LITHUANIAN ENERGY INSTITUTE

Reconstruction and transformation of Ignalina NPP storage facility of bituminised radioactive waste into repository

Ignalinas atomelektrostacijas bituminizētu radioaktīvo atkritumu glabāšanas vietas rekonstrukciju un pārveidi par apglabāšanas vietu

Environmental Impact Assessment Report

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Main Objectives of EIA

- To determine if the proposed economic activity may be carried out at the chosen site
- To assess potential environmental impacts of the proposed economic activity
- To identify and to evaluate viable alternatives of the project
- To provide information on the proposed economic activity for all EIA participants and stakeholders

Description of the EIA Procedure

- Preparation of the EIA program:
  - plan for how the environmental impact assessment will be carried out
  - identification of environmental impacts that are most likely to be significant
- Coordination of the EIA program:
  - with EIA parties
  - with public
  - informing other countries
- Preparation of the EIA report:
  - description of project and environment
  - impact prediction and assessment
- Coordination of the EIA report:
  - with public (information and consultations)
  - with EIA parties
  - with other countries

- State Nuclear Power Safety Inspectorate (VATESI)
- Radiation Protection Centre
- Fire and Rescue Department
- Department of Cultural Heritage under the Ministry of Culture
- State Service for Protected Areas under this Ministry of Environment
- National Public Health Centre under the Ministry of Health
- Administration of Visaginas Municipality
- Environmental Protection Agency (Competent Authority)

Description of Proposed Economic Activity (1/8)

- **Organizer of proposed economic activity**

  State Enterprise “Ignalina Nuclear Power Plant”

- **Developer of EIA Report**

  Public institution “Lithuanian Energy Institute”

- **Contractor of the Project**

  JSC “Svertas Group”

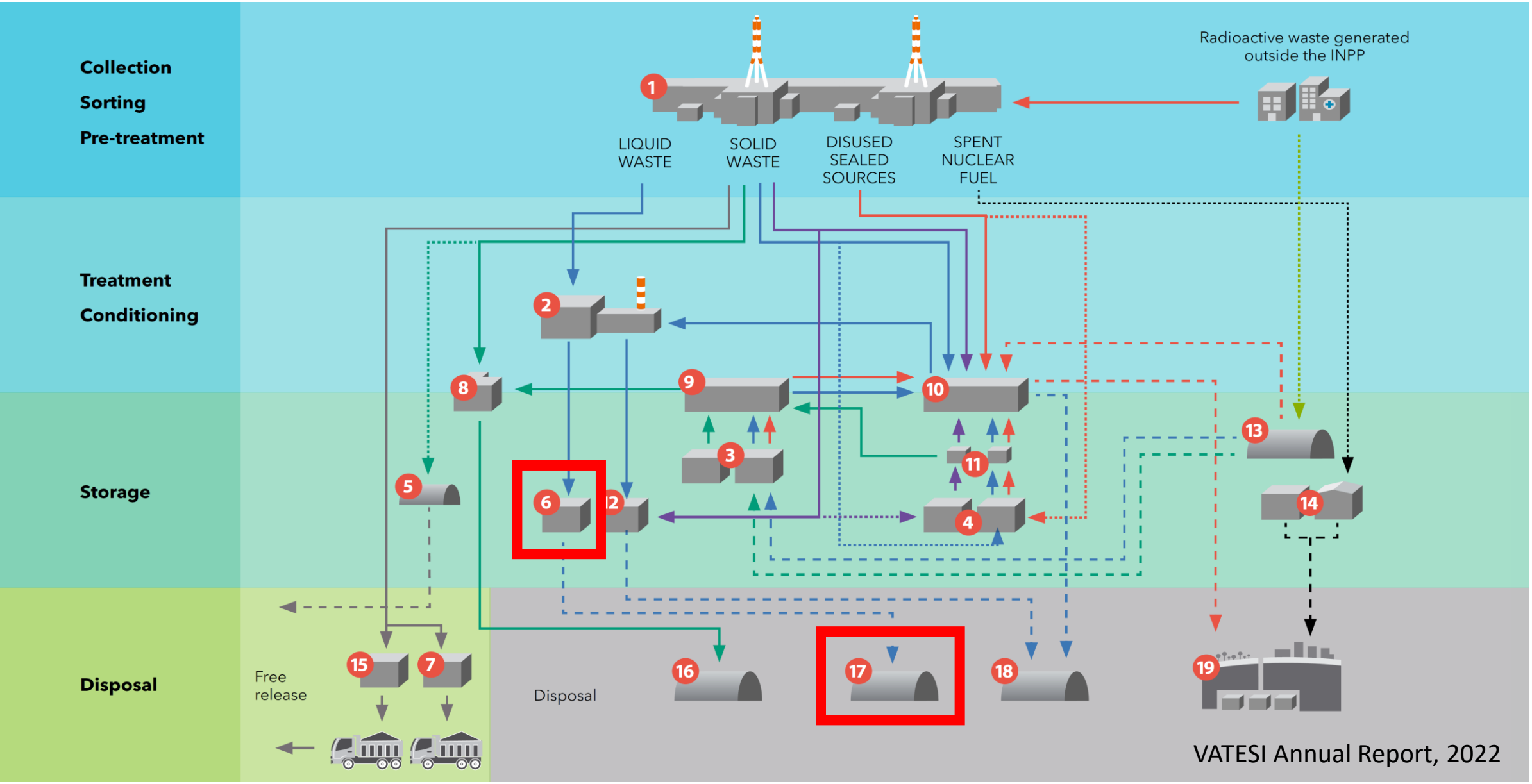
Description of Proposed Economic Activity (2/8)

