



## Extended interim storage – the technical, organisational and social dimensions

The operation of nuclear power plants produces high-level radioactive waste, such as spent fuel elements and vitrified fission products from reprocessing, as well as operational waste with a lower level of radioactivity. In Germany, all these forms of waste will ultimately be disposed of in deep geological formations. As yet, no site has been selected for a repository for high-level radioactive waste; for low- and intermediate-level radioactive waste, a repository is now being built at Schacht Konrad (Konrad pit). However, until a repository is available for particularly hazardous waste, these highly radioactive substances must be stored safely. At present, most of this waste is kept in on-site interim storage facilities at the German nuclear power plants or in central interim storage facilities.

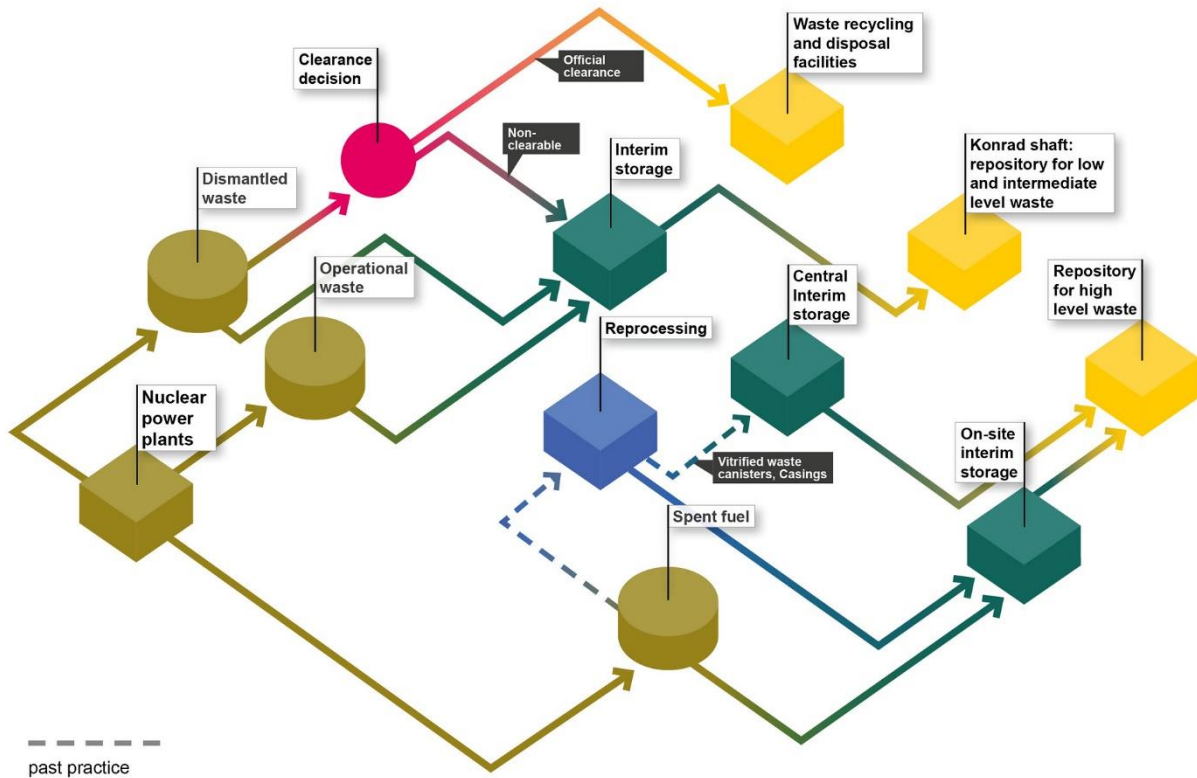
There is a problem, however: in Germany, the licences for interim storage facilities for high-level radioactive waste are time-limited to 40 years. This was mainly motivated by political factors: it was intended to assuage local concerns that the facilities might quietly be reclassified as final repositories, without proper scrutiny. As a consequence, a 40-year time limit was applied to all the studies and tests required for the granting of licences. The existing licences for the interim storage facilities therefore expire between 2034 and 2046/47.

