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## DOCUMENT HISTORY

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## ABBREVIATIONS AND TERMS

**ALARA** – As Low As Reasonably Achievable

**IDZ** – Conceptual Design

**LILW** – Low and intermediate level waste

**ReCO** – Regional notification centre

**SNSA** – Slovenian Nuclear Safety Administration

**SRPA** – Slovenian Radiation Protection Administration

**Accidental exposure** – Exposure of individuals due to emergencies. Accidental exposure does not include exposure of persons carrying out protective measures.

**Emergency** – an event in which radiation or nuclear safety is reduced. Due to the situation that arises as a consequence of an emergency, preparations for and/or the implementation of measures to protect workers, representatives of the population or the population as a whole or in part, or the protection of patients, must be instituted if the emergency involves a radiological practice.

**Nuclear safety** – technical and organisational measures that result in the safe operation of a nuclear facility, the prevention of emergencies or the mitigation of the consequences of emergencies and that contribute to protecting exposed workers, the population and the environment against ionising radiation.

**Contamination** – the corruption of objects, surfaces or persons by radioactive substances.

**Irradiation** – an expression used in protection against ionising radiation for exposure to radiation (especially of people) over a certain time period.

**Radiological accident** – an emergency in which significant discharges of radioactive substances into the environment or irradiation of people can occur, and which requires protective measures for the population.

**Controlled area** – the area inside the fence surrounding the disposal part of the repository, with warning signs posted by the operator marked “Controlled Area” and “Restricted Access”.

The other abbreviations and expressions used in this document have the same meanings as those set out in the act governing protection against ionising radiation and nuclear safety.

## 14.1 General

The planning of emergency measures and maintaining of emergency preparedness is a legal obligation of the operator of the nuclear facility. The purpose is to determine the organisation of the response to and measures required for the management of emergencies at the LILW repository (hereinafter: the repository) during its operational period. The basic objectives of emergency preparedness are to prevent the further development of emergencies into radiological accidents, to limit risk and to protect the environment, the population and repository employees against any harmful consequences.

Repository emergencies are events in which radiation safety is reduced and events that require action. Owing to the danger of an increased level of radiation or contamination of the working environment and of various surfaces at the repository with radioactive material and the spreading of the repository's radiological impact into the surrounding environment as a result of an emergency, remedial measures will be required. Emergencies are covered during the phase of operation of the LILW repository. The safety analyses for that period indicate that due to emergencies, radiation safety could be reduced to such extent as to require protective measures.

In the safety analyses, which are summarised in Chapter 7 of this document, fire, container drops and explosions are recognised as repository emergencies. The scenario analyses have indicated that in the event of an emergency, the design of the disposal unit (silo) is sufficient to reduce the radiological impact on workers, the population and the environment below the legally defined limits. In addition to the aforementioned events, other emergencies are covered that could directly or indirectly impact radiation safety at the LILW repository (work accident, accident during transport, intrusion, sabotage, diversion, attack and similar events).

Article 104 of the Ionising Radiation Protection and Nuclear Safety Act [1] states that the operator of a radiation or nuclear facility must draw up a risk assessment in accordance with the act governing protection against natural and other disasters [2] to establish whether intervention measures need to be planned for outside the area of the radiation or nuclear facility. If such measures are required, the operator must draw up a protection and rescue plan; if they are not, the operator must draw up instructions for the measures to be taken in the event of an emergency. Under the Rules on operational safety of radiation and nuclear facilities, [3] the preparation and maintenance of a protection and rescue plan, along with implementing procedures, is the obligation of the operator of the nuclear facility, who must ensure readiness for any possible emergency.

At the time of the drafting of this document, the estimated level of threat to humans, animals, property, cultural heritage and the environment during natural and other disasters has not yet been determined for the repository, however, in view of the results of the safety analyses, we assume that the impacts outside the area will remain below the legally permissible levels. A suitable plan or instructions for taking measures will be drawn up in accordance with the law. When drawing up instructions and plans it will be necessary to take account of the municipal, [4] regional [5] and national [6] protection and rescue plans for nuclear or radiological accidents and the risk assessment for emergencies at nuclear facilities and emergencies involving radiological substances. [7] Regardless of whether a protection and rescue plan or instructions for measures to be taken in the event of an emergency are drawn up, the basic purpose of both documents is the same: the planning and maintaining of emergency preparedness and

training for measures to be taken in the event of an emergency, which includes providing for the protection, safety and health of the workers who will be working at the repository and in its immediate vicinity. The possibility of an accident or emergency occurring must be reduced to a minimum, but in the event of one occurring, the consequences must be mitigated and conditions ensured for re-establishing normal operation. The repository operator must implement all reasonable measures to prevent accidents relating to activities associated with the operations of the repository, which it shall demonstrate in the Safety Analysis Report and through external and internal checking of the implementation of those measures.

