

# Development of the concept for derivation of conditional clearance levels for industrial waste disposal facility at Ignalina NPP



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## Introduction:

Industrial waste generated from the operation of Ignalina Nuclear Power Plant (Ignalina NPP) was disposed in industrial waste dumps, the so-called "landfill facility". The facility is located inside the controlled area of the plant. The industrial waste disposal was stopped in 2014 with approximately 20 000 Mg of the waste accumulated in two disposal locations.

At the time of disposal, the waste was considered as exempt waste. Due to changes in the regulatory requirements, including the radioactive waste classification system, a part of the waste was reclassified to a very low-level radioactive waste. Application of unconditional clearance levels revealed the necessity for regulatory control of the facility beyond the planned date of decommissioning of the Ignalina NPP – 2038.

As a possible option for the industrial waste management, the Ignalina NPP final decommissioning plan [1] foresees the analysis and development of conditional clearance levels for the industrial waste disposed in landfill facility. Application of conditional clearance would allow removal of the regulatory control and conversion (with construction of additional engineered barriers, if required) of the existing landfill to a conventional waste disposal facility. The waste retrieval will not be required.

## Radiation safety context :

According to the national requirements, values of conditional clearance levels are to be determined using 0.01 mSv annual effective dose limit for representative members of the population, also taking into account European Commission technical framework for determination of conditional clearance levels [2]. It is also recommended to follow the recommendations of International Atomic Energy Agency (IAEA) for determination of conditional clearance levels. The Lithuanian Republic regulatory approved unconditional clearance levels are based on IAEA publication [3] provided values.

## The waste:

The largest part of the Ignalina NPP industrial waste (see Fig. 1), consists of various construction waste types (concrete, soil, stones, bricks, tiles, glass, etc.). Metals (aluminum, iron, steel, cables etc.) make the second significant part the waste mass. Presence of metals, approximate 5 000 Mg, makes industrial waste potentially attractive for the intentional intrusion – illegal excavation and selling of metal scrap.

The disposed waste is mixed with the filling material - various types of sand and loam.

Radiological characterization of the waste defined specific activities of 18 radionuclides. Assessment of the waste compliance with unconditional clearance levels revealed that activities of four radionuclides - <sup>60</sup>Co, <sup>94</sup>Nb, <sup>137</sup>Cs and <sup>241</sup>Am are important for clearance of the waste.

## Scenarios:

Scenarios used for calculation of conditional clearance levels can be subdivided into two main groups:

- Intrusion scenarios, which further can be subdivided into:
  - Unintentional intrusion scenarios: small scale intrusion, road construction (see Fig. 2), public place construction and on-site residence;
  - Intentional intrusion scenario (see Fig. 3);
- Underground water path scenarios, for assessment of groundwater and interlayer water pathways, impact from on-site groundwater drainage system.

Scenarios are calculated with realistic and low probable parameter values.