- During the operation of the Ignalina NPP all water discharged in the controlled area from the various technological tanks and pipelines as well as wastewater was collected in dedicated storage tanks.
- The collected water was evaporated in special facilities and the concentrate of the impurities present in the water was mixed with bitumen in a bituminisation facility.
- The resulting mixture of bitumen and evaporator concentrate (compound) was placed in the storage canyons in Building 158.
- Over the entire period from 1987 to 2015 (when the bituminization process was stopped) 14 422 m^3 of bituminized radioactive waste were loaded into building 158. Bituminized radioactive waste is classified as Class B and C solid radioactive waste (short-lived, low and intermediate level activity).

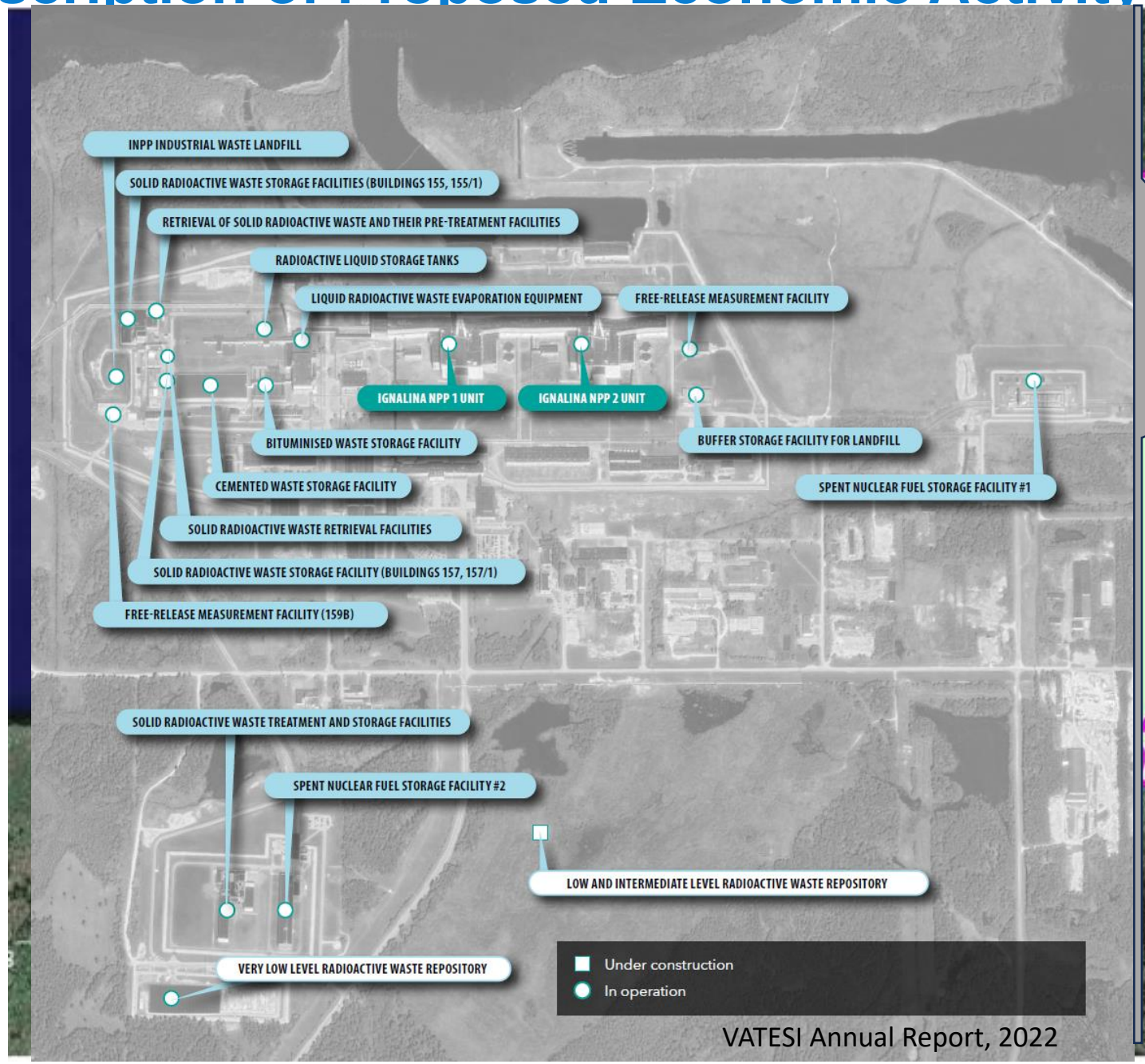
Description of Proposed Economic Activity (3/8)

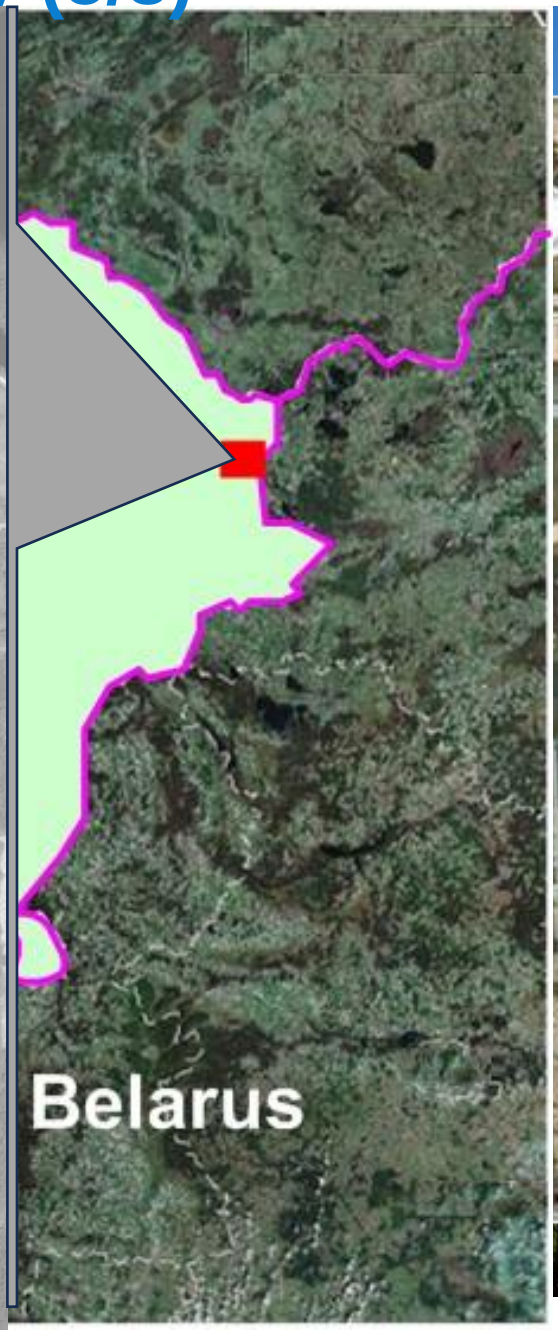
- The possibilities of transforming the bituminised radioactive waste storage facility at Ignalina NPP into a repository have been evaluated since 2007, when a feasibility study for transforming the storage facility into a repository was prepared.
- Later, an IAEA expert mission was organised in 2015 to assess the feasibility of converting the storage facility into a repository.
- In 2019-2022 the conceptual design of a repository was prepared, the safety justification of the repository concept and an evaluation of the repository site were performed.

