Radioactive contamination	Injuries during handling of contaminated items	Personnel	Exposure (injection dose) of personnel	1	1	1	5	5	A	Use of suitable gloves when handling materials; Suitable PPE to be worn for specific activities (vacuum blasting etc.) Operator training	Dose rate and contamination levels are relatively modest. Risk level can be reduced to appropriate level by design solutions
Building 117/1	Deplanting, size reduction, internal transport, decontamination	Malfunction in power supply	Loss of power supply	Personnel	Loss of important services (ventilation, monitoring, suspended loads on cranes, alarms inoperable etc) Loss of lighting, difficulties with personnel evacuation	2	-	1	5	5	A	Standby power for airborne activity monitors; Fail safe equipment; Emergency lighting	In case of loss of services the D&D activities will be stopped. Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, crane (EOTC) in the Main Hall, crane in the dispatch area	Support in ECCS PT deplanting, downloading cut-off items, uploading decontaminated items for dispatch	Heavy items. The EOTC safe working load is 3200 kg	Overload, overdrive, loss of services (power etc.) Swing of load	Building structure	Damage to the building if load hits the building	1	1	2	5	4	B	The safety measures for the cranes to be foreseen: overload / over-raise protection, fail safe breaking system. Load sensor and overload trip to give indication of preloading the crane; Safe transport speed; Training of personnel	Risk level can be reduced to appropriate level by design solutions
Building 117/1	Deplanting, size reduction, internal transport	Working at height	Falls from height	Personnel	Injuries, disablement	3	-	2	5	5	B	Safe systems of work to be developed, for example: - any working at height required should be carried out from suitable working platforms with handrails; - fall arrestors and harnesses should be employed; Operator training	Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1	Deplanting, size reduction, internal transport	Raised tools, equipment	Being struck by tools / equipment falling from height	Personnel	Injuries, disablement	3	-	2	5	5	B	Safe systems of work to be developed, for example: - all working platforms and raised deck levels to be equipped with suitable toe boards around openings; - exclusion zones barriered off below working areas; - safety helmets to be worn; - equipment to be suitably supported and retained during deplanting Operator training	Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction using hot cutting technique	Sparks, flash, heat, hot surfaces; Fume, hazardous gases; Work in confined spaces	Burns, inhalation of fume, hazardous gases, flash	Personnel	Injuries, impact on health due to inhalation of fume and hazardous gases, asphyxiation	2	-	2	5	5	B	Safe systems of work to be developed; Consider specific of confined spaces where applicable; Suitably specified & maintained equipment; Ventilation arrangements at the working place; Operator training; PPE;	Risk level can be reduced to appropriate level by design solutions
Building 117/1	Deplanting, size reduction using hot cutting technique	Sparks, hot cutting slag, heat load	Damage or fire of flammable materials in vicinity, release of toxic gases from hazardous materials	Personnel, flammable material	Damage to the building, installations, injuries to personnel, spread of contamination	2	1	1	5	5	B	If practicable, remove potentially flammable material in advance (i.e. lino from staircase etc.) Use of slag catch pots, fire blankets etc. Fire watch, local fire extinguishes	Risk level can be reduced to appropriate level by design solutions
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction	Mechanical cutting equipment (e.g. band saw, sabre saw)	Cuts, amputation, etc	Personnel	Injuries	2	-	1	5	5	B	Safe systems of work to be developed; Suitably specified & maintained equipment; Operator training	Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1	Deplanting, size reduction, preparation activity	Conventional dust	Dust inhalation	Personnel	Impact on health due to dust inhalation	1	-	1	1	5	A	Safe systems of work to be developed; Suitably specified & maintained equipment; Ventilation arrangements; Operator training RPE as necessary.	The building ventilation system with HEPA will prevent emission of dust into environment. MFU and building ventilation system will assure air exchange and dust filtration
Building 117/1	Deplanting, size reduction, decontamination	Noisy equipment, confined space	Noise	Personnel	Impact on health	2	-	1	1	5	B	Safe systems of work to be developed; Suitably specified & maintained equipment; Operator training; PPE as necessary (ear plugs / ear defenders)	Risk level can be reduced to appropriate level by design solutions
Building 117/1, equipment and installations to be D&D	Deplanting, size reduction, decontamination	Hazardous chemicals in existing materials e.g. lead /cadmium in paint	Inhalation of hazardous substances	Personnel	Impact on health	2	-	2	5	5	B	Safe systems of work to be developed; Operator training; PPE as necessary.	Risk level can be reduced to appropriate level by design solutions
Building 117/1	Transport of materials into and out of the building via open access gate	Contamination inside the premises of the building	Spread out of contamination into environment due to inadequate confinement	Environment	Non controlled emission from the building, contamination of environment	1	2	1	3	5	B	Assure directional air flow (into the building), construct an air lock or double door on entrance etc.	Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, INPP site	Transport of D&D items to FRMF or Landfill buffer store	Radioactive contamination	Environment influence (wind, rain etc.)	Environment	Spread out of contamination into environment	1	2	1	3	5	B	All items sent out of the building will be placed into Half height ISO container; The Half height ISO container will be covered with tarpaulin; All items in the container will be wrapped in polyethylene.	Risk level can be reduced to appropriate level by design solutions
Building 117/1, INPP site	Transport of D&D items to FRMF or Landfill buffer store, transport of radioactive waste, produced due to the D&D activities on INPP site	Radioactive contamination	Cross contamination of container or / and vehicle that enters the building	Environment	Spread out of contamination into environment	1	2	1	3	5	B	Check container and transport vehicle prior entering and dispatch, decontaminate if necessary Check dispatch area in Building 117/1 prior vehicle / containers enters building; clean / decontaminate if necessary	Risk level can be reduced to appropriate level by design solutions. Monitoring of transport roads at INPP site is performed on regular basis. Roads are cleaned and decontaminated if reference levels are exceeded.