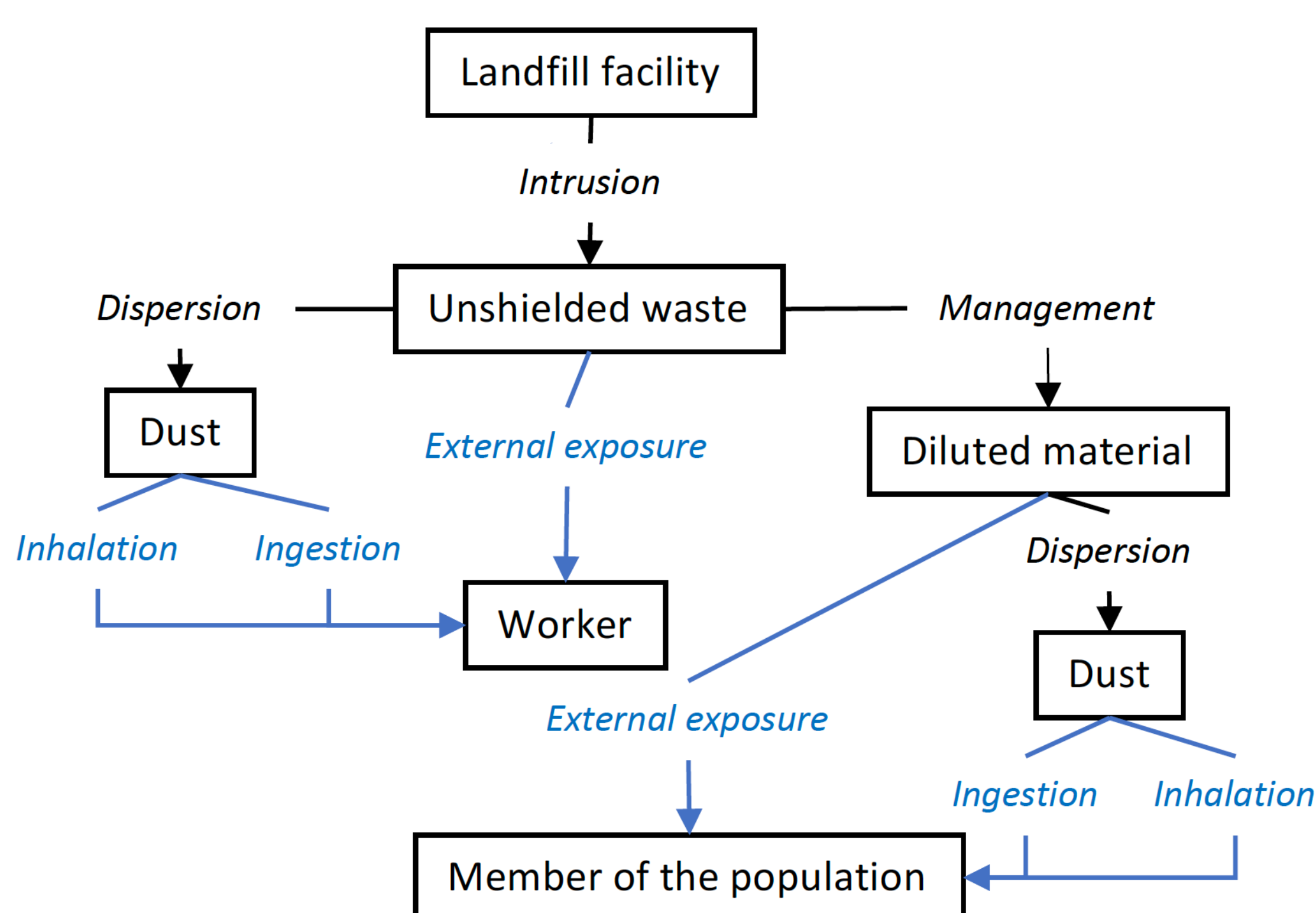


Fig. 2 Exposure pathways for unintentional intrusion, road construction scenario

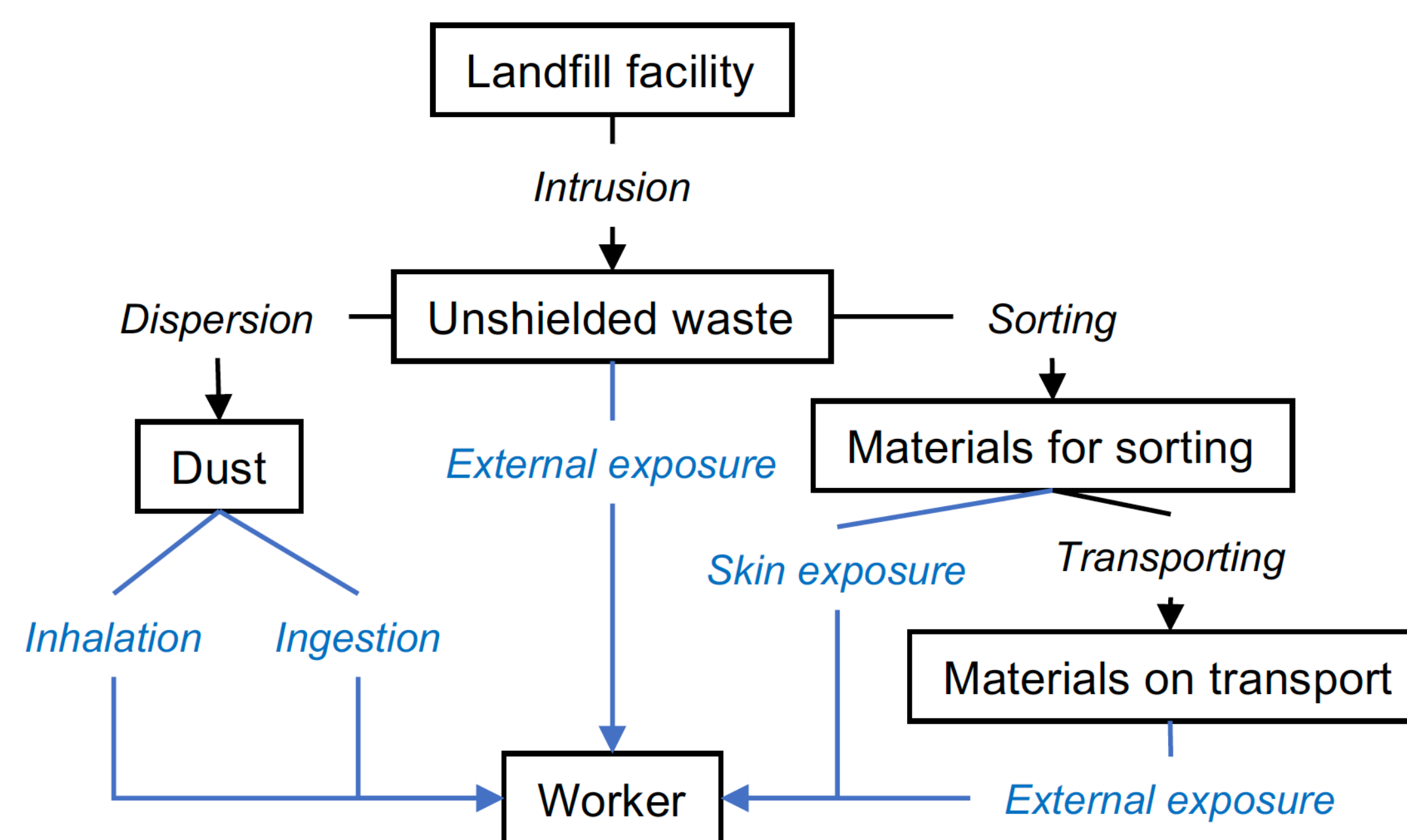


Fig. 3 Exposure pathways for intentional intrusion scenario

## Conclusions:

- Establishing and application of conditional clearance levels for the Ignalina NPP industrial waste disposed in the landfill facility would allow removal of regulatory control and conversion of the landfill facility to a conventional waste disposal facility;
- Conditional clearance levels are required for at least four radionuclides: <sup>60</sup>Co, <sup>94</sup>Nb, <sup>137</sup>Cs and <sup>241</sup>Am. Specific activities of other radionuclides in the waste are low and unconditional clearance levels [2] for these radionuclides can be used as a conservative substitution for conditional clearance levels;
- Presence of significant amount of metals in the waste makes the waste potentially attractive for illegal excavation and requires for consideration of intentional intrusion scenarios.