Description of Proposed Economic Activity (4/8)



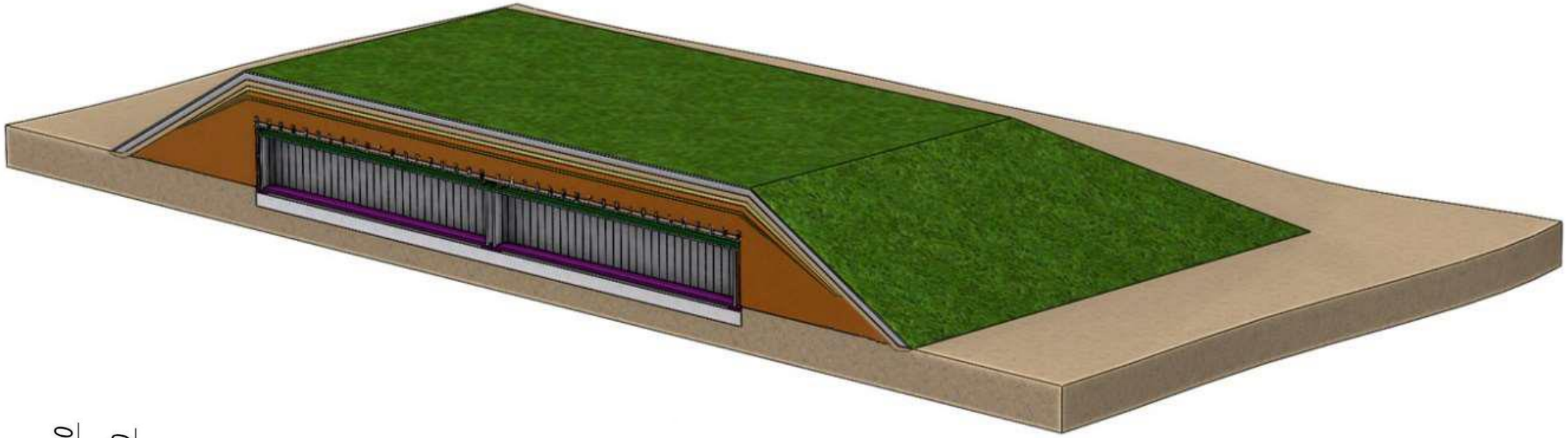
Description of Proposed Economic Activity (5/8)