Table 8-2 Hazards and risks arising from abnormal operation conditions (i.e. malfunction of equipment, accident situations etc.) of the proposed economical activity

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, mobile filtration unit	Removal and filtration of hazardous gases and airborne activity from working place	Hazardous gases from hot cutting, airborne activity from cutting, size reduction or decontamination	Loss of air extraction from working place (due to loss of power, malfunction of unit etc.)	Personnel	Build-up of hazardous gases, asphyxiation, unanticipated exposure of personnel, spread of contamination,	2	1	2	3	5	B	Hazardous gas and airborne activity monitoring at working place. Audible and visual alarm to stop D&D works if filtration unit fails.	Risk level can be appropriately reduced by design solutions.
Building 117/1, mobile filtration unit	Removal and filtration of hazardous gases and airborne activity from working place	Airborne activity from cutting, size reduction or decontamination	Loss or reduction of filtering capability leading to emission of non filtered air into internal premises	Personnel	Unanticipated exposure of personnel, contamination of internal premises	1	1	1	3	4	B	Permanent check of filters status, on-time replacement; Monitoring of airborne activity concentration in premises, audible and visual alarm to stop D&D works if concentration exceeds safe level	The upgraded building ventilation system with HEPA filtration will prevent emission of radioactivity into environment if local filtration unit fails.
Building 117/1, upgraded building ventilation system	Air cleaning and exchange, creation of building dynamic confinement	Airborne activity, hazardous gases from hot cutting inside the building	Loss of services (electricity) or malfunction leading to stop of operation	Personnel, Environment	Hazardous gases concentration build-up inside the building, loss of dynamic containment	1	1	1	3	5	B	Interlock of system with audible and visual alarm to stop D&D works Interlock of stack damper with stack monitor to stop air exchange if activity concentration exceeds safe level)	Risk level can be appropriately reduced by design solutions.

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, upgraded building ventilation system	Air cleaning and exchange, creation of building dynamic confinement	Airborne activity inside the building	Loss or reduction of filtering capability leading to emission of non filtered air into environment	Environment	Unanticipated release of activity into environment	1	1	1	3	4	A	Permanent check of filters status, on-time replacement; Interlock of stack monitor with audible and visual alarm to stop D&D works Interlock of stack damper with stack monitor to stop air exchange if activity concentration exceeds safe level	Assessment of potential consequences on environment (c.f. chapter 4.2.3) shows that only negligible impact on environment can be expected.
Building 117/1, radioactive waste, produced due to the D&D activities	Handling of VLL or LL waste (spent HEPA filters, blast decontamination waste, waste from cyclones etc.)	Dispersible radioactive material	Damage of radioactive waste package (due to drop, improper handling etc.) leading to dispersion of radioactivity	Personnel, internal premises	Spread of contamination, personnel exposure, contamination of internal premises	2	1	1	5	4	B	Safe handling procedures, training of personnel;	Risk level can be appropriately reduced by design solutions. The upgraded building ventilation system with HEPA filtration will prevent emission of radioactivity into environment.
Building 117/1, live part of nitrogen system	Deplanting activity	Pressurized nitrogen	Inadvertent damage to the system leading to release of confined media	Personnel	Injuries to personnel, nitrogen asphyxiation	2	1	1	5	4	B	Identification and marking of potentially hazardous installations; Appropriate protection (apply shields, isolate etc.) considering local deplanting specific	Emergency planning and personnel training are necessary