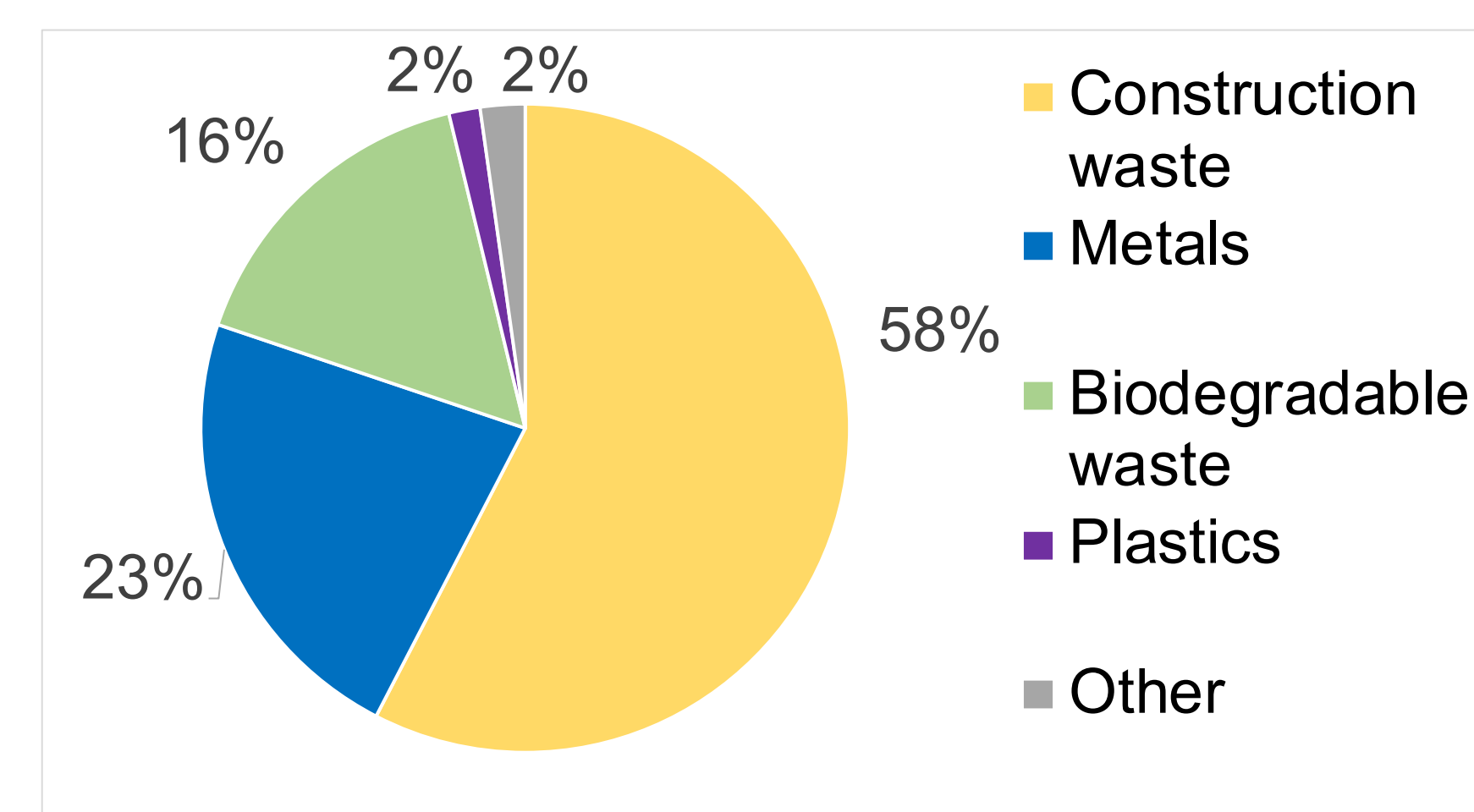


Fig. 1 The waste composition, % by mass

## Exposed representants:

- Members of the population:
  - Adult;
  - 1-2 years old child;
- Worker (adult member of the population, performing heavy physical activities).

## Applicable dose limits:

- 0.01 mSv/a effective dose for realistic scenarios and parameter values;
- 1 mSv/a effective dose for low probable scenarios and parameter values.



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