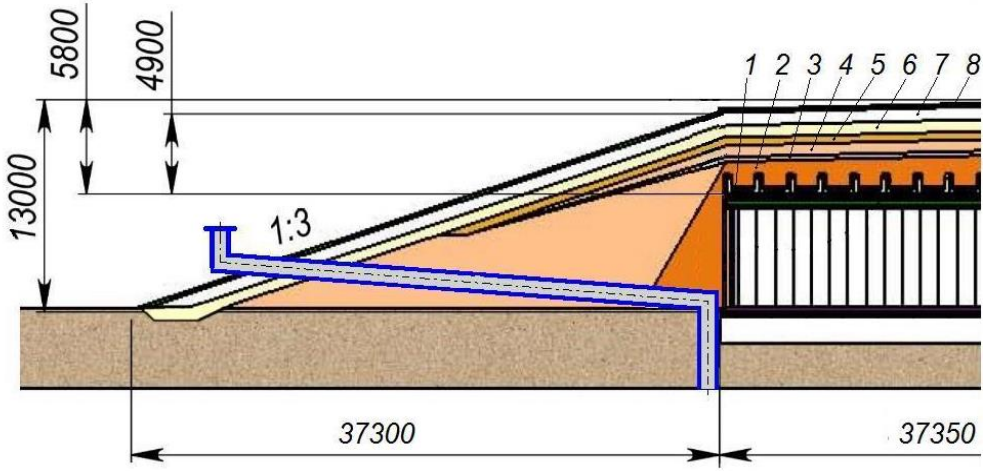




VATESI Annual Report, 2022

Description of Proposed Economic Activity (6/8)





5.8 m thick engineered barrier:

1 – drainage layer (0.2 m of sand);
2 – insulating clay layer (1.5 – 2.4 m);
3 – drainage layer (0.3 m of gravelly sand);
4 – protective clay layer (0.7 m);
5-7 – drainage layers (0.6 m of sand, 0.6 m gravel and 0.8 m of crushed stone);
8 – vegetation layer of 0.2 m thickness

Description of Proposed Economic Activity (7/8)

Implementation stages:

1) Filling in all the unfilled canyons of the Storage Facility (preliminary term 2028–2029).
2) Dismantling of the second floor of the Storage Facility (preliminary term 2028–2029).
3) Covering of all flooring and exterior walls of the Storage Facility with waterproofing material (preliminary term 2028–2029).
4) Conservation and maintenance of the Storage Facility (preliminary term 2029–2039).
5) Installation of engineered barrier supports of future Repository on the flooring of building 158 (preliminary term 2039–2040).
6) Installation of engineered barrier of the Repository (preliminary term 2039–2040).
7) Period after Repository closure, i.e. institutional control period (100 years – active control and 200 years – passive).

Description of Proposed Economic Activity (8/8)

- The reasonable alternatives for this proposed economic activity are:
  - “zero” alternative, i.e. bituminized RAW continues to be stored in building 158 (the building is not reconstructed, additional engineered barriers are not installed), and
  - location alternative, i.e. to construct the repository in another site (then the bituminized RAW should be removed from the existing storage facility, placed in packages and transported to the new repository)
- Previous assessments have shown that the existing structures of bld. 158 would not provide a reliable containment of the waste for the long term storage
- In case of the location alternative, bituminized radioactive waste from bld. 158 should be retrieved, placed in appropriate packages and transported to the disposal site. This would lead to additional socio-economic challenges in the selection of the repository site, higher exposure of personnel and the members of population are expected while performing additional radioactive waste management activities

Contents of the EIA Report

- **Chapter 1**: GENERAL INFORMATION
- **Chapter 2**: MAIN EQUIPMENT AND TECHNOLOGICAL PROCESSES
- **Chapter 3**: WASTE GENERATION AND MANAGEMENT
- **Chapter 4**: COMPONENTS OF THE ENVIRONMENT THAT MAY BE IMPACTED BY PROPOSED ECONOMIC ACTIVITY (*water, air, soil, underground, biodiversity, landscape, social and economic environment, ethnic and cultural conditions, cultural heritage, public health*)
- **Chapter 5**: ANALYSIS OF ALTERNATIVES
- **Chapter 6**: MONITORING
- **Chapter 7**: RISK ANALYSIS AND ASSESSMENT
- **Chapter 8**: POTENTIAL IMPACT ON NEIGHBORING COUNTRIES
- **Chapter 9**: DESCRIPTION OF DIFFICULTIES
- **Chapter 10**: REFERENCES

Environmental Impacts (1/3)

- Proposed economic activity will be carried out at the Ignalina NPP industrial area, that has sanitary protection zone with radius of 3 km, where there are no permanent residents and economic activity is limited.
- Non-radiological impacts (due to noise, dust, etc.) during dismantling works and installation of repository engineered barrier is possible only locally at the site and in the immediate vicinity of the facility (about 300 m away from the repository).
- Potential radiological impact on the environment as well as to the public health is possible due to radionuclide release from the planned bituminised waste repository:
  - Radionuclides could be released into the ambient air in case of accidents and inadvertent intrusion into the repository after the end of institutional control period
  - Radionuclide migration (diffusion) from the bitumen compound through the reinforced concrete structures (walls and bottom) into ground water

