compiled at different stages. For this reason, the uniformity of the data for the analyses needs to be improved, for example by "freezing" the used data sufficiently early in order to ensure it is harmonious in the safety case to be submitted together with the operating licence application.

Generally, the reliability of the data and the models can be deemed sufficient at the construction licence stage.

Even though the safety case submitted by Posiva can be deemed reliable, it requires further development. Elements which would facilitate assessing the reliability of the safety case include a more understandable and less ambiguous description of barrier evolution, the identification of the parameters most important to safety and of the most significant barriers as well as a summary of the uncertainty analysis and a comparison of that analysis with the concept development programme.

Also, the methods related to preparing the safety case require further development before the operating licence application can be submitted. Scenarios need to be constructed in a more systematic and comprehensive manner and the safety case description of the scenario construction process needs to be easier to follow. Safety functions and performance targets must be specified so that the performance of the barriers and the scenarios derived from impaired performance can be assessed in a less ambiguous manner.

The structure and representation of the safety case need to be developed so that the fulfilment of the safety requirements can be verified more effortlessly.

The references made in the safety case need to be clear and the reference material must be accessible at the point of submitting the operating licence application.

The safety case must also cover the entire disposal system, which means that the safety analysis concerning low- and intermediate-level waste must be linked to the safety case for the disposal of spent fuel.

Conclusion

Based on the review, the safety case is sufficiently reliable at the construction licence stage. However, before the operating licence application can be submitted, the performance and safety analyses require improvement, and the safety case needs to be modified in order to increase reliability.

In the safety case, Posiva does not always clearly express its position on matters related to safety or justify the choices made. In the future, Posiva must present its conclusions and their rationale more clearly.

8 Posiva's plan for arranging the safeguards control necessary to prevent proliferation of nuclear weapons

Basis of nuclear material safeguards

Nuclear material safeguards is based on international treaties: the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/140), the Safeguards Agreement (INFCIRC/193), the Additional Protocol to the Safeguards Agreement (INFCIRC/193a8), and the Euratom Treaty. Each operator planning to use or currently using nuclear energy in Finland is, on its part, responsible for ensuring that Finland, in its capacity as a state, is capable of fulfilling its obligations under the relevant international treaties.

In connection with submitting a construction licence application and in accordance with the requirements of Section 35 subsection 7 of the Nuclear Energy Decree, Posiva has submitted a plan of the arrangements for the implementation of safeguards control necessary to prevent the proliferation of nuclear weapons to the Finnish Radiation and Nuclear Safety Authority. In accordance with Section 118 b of the Nuclear Energy Decree, the planning, construction and operation of a nuclear facility shall be implemented so that the obligations concerning the control of nuclear material, as provided and defined in the Nuclear Energy Act and provisions issued thereunder as well as in the Euratom Treaty and provisions issued thereunder (such as European Commission Regulation 302/2005), are met.

The plan prepared by Posiva covers the required issue on a general level, various options are put forward for some technical solutions, and references are made to future development work. The nuclear waste facility constructed by Posiva is globally the first of its kind, and the control measures implemented by IAEA and the European Commission are still partly unresolved. The control measures by IAEA and the Commission may affect the detailed designs of the nuclear waste facility, which means that Posiva cannot be required to submit a final plan on nuclear material safeguards at this stage.

Nuclear material safeguards by Posiva during construction and operation of the research facility

STUK has overseen the construction of the Onkalo underground rock characterization facility in accordance with the principles that govern the construction of a nuclear facility. In accordance with its safeguards manual, Posiva has submitted the data required for the oversight to STUK, and STUK has reviewed the data. In the same context, it was ascertained that Onkalo does not include unreported facilities or functions significant to the proliferation of nuclear weapons. Posiva has submitted the basic technical characteristics (BTC) of the facilities for regulation by IAEA and the European Commission and STUK has declared-Posiva's site in accordance with the Additional Protocol to the IAEA Safeguards Agreement. IAEA and the European Commission have inspected the Posiva site and Onkalo and have issued statements related to the inspections. The statements did not contain objections concerning Finland or Posiva.