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, live water based building heating system	Deplanting activity	Hot pressurized water	Inadvertent damage to the system leading to release of confined media	Personnel	Injuries to personnel, release of hot water into the building	2	-	1	5	4	B	Identification and marking of potentially hazardous installations; Appropriate protection (apply shields, isolate etc.) considering local deplanting specific; The basement premises are equipped with water effluents collection system	Emergency planning and personnel training are necessary
Building 117/1, live electric cables	Deplanting activity	Electricity	Inadvertent damage to cables (by fire or impact)	Personnel	Injuries to personnel, fire, loss of power for important services (lightning, ventilation, monitoring etc)	2	-	1	5	4	B	Identification and marking of potentially hazardous installations; Appropriate protection (apply shields, isolate etc.) considering local deplanting specific; Fire fighting means;	Emergency planning and personnel training are necessary Standby power will be provided for airborne activity monitors and for emergency lightning
Building 117/1, crane (EOTC) in the Main Hall	Support in ECCS PT deplanting, downloading cut-off items	Heavy cut-off items e.g. ECCS PT ring segment etc. The crane safe working load is 3200 kg.	Drop of cut-off item due to inadequate fixing etc.	Building structure, steel platforms	Damage to the building floor, steel platforms, injuries to personnel	1	-	1	5	3	B	Safe systems of work to be developed Training of personnel	Risk level can be appropriately reduced by design solutions.

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, crane (EOTC) in the Main Hall	Support in ECCS PT deplanting, downloading cut-off items	Heavy cut-off items e.g. ECCS PT ring segment etc. The crane safe working load is 3200 kg.	Hit of ECCS PT with cut-off item due to mistaken movement etc.	Building structure	Damage to the ECCS PT, building floor (where ECCS PT are fixed),	1	-	1	5	3	B	Safe systems of work to be developed Training of personnel	Risk level can be appropriately reduced by design solutions.
Building 117/1, bottles with acetylene gas	Use and handling of hot cutting equipment	Acetylene gas	Explosion / fire due to inadequate handling	Personnel, building structure	Damage to the building, injuries to personnel, fire, spread of contamination	3	1	2	5	3	B	Limited amount of acetylene Adequate arrangements - bottles to be stored on the ground floor and protected from potential impacts by dropped / hit items etc.) Training of staff	Risk level can be reduced to appropriate level by design solutions
Building 117/1, hydraulic systems (e.g. hydraulic shears), gas systems (e.g. cutting gas system)	Deplanting, size reduction	Pressurized systems	Release of pressure	Personnel	Injuries	2	-	1	5	5	B	Safe systems of work to be developed; Suitably specified & maintained equipment; Operator training	Risk level can be reduced to appropriate level by design solutions

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
Building 117/1, loading bay	Transport of materials into and out of the building	Raised level of loading bay (loading bay is at level +0.0 m while basement level is at -3.6 m)	Overdrive or reversing too far into the building leading to fall down of truck or trailer into basement level	Truck, trailer, equipment in the basement level, personnel	Damage to the tuck or trailer, damage to equipment located in the basement level, injuries to personnel	2	1	2	5	4	B	Appropriate safety barrier in the loading bay; Safe systems / procedures of work to be developed	Risk level can be eliminated by appropriate design solutions
INPP site, Half height ISO container on transport truck	Transport of solid non-compressible VLL waste to Landfill buffer store	Dispersible VLL radioactive material	Transport accident leading to damage of Half height ISO container, damage to bag(s) with VLL waste, dispersion of activity	Environment, personnel, population	Spread out of contamination, exposure of personnel, exposure of population	2	2	1	5	3	B	Safe transport speed Appropriate design of container fixing	Transport will take place only within INPP site. Waste will be collected into ~20 litre double polyethylene bags. Bags are taped and placed into Half height ISO container