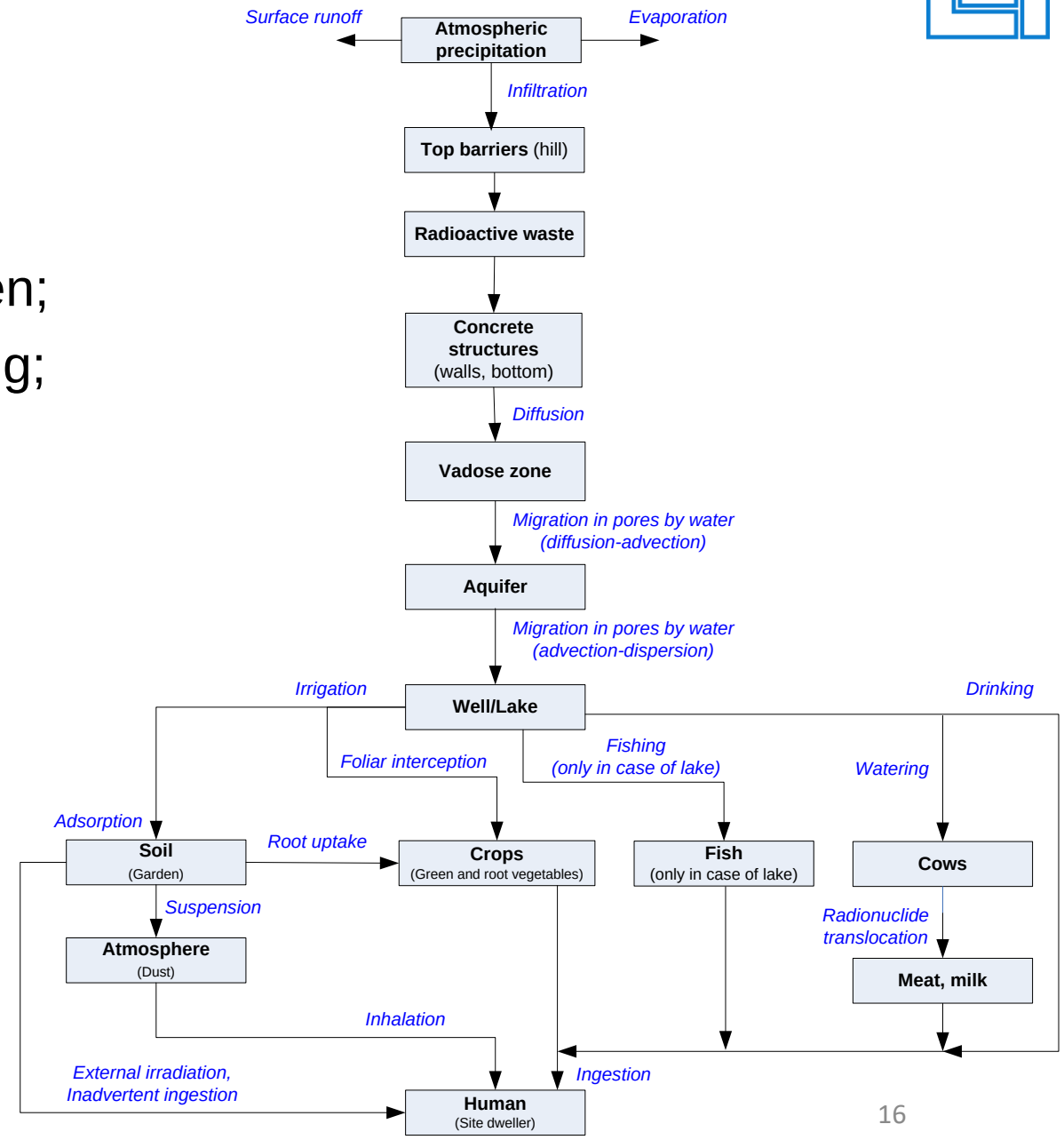
Environmental Impacts (2/3)