## 14.2 Types of emergencies

Emergency preparedness is covered in the document Measures to be taken in the event of an emergency at the LILW repository. [8] Before the start of repository operations, the document will be supplemented in line with the risk assessment via amendments to the instructions for taking emergency actions or the protection and rescue plan. The basic purpose of the instructions or plan will be to plan a response and measures necessary to manage emergencies at the repository, with the aim of preventing an escalation of the emergency into a radiological accident, to limit the risk and mitigate the consequences. In subsequent phases of the project, the document covering the management of emergencies will be supplemented with reminders and written procedures for remediation of consequences.

The actions of the security personnel who will provide physical security and fire safety for the LILW repository will be covered in the physical security plan and associated instructions for action. All plans and documents that address emergency preparedness will be harmonised.

In general not every emergency involves the occurrence of a radiological accident. It could involve a reduction in radiation safety that also requires an appropriate response. Owing to the danger of an increased level of radiation or contamination of the working environment and of some parts of the repository with radioactive material as a result of an emergency, remedial measures are required.

The following potential emergencies that could occur during the operation of the repository and during transport were identified in the safety analyses:

- fire
- container drop (during operations)
- terrorist attack scenario – explosion
- airplane crash scenario – explosion + fire

The aforementioned events could occur as a result of various initiating events (hazards): earthquake, extreme weather, airplane crash, work accident, traffic accident, intrusion, protest, sabotage, diversion, attack, etc. These initiating events could lead to a chain of related emergencies (explosion causing a fire, etc.). Due to the design of the facility and the preventive measures in place, the likelihood of a chain event occurring is assessed as very low. The following initiating events are added to the postulated initiating events identified in the safety analyses: work accident, intrusion, protests and similar events that require actions to prevent the further escalation into an event identified in the safety analyses. Descriptions of the events are given below.

- Fire emergency

Fire is treated as the consequence of several initiating events. It is divided into two sub-scenarios. The first is in the hall above the silo, and the second is a fire in the technological facility. Owing to the requirement of conservativeness, fire in the technological facility is addressed in the safety analyses. [9] Fire in the hall above the silo is addressed as a part of the airplane crash scenario. Fire emergencies are classified as incipient fires and fully developed fires. Incipient fires are extinguished by repository staff using fire extinguishers. Fully developed fires are extinguished by firefighting units.

- Container drop emergency

A container drop emergency is a work accident that occurs during repository operations. Three events were addressed:

- a container drop from a height of nine metres inside the technological facility
- a container drop from a height of 50 metres in the silo
- a container drop from a height of 35 metres in the silo

The worst-case scenario is a container drop during the operation of the gantry crane that will be used to place the final containers into the silo, as the drop heights in this instance can be high. The consequences include damage to the final package and partial spillage of solid radioactive waste, which could lead to contamination of the surfaces of the disposal facility or its nearfield.

- Explosion

An explosion in the technological facility could be the consequence of an airplane crash or terrorist attack. The consequences of an explosion include destruction of equipment and containers and contamination of surfaces.

- Work accident

Work accidents can include exposure to radiological sources. Both injuries and irradiation of workers can occur.

- Intrusion

This event comprises forced and unauthorised entry into the repository's controlled radiation area, intentional damage to structures and components, or the appropriation of equipment.

- Protest, sabotage, diversion, attack and similar events

These events include organised non-violent marches in the vicinity of the repository or attacks on the structures or operational staff involving the use of force or weapons.

### 14.3 Principles of taking action

The planning of emergency measures includes the response of repository staff and the provider of the security service to the emergency, notification of the repository operator, emergency response services and the administrative authorities, planning the emergency

response or remediation of the situation, checking the effectiveness of emergency and corrective measures, and notification of the public.

The document covering emergency response includes plans for events identified as safety relevant in the safety analyses. Conduct is determined in the form of brief reminders, which will be included in the appendices to the basic document and will be accessible by staff and security personnel at all times. Written procedural instructions for remediation of the consequences of emergencies will be drafted in subsequent phases of the project.