According to even the most optimistic estimates, it is likely to take until at least 2050 for a repository site to be selected in Germany and for the facility itself to come into operation. The [German Nuclear Waste Management Commission \(ESK\)](#), which advises the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on matters of nuclear waste management, refers in a discussion paper to interim storage periods of between 65 and 100 years.

The extension of interim storage now presents policy-makers and society with various challenges: technical, organisational and social.

Figure: The paths of radioactive waste

From nuclear power plant to repository: The paths of radioactive waste



SOURCE: ÖKO-INSTITUT, 2017

Source: Öko-Institut

Technical challenges: buildings, casks and infrastructure

Spent fuel elements from nuclear power plants generate intense heat; the same applies to vitrified waste from reprocessing. Science does not yet have a full understanding of the behaviour of casks and radioactive inventory during extended storage. Likewise, the cladding tubes which enclose the nuclear fuel may undergo changes as a result of the ageing process. This has implications for the safety of interim storage but also for subsequent permanent disposal, as it may limit the options for conditioning (processing) and packaging of waste.

The facility buildings, too, are not designed with extended interim storage in mind. Originally classed as having lower safety significance, they need to be upgraded to bring them into line with current standards. The infrastructure for extended interim storage facility operation must also be reviewed; one issue to be considered, for example, is how to ensure that there are opportunities to carry out essential repairs in future.

Germany’s interim storage facilities are subject to supervision and are regularly monitored. The resulting knowledge and experience, however, relate solely to accessible container areas and to infrastructure. With German input, international researchers are currently investigating potential ageing-related changes in the nuclear inventory, but no such research is being conducted in Germany itself. In its guidelines, the German Nuclear Waste Management Commission states that

additional and appropriate verification of the long-term behaviour of the casks and their inventory has to be provided for extended interim storage beyond 40 years, with due regard for facility-specific operating conditions.

### **Organisational challenges: disposal pathways, knowledge transfer and skills**

From an organisational perspective, extended interim storage means constantly rethinking the disposal pathway. Interim storage, transportation, conditioning and permanent disposal are all interlinked. Changes at any point can have a significant impact on subsequent stages in the waste management process. It should also be borne in mind that each stage is funded from the same source, i.e. the Nuclear Waste Disposal Fund (KENFO).

If interim storage is extended across several generations of industry employees, workable rules on the management and transfer of knowledge must be established. Adding to the complexity, know-how and “know-why” are currently shared among a range of stakeholders: energy supply companies, interim storage facility operators, supervisory and licensing authorities and technical experts. Any change in the allocation of responsibilities must be accompanied by a corresponding transfer of knowledge. It is extremely important that skills are maintained. Documentation must also be complete and must be available over the long term.

The number of stakeholders and their functions will change following the decommissioning and dismantling of Germany’s nuclear power plants. Precisely for that reason, a balanced approach must continue to apply in relation to the division of responsibilities for the monitoring system and opportunities for intervention between the operators, on the one hand, and the supervisory authorities, on the other.

### **Social challenges: dialogue, transparency and socioeconomics**

When it comes to interim storage, not everything runs smoothly: in Brunsbüttel, the licence for the interim storage facility was withdrawn by a court ruling; the approval of the interim storage facility in Jülich has expired and cannot be renewed; and in Lubmin, a new facility is required for high-level radioactive waste. Society is quite rightly asking: is interim storage of nuclear waste ever safe?

[Dialogue with the public](#) is an ongoing task, not only as regards the selection of a repository site but also in relation to interim storage issues. Safety is of great relevance to the public and must therefore be subject to regular – and demonstrable – verification. The longer the duration of interim storage, the more likely it is that a facility will start to be viewed as permanent.

In Germany, little research has been carried out thus far on social demands upon extended interim storage and on facilities’ socioeconomic impacts at the regional level. It is essential to close these knowledge gaps.