- AMBER and COMSOL computer codes were used to model radionuclide transport through engineered barriers of the repository, in ground water, geosphere and biosphere
- 14 scenarios of the repository evolution and the dispersion of radionuclides were analysed
- Two discharge points of radionuclides were investigated: a well installed in the aquifer at the distance of 50 m from the repository and the lake Druksiai located at the distance of 600 m from the repository
- The water taken from the well or the lake can be used by the humans (members of reference group of population) for their everyday needs and, thus it can become a source of exposure
- In case of inadvertent intrusion into the repository after completion of the institutional control period a site dweller consuming vegetables grown in the garden or a worker constructing a road at the repository site are considered as a member of the reference group

Environmental Impacts (3/3)

The following internal exposure pathways have been taken into account:

- inhalation of air contaminated with the dust suspended from soil during works in the garden;
- ingestion of contaminated water during drinking;
- ingestion of vegetables irrigated with contaminated water;
- ingestion of meat and milk from the cattle watered with contaminated water;
- ingestion of fish caught in the contaminated lake;
- inadvertent ingestion of soil (e.g., particles of soil residual on vegetables).



Main Conclusions of the EIA Report (1/4)

- Lithuanian Hygiene Standard HN 73:2018 “Basic Standards of Radiation Protection” defines dose constraint of 0.2 mSv/year for the population exposure during operation and decommissioning period of nuclear facilities.
- The maximum annual dose due to the water pathway scenario to the representative member, which daily uses a contaminated water from a well (located 50 meters from the repository) and assuming the very conservative hypothetical case that lower layers, foundation, walls and top slab of the repository are cracked immediately after its closure and the multilayer cap is also assumed to be degraded immediately after a closure, is about 10 times lower than the dose constrain of 0.2 mSv/year.

Main Conclusions of the EIA Report (2/4)

- According to VATESI Nuclear safety requirements BSR-3.2.2-2016 “Radioactive Waste Repositories” the scenario of an inadvertent intrusion into a repository after termination of the institutional control shall be analyzed. The effective dose received by public in case of such intrusion shall not exceed 10 mSv in a year.
- Evaluation of the different inadvertent intrusion scenarios has shown that exposure doses are below the dose constrain of 10 mSv/year. A highest dose value (~4 mSv/year) is estimated in case of on-site residence scenario.

Main Conclusions of the EIA Report (3/4)

- Airplane crash onto building 158 probability calculations have showed that in all cases the probability is less than the screening probability level (SPL) ($1 \cdot 10^{-7}$ per year for nuclear objects). According to IAEA Specific Safety Guide No. SSG-79 “Hazards Associated with Human Induced External Events in Site Evaluation for Nuclear Installations” the initiating events with a probability of occurrence lower than the SPL should not be given further consideration.
- Nevertheless, the assessment of a civil airplane crash onto the bituminized RW storage facility was done and it shows, that according to the conservative dispersion scenario, the 24 hours exposure of member of the population is 0.001–0.003 mSv. The corresponding annual effective dose is approximately 0.06 mSv. The highest doses are observed close to the INPP site and in the distance from 2 km to 5 km from the release source (the building 158).

Main Conclusions of the EIA Report (4/4)

- Latvian and Lithuanian state boarder is about 8 km north from INPP industrial area. Border between Lithuania and Belarus is about 5 km east and south-east from INPP industrial area.
- Taking into account that the nearest neighbouring countries and their settlements are more distant (> 5 km distance) from the site of the proposed economic activity, i.e. further than the distance taken into account for the assessment of the radiological impact on the representative member of population (50 metres away), the health impact on the population of neighbouring countries would be even lower when considering the same water pathways as for the representative in the vicinity of the repository, as the increase in distance from the source of the discharge results in a decrease in the concentrations of radionuclides and the resulting exposure doses. The scenarios of inadvertent intrusion into the repository are not relevant for residents of neighbouring countries.

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Thank you for your attention!