Emergency measures shall be organised in accordance with the principles set out in the following:

- Ionising Radiation Protection and Nuclear Safety Act [1]
- Protection against Natural and Other Disasters Act [2]
- Transport of Dangerous Goods Act [10] and ADR [11]

They primarily concern the principles underlying the right to protection and assistance, the principle of transparency, prevention, responsibility and a graduated approach to the use of protection, rescue and assistance forces.

The following are taken into account when implementing the planned measures:

- that the costs and damages caused by emergency measures to reduce damage to people's health be justified,
- that the method, scope and duration of emergency measures be optimised so that damage to people's health is minimised in comparison to the increased damage caused by the implementation of the emergency measures,
- the prescribed dose limit for exposure of persons carrying out protective measures and emergency measures.

ARAO is responsible for planning the response, maintenance of the plan and initial response in the event of an emergency in the area of the repository. In order to ensure an effective response, a state of constant preparedness will be implemented, for which ARAO will have to have a job classification scheme in place.

#### **14.4 Concept and organisation of response**

The response concept will be based on the classification and announcement of the danger level:

- a danger level whereby the event is brought under control entirely by ARAO staff and the safety department (unusual event);
- a danger level for which the involvement of external emergency response teams is envisaged.

The level of danger is determined by the person present at the event (ARAO worker or security officer). The worker determines this based on the information available.

For an effective response the repository operator will have a state of constant preparedness during and outside working hours. During the period of preparedness, one worker will be reachable by mobile telephone (a worker from the LILW repository section or a worker from the radiation protection department). The envisaged response time for a worker outside



working hours is up to 60 minutes from receipt of notification of an emergency (arrival at the repository site). The state of constant preparedness is managed by the head of the repository.

In the event of a response including external emergency response services (police, fire, ambulance), the repository's head of response will coordinate with the heads of the emergency response services. In emergencies involving radioactive waste, a worker from the radiation protection department of the repository operator will participate by conducting emergency monitoring and radiation protection measures.

#### **14.5 Participating organisational units**

In addition to the repository staff, security officers will play an important role, primarily with regard to events that occur outside of working hours and when employees of the repository operator are not present at the site. The following participating organisational units and responsible persons of the repository operator are envisaged:

- director
- workers in the repository operations department
- radiation protection department
- person responsible for the implementation of fire safety measures
- public relations office

The following external participating organisational units and responsible persons are planned:

- physical security contractor
- SNSA
- SRPA
- ReCO
- Krško Police Directorate
- Krško Fire Department
- Emergency medical assistance team

#### **14.6 Material technical resources**

The repository operator will provide personal protective equipment and technical protective means including:

- full-face masks with respirators
- TL dosimeters
- electronic dosimeters
- respirators
- Tyvek coveralls
- shoe protection and latex gloves
- dose rate monitors
- contamination monitors
- adhesive tape

The operator shall provide an area in which these materials will be stored, and their adequacy and condition checked. The adequacy and functionality inspections will be carried out by the repository's radiation protection department. The repository operator shall also provide equipment and technical means for remediation of the consequences of emergencies.

The authorities that established the external organisations will be responsible for their readiness, equipment and level of training.

## 14.7 Funding

The repository operator will include a fiscal item in its work plan for emergency preparedness, which must cover the funding of the following items:

- personal protective equipment
- technical protective equipment
- measuring equipment
- training, practice and exercises
- implementation of preventive measures (updating and maintenance of active fire protection systems, burglary protection systems, physical security systems, etc.)
- constant preparedness and implementation of emergency measures
- constant preparedness at home (on-call status)
- extraordinary monitoring
- remediation for return to normal condition

On the basis of the approved work programme and financial plan, the operator of the LILW repository receives funding for the implementation of measures from the Krško NPP Fund, which provides funding for the activities of ARAO set out in the Act Governing the Fund for the Financing of the Decommissioning of Krško Nuclear Power Plant and for the Disposal of Radioactive Waste from Krško Nuclear Power Plant. [12]

## 14.8 Surveillance and notification

The surveillance and notification system is drawn up on the basis of the IDZ [13] and may be changed subsequently during the course of the project.

The repository operator's employees will be present at the repository during working hours. Weekends and holidays will be off days. Workers on-call at home will be reachable via their company mobile telephones, 24 hours a day, 7 days a week, 365 days a year. An on-call worker in the disposal sector is the head of response.