Object	Operation	Hazard	Risk type	Threatened object	Consequences	Seriousness				Risk level		Preventive and mitigation measures	Remarks
						L	E	P	S	Pb	Pr		
INPP site, INPP transport container on transport truck	Transport of LLW-SL container with solid LL waste to INPP waste treatment facilities	Dispersible LL radioactive material	Transport accident lading to damage of LLW-SL container, damage to bag(s) with LL waste, dispersion of activity	Environment, personnel, population	Spread out of contamination, exposure of personnel, exposure of population	2	2	1	5	3	B	The existing and licensed INPP equipment and procedures will be used for the D&D waste transport, handling and interim storage (before final treatment) at the existing INPP waste management and treatment facilities.	Transport will take place only within INPP site. Waste will be collected into ~20 litre double polyethylene bags. Bags are taped and placed into 25 litre steel drums (one bag in one drum). Drums are lidded and placed into transport container.
INPP site, INPP transport container on transport truck	Transport of container with spent water from wet decontamination	Liquid VLL or LL radioactive material	Transport accident leading to damage of container and spill out of contaminated water	Environment, personnel, population	Spread out of contamination, exposure of personnel, exposure of population	2	2	1	5	3	B	The existing and licensed INPP equipment and procedures will be used for the waste transport, handling and treatment at the existing INPP liquid radioactive waste treatment facility.	Transport will take place only within INPP site. The foam decontamination is not expected to be extensive; a limited volume of fluid can be expected.

Table 8-3 Classification of consequences for life and health (L), environment (E), property (P), accident development speed (S), accident probability (Pb) and prioritization of consequences (Pr) according to requirements [1]

Classification of consequences for life and health (L)

ID	Class	Characteristic
1	Unimportant	Temporary slight discomfort
2	Limited	A few injures, long lasting discomfort
3	Serious	A few serious injures, serious discomfort
4	Very serious	A few (more than 5) deaths, several or several tenths serious injures, up to 500 evacuated
5	Catastrophic	Several deaths, hundredths of serious injures, more than 500 evacuated

Classification of consequences for the environment (E)

ID	Class	Characteristic
1	Unimportant	No contamination, localized effects
2	Limited	Simple contamination, localized effects
3	Serious	Simple contamination, widespread effects
4	Very serious	Heavy contamination, localized effects
5	Catastrophic	Very heavy contamination, widespread effects

Classification of consequences for property (P)

ID	Class	Total cost damage, thousands Lt
1	Unimportant	Less than 100
2	Limited	100 - 200
3	Serious	200 - 1000
4	Very serious	1000 - 5000
5	Catastrophic	More than 5000

Classification of accident development speed (S)

ID	Class	Characteristic
1	Early and clear warning	Localized effects, no damage
2		
3	Medium	Some spreading, small damage
4		
5	No warning	Hidden until the effects are fully developed, immediate effects (explosion)

Classification of accident probability (Pb)

ID	Class	Frequency (rough estimation)
1	Improbable	Less than once every 1000 years
2	Hardly probable	Once every 100 – 1000 years
3	Quite probable	Once every 10 – 100 years
4	Probable	Once every 1 – 10 years
5	Very probable	More than once per year

Prioritization of consequences (Pr)

ID	Characteristic of consequences
A	Unimportant
B	Limited
C	Serious
D	Very serious
E	Catastrophic

9 DESCRIPTION OF DIFFICULTIES

The chapter includes description of difficulties (technical or practical) encountered while performing EIA and preparing the EIA Report.

No difficulties are presently obvious.

CONCLUSIONS OF THE RELEVANT PARTIES

The prepared EIA report, issue date September 19, 2008, has been submitted for review to the subjects of EIA by letter No. 10S-6023 (15.5) from December 4, 2008. The EIA report has been submitted to the following institutions of the Republic of Lithuania:

- The Republic of Lithuania Ministry of Health;
- State Nuclear Power Safety Inspectorate (VATESI);
- Department of Fire Protection and Rescue under the Republic of Lithuania Ministry of Internal Affairs;
- Department of Cultural Heritage under the Republic of Lithuania Ministry of Culture;
- Administration of the Utena District;
- Environment Protection Department of Utena Region;
- Visaginas Municipality Administration.