Nuclear material safeguards after the closure of the disposal facility

The application prepared by Posiva does not comment on safeguards after the closure of the disposal facility. In accordance with Section 11 of the decree on the enforcement of the Safeguards Agreement conforming to the Non-Proliferation Treaty, nuclear materials remain under the IAEA Safeguards until it becomes practically impossible to retrieve them. The spent nuclear fuel disposed

by Posiva can also be retrieved after the closure of the disposal facility (appendix 17 of the construction licence application), though this would require considerable costs and labour input. Nuclear safeguards measures do not, therefore, end with the operational phase of the facility, but shall continue at least until the expiration of the Safeguards Agreement. Spent fuel is not highly suitable nuclear waste owing to its properties. However, the usability of the disposed fuel for nuclear weaponry improves over the course of several thousands of years, which constitutes grounds for long-term IAEA Safeguards. In accordance with the Nuclear Energy Act, the nuclear waste management obligation expires after the decommissioning of the nuclear facility, and the licensee has paid a lump sum to the State for the monitoring and control of the nuclear waste. The State shall be responsible thereafter for safeguards obligations respective to the decommissioned nuclear facility.

Conclusion

The plan prepared by Posiva accounts for the known and expected safeguards needs and the measures required to enable these. No issues that may prevent Posiva from carrying out nuclear safeguards at the disposal facility have been detected in the plan prepared by Posiva.

9 Emergency arrangements

General

The preliminary emergency plan is a document based on Section 35 of the Nuclear Energy Decree and must be submitted to STUK in connection with the construction licence application. In accordance with Section 1 of the Government Decree on Emergency Response Arrangements at Nuclear Plants (716/2013), the decree lays down provisions on emergency response arrangements at a nuclear power plant and shall apply, as necessary, to other nuclear facilities and to nuclear transport as required by the degree of the threat.

Emergencies cannot rise at the encapsulation facility during construction until spent fuel has been transported to the facility. However, Posiva has been preparing for potential emergencies at the operating nuclear power plant units of the power company Teollisuuden Voima Oyj (TVO) in Olkiluoto over a period of several years. The personnel working at the Onkalo construction site have received emergency response training. A safety plan has been prepared for the Onkalo construction site and places of assembly have been designated for possible evacuation. The construction site has also been taken into account in the emergency plan and instructions of the Olkiluoto nuclear power plant and in the training and drills arranged by the TVO emergency response organisation.

Planning of emergency response arrangements

The topic-specific report included in the preliminary safety report prepared by Posiva for the construction licence application, entitled "Operational safety analysis of the Olkiluoto encapsulation plant and disposal facility", includes an assessment of operational safety at the facilities and of the radiation doses the facility employees and the local population are exposed to during normal operation and emergencies. Posiva will specify its estimates of the radiation doses released in the event of more serious accidents causing releases into the environment as well as of the need for protective measures at varying distances from the encapsulation and disposal facilities. The results will be observed in preparing an emergency plan for the operating licence as well as an external emergency plan.

The emergency response arrangements prepared by Posiva will be consistent with the operations, fire prevention and security arrangements of the facility as well as the external emergency plan prepared by authorities for responding to nuclear power plant accidents.

The preliminary emergency plan includes a description of the facilities, devices and equipment required for emergency response measures, including reliable communication and alarm systems and a data transfer system for transmitting process parameters and radiation measurement results and weather information. The plan describes the estimation of the radiation situation, assessment of releases and formation of an assessment of the situation in the event of disturbances or accidents.

Posiva will ensure the safety of the personnel in emergency situations. The preliminary emergency response plan specifies places of assembly during the operating of the encapsulation and disposal facilities, personnel decontamination measures, and personal protective equipment and measurement equipment for radiation control. Posiva is not required to provide iodine pills for its personnel or the local population in the event of an accident, because fuel that has been stored for a long period of time only contains low doses of isotope iodine-129. Nevertheless, iodine pills have been reserved to prepare for accidents at the operating facilities in Olkiluoto.

The preliminary emergency response plan prepared by Posiva specifies the management pro-