### **Interim storage is an interim solution**

The extension of interim storage poses challenges at various levels, whose interaction must also be considered. New licences will be required, based on new evidence. The Bundestag must turn its attention once again to the statutory regulation of these licences and the issues that it raises.

In light of these technical, organisational and social challenges, it is essential to specify a timeframe for the new licences for extended interim storage. The following principle should always be borne in

mind: “The storage of radioactive waste, including long-term storage, is an interim solution, but not an alternative to disposal.” (Euratom 2011/70)

Researchers from the Oeko-Institut work on various aspects of interim storage of radioactive waste and compile expert opinions, reports and studies on this topic.

## **Expert opinion on the safety aspects of interim storage of high-level radioactive waste**

The Oeko-Institut has produced a general review of the topic of interim storage of high-level radioactive waste on behalf of the National Support Body (NSB). This expert opinion is also aimed at the general public and therefore answers various basic questions relating to key aspects of safety.

The main topics are the current safety status of the interim storage facilities and its future development. The expert report also looks at prospects for interim storage beyond the licensed operating periods of the existing 16 interim storage facilities.

In the conclusions, the authors identify further aspects which may benefit from transparency and publicity, as provided by the National Support Body.

### [Gutachterliche Stellungnahme zu wichtigen sicherheitstechnischen Aspekten der Zwischenlagerung hoch radioaktiver Abfälle Revision 01](#)

Key safety aspects of interim storage of high-level radioactive waste, revised version 01]: Expert opinion by the Oeko-Institut for the German National Support Body (NSB)

## **Projects on new developments in longer-term interim storage**

Several of the Oeko-Institut’s research projects have studied the long-term impacts of interim storage. In cooperation with Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) and other project partners, Oeko-Institut researchers have investigated the possible effects of ageing on the various components that are important for the safety of the storage in order to identify relevant effects which may not have been adequately considered so far. Also as part of the study, the researchers provided proposals for improved ageing management and examined the question whether additional analyses or monitoring measures may be required.

As a further element of the project, the researchers studied national and international developments in non-technical ageing management, as extended interim storage periods create new safety management requirements. The project also considered to what extent there is scope to develop proposals on Germany’s future pathway in light of international experience.

The findings were presented at the GRS’ 2nd Workshop on Safety of Extended Dry Storage of Spent Nuclear Fuel, an international event held in 2018.

### [Organisational and management aspects in extended storage](#): Presentation by the Oeko-Institut

### [Sicherheitstechnische Aspekte der langfristigen Zwischenlagerung von bestrahlten Brennelementen und verglastem HAW](#)

[Safety aspects of long-term interim storage of irradiated fuel elements and vitrified HLW]: Study by the Oeko-Institut.

## Expert opinion on long-term interim storage of spent fuel elements and vitrified waste

On behalf of the German Commission on the Storage of High-Level Radioactive Waste, the Oeko-Institut and TÜV Nord jointly produced an expert opinion on the long-term interim storage of spent fuel elements and vitrified waste over a period of several hundred years.

They conclude that this type of long-term interim storage is a viable strategy in principle in the absence of a suitable repository in deep geological formations. However, this solution requires transparent decision-making and proper justification, since it shifts the responsibility for the nuclear legacy to future generations.

The expert opinion looks at technical and non-technical aspects, including legal requirements. It also considers various practical options: the continued use of existing sites and the construction of one or more new interim facilities, located either above-ground or underground near the surface.

### [Langzeitzwischenlagerung abgebrannter Brennelemente und verglaster Abfälle](#)

[Long-term interim storage of spent fuel elements and vitrified waste]: Study by the Oeko-Institut and TÜV Nord for the German Commission on the Storage of High-Level Radioactive Waste

## Further information

### [Verlängerte Zwischenlagerung im Spannungsfeld zwischen technischen Anforderungen und gesellschaftlichen Erwartungen](#)

[Extended interim storage in the field of tension between technical requirements and society's expectations]: Presentation at a workshop, organised by BGZ Gesellschaft für Zwischenlagerung mbH, in Berlin on 22-23 October 2019

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