The remarks to the EIA report have been submitted by the:

- State Nuclear Power Safety Inspectorate (VATESI) letter No. (14.2.17)-22.1-34 from January 13, 2009;
- Department of Fire Protection and Rescue under the Republic of Lithuania Ministry of Internal Affairs letter No. 9.4-32 (9.4) from January 7, 2009;
- Technical support organizations of RPC letter No. 03-28-374 from February 10, 2009.

Remarks from other relevant parties have not been submitted.

The remarks from relevant parties have been answered by the:

- State Enterprise (SE) Ignalina NPP letter No. 10S-2147 (15.5) from May 7, 2009. The letter includes answers to the remarks from the Republic of Lithuania Ministry of Health and Technical support organizations of RPC;
- SE Ignalina NPP letter No. 10S-497 (15.5) from February 5, 2009. The letter includes answers to the remarks from the VATESI;
- SE Ignalina NPP letter No. 10S-322 (15.5) from January 26, 2009. The letter includes answers to the remarks from the Department of Fire Protection and Rescue under the Republic of Lithuania Ministry of Internal Affairs.

The relevant parties, which provided remarks, have coordinated the EIA report:

- The Republic of Lithuania Ministry of Health and RPC by letter No. 10-3026 from May 25, 2009;
- VATESI by letter No. (14-2-17)-22.1-133 from February 17, 2009;
- Department of Fire Protection and Rescue under the Republic of Lithuania Ministry of Internal Affairs by letter No. 9.4-228 (9.4) from January 29, 2009.

The EIA report and the conclusions of the relevant parties have been submitted to the Republic of Lithuania Ministry of Environment by June 1, 2009.

The Ministry of Environment by letter No. (1-15)-D8-5502 from June 22, 2009 have provided remarks to the EIA report and to the conclusions of the relevant parties.

The Ministry of Environment by letter No. (1-15)-D8-5501 from June 22, 2009 have additionally asked the relevant parties to provide their conclusions not only respect to the EIA report but also respect allowance of implementation of the proposed economic activity.

The additional conclusions have been provided by the:

- Department of Cultural Heritage under the Republic of Lithuania Ministry of Culture letter No 2U-(13.3)-363 from July 15, 2009;
- Department of Fire Protection and Rescue under the Republic of Lithuania Ministry of Internal Affairs letter No. 9.4-1759 (9.4) from June 26, 2009.

The copies of the above discussed official letters are provided in the Lithuanian version of the EIA report.

PUBLIC INFORMING DOCUMENTS

The prepared EIA report, revision 3, issue date September 19, 2008, has been presented for public review.

The EIA report has been presented in accordance with requirements of the Law on the Environmental Impact Assessment of Proposed Economic Activity [1] and of the Order on Informing the Public and the Public Participation in the Process of Environment Impact Assessment [2].

The public was informed about the EIA report and scheduled public meeting in more than 10 working days before the meeting date. Announcements were published in the national newspaper "Lietuvos rytas" (December 23, 2008), Ignalina region newspaper "Nauja vaga" (December 25, 2008), Zarasai region newspaper "Zarasų kraštas" (December 24, 2008), Visaginas town newspaper "Sugardas" (December 23, 2008). The announcement has been placed in the advertisement board of the Visaginas town municipality. Announcements have been published in websites of the Visaginas town municipality (http://www.visaginas.lt) and Ignalina NPP (http://www.iae.lt). Copies of the EIA report for public review were available at the Visaginas town municipality and at the Ignalina NPP information center. An electronic version of the EIA report for the free public download was available at the Ignalina NPP website (http://www.iae.lt).

Up till now no motivated proposals for the proposed economic activity have been received.

Public presentation and consideration of the EIA report was scheduled for November 14, 2008 in the Visaginas town municipality, at convenient for the public and non working time. Within an hour from the scheduled time, no public representatives appeared. Therefore, it was concluded that public is not interested in the proposed economic activity and the public informing procedure has been performed. The statement was recorded in the minutes and signed by the chairman and the secretary of the meeting.

The copies of public informing documents and minutes of the public meeting are provided in the Lithuanian version of the EIA report.

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