The controlled radiation area will be physically secured during working hours (continuous presence of a security officer), and periodic patrols will be conducted by security officers outside of working hours. Technical security measures will be in place in the controlled radiation area 24 hours a day.

Emergencies during working hours can be detected by:

- employees of the repository operator
- security officers

Fires in the facility will be detected by the active fire protection system.

Intrusions will be detected by the technical security system.

The alarm will be connected to the reception desk and to the security provider's security control centre, and potentially also directly to the Police via the IP Infranet.

The initial notice of abnormal event (level 0) is reported to the head of response by an employee of the repository operator or a security officer. The exception to this is a fully developed fire, where the security officer first notifies ReCO and then the head of response.

When the assistance of external emergency response services is required (fire, intrusion), a repository employee or security officer present notifies ReCO directly.

Rescue, prevention of further escalation of events and mitigating consequences have priority over notification.

In the event of emergencies where the assistance of external emergency response services is required (fire, intrusion, significant contamination, irradiation or contamination of workers), the following stakeholders shall be notified:

- the administrative authorities (SNSA and SRPA)
- the public (local administrative unit, media)

#### **14.9 Duties of responsible persons**

The duties of the responsible employees of the repository operator and the physical security provider are covered in the document Measures to be taken in the event of an emergency at the LILW repository. [8]

#### **14.10 Communications connections**

In the transmission of information and spoken communication, all available telecommunication and IT infrastructure will be used.

Employees of the repository operator will use:

- mobile telephones
- stationary telephony
- e-mail
- the website

Security officers will use:

- mobile telephones
- stationary telephony
- radios

#### **14.11 Monitoring radioactivity in an emergency**

Operational radioactivity monitoring in the area surrounding the disposal facility will be performed in accordance with the radioactivity monitoring programme, which will be approved via the Safety Analysis Report for the repository. The purpose of operational monitoring is to carry out regular monitoring of ionising radiation and radioactive contamination in the environment, which will enable immediate notification of any raised levels and an estimate of the doses from exposure to additional radiation from the repository for representatives of reference groups working in the direct vicinity of the repository.

In the event of an emergency at the repository, where there is the possibility of the event involving radioactive material, emergency monitoring will be started at the repository site, as provided in the Safety Analysis Report. The proposed emergency monitoring includes:

- radiation monitoring at the location of the emergency
- radiation monitoring in the impact area of the emergency
- monitoring of the contamination of persons, equipment and objects
- monitoring of exposure to external radiation
- monitoring the decontamination of persons, equipment and objects

The sampling frequency, the duration of an individual sampling or measurement operation, the number of measurements and the locations of the measurements will be determined in accordance with the danger level and the extent of the consequences of the emergency. The sampling and measurement locations will be determined by the repository operator's radiation protection department, and in the event of a major threat the department will consult the SNSA.

#### **14.12 Protective measures**

Remedial measures in an emergency are measures to prevent environmental contamination and/or to reduce exposure of individuals to sources of radiation.

The radiation doses for individuals involved in emergency measures, including police, medical and firefighting personnel, may not exceed the doses for professionally exposed workers from sources of ionising radiation, except in cases of:

- saving life or averting a direct threat to the life or health of a large number of people;
- implementing measures that would ensure protection against a large collective dose;
- implementing measures that will prevent the onset of events with catastrophic consequences.

In all events, received doses must be as low as possible, in compliance with the ALARA principle.

The repository operator will provide personal protective equipment and technical protective means for action in an emergency and for remediation of the consequences of an emergency. A space will be provided at the repository for the storage of the above means and equipment. The repository operator shall also provide equipment and technical means for remediation of the consequences of emergencies. The authorities that established external organisations will be responsible for their readiness, equipment and level of training.

In the transmission of information and spoken communication, all available telecommunication and IT infrastructure will be used. Employees of the repository operator will use mobile telephones, stationary telephones, e-mail and the website.

Security officers will use mobile telephones, stationary telephones and radios.

In the event of an emergency at the repository, where there is the possibility of the event involving radioactive material, emergency monitoring at the repository site is envisaged. Emergency monitoring will cover radioactivity measurements at the radiation source, measurements of the contamination of equipment and objects and measurements in the

environment, and measurements of the exposure of the operator's workers, persons conducting protective measures and other persons present.

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