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Environmental impact assessment for the life extension and uprating thermal power of Olkiluoto units 1 & 2

Project element: scoping

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE LIFE EXTENSION AND UPRATING THERMAL POWER OF OLKILUOTO UNITS 1 & 2

Project element: scoping

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REPORT
REP-0910

VIENNA 2024

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Title photograph © iStockphoto.com/imagestock

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Imprint

Owner and Editor: Umweltbundesamt GmbH
Spittelauer Laende 5, 1090 Vienna/Austria

This publication is only available in electronic format at https://www.umweltbundesamt.at/.

ISBN 978-3-99004-754-5

1 EXECUTIVE SUMMARY

Olkiluoto nuclear power plant is one of the two NPP in Finland, located in Eurajoki on the Finnish west coast. It houses 3 units, Olkiluoto 1&2 being boiling water reactors that entered operation in 1978 and 1980, and Unit 3, an EPR that started operation in 2023. Although Olkiluoto 1&2 are currently licenced to operate until 2038, the operator TVO, is considering possible options. Those include further extension of the lifetime for an additional 10 or even 20 years, as well as an additional increase of reactor power to 2750 MWth. TVO states that "extensive and demanding maintenance and improvement work has already been performed at the plant in earlier years". Building upon those, the power uprate might be implemented in combination with the next periodic safety review that is scheduled to take place in 2028.

The lifetime extension and the power uprate of Olkiluoto 1&2 require a licensing process, as defined in the Finnish regulation and an approval by STUK, Finland's nuclear regulatory authority. Furthermore, to extent the operating life, an environmental impact assessment is required per EU Directive 2014/52/EU and the Espoo Convention. As a preparation for the future EIA, TVO developed the "Environmental impact assessment Programme", which presents the envisaged scope and the methodology for the future EIA report. Per EU Directive and the Espoo Convention, potentially affected parties have a right to participate in the EIA process.

Being a potentially affected party by a transboundary radiological release in a case of an accident at Olkiluoto 1&2, Austria has an interest to participate in the EIA procedure. In this respect, the Austrian Environment Agency engaged an expert team of ENCO to assess the Olkiluoto 1&2 EIA programme, to assure that the EIA report would provide information and insights to enable a critical assessment of a possible impact on the population and environment in Austria. The expert team addressed procedural aspects of the EIA, looked into proposed alternatives, scrutinised the consideration of lifetime extension to 70 or 80 years as well as effects of power uprate to 970 MWe. Of highest interest to Austria are accidents including those caused by external events to lead to a transboundary impact that might affect Austrian territory.

The EIA programme as presented will assure that the EIA report fulfils the requirements of the applicable Conventions and the EU Directives. It will allow Austria to receive the documents and assess those in order to determine possible impact on the environment and population. Nevertheless, from Austrian perspective, the EIA programme provides too little emphasis on measures to assure safety of long term operation and the assessment of transboundary impact as compared to very detailed requirements for a local environmental impact.

The EIA programme proposes three different alternatives for the Olkiluoto 1&2. Those include the "zero" alternative, with units operating at the currently-licensed power level and being decommissioned after expiry of the operating licence in 2038. Then there are 2 lifetime extension alternatives, one to 70 and another to 80 years of operation, as well as a power uprate alternative, to be implemented already in 2028. From Austrian perspective, extending the operation of Olkiluoto 1&2 for 10 or 20 years add to a cumulative probability of an accident leading to a transboundary impact. Increased power level leads to a (linear) increase of source term. Remaining safety margins as well as any safety modifications/improvements to be introduced needs to be detailed in the EIA report.

Extending the lifetime beyond 60 years would make Olkiluoto 1&2 the first Gen II plants in Europe with such a long operating life. This puts a question to the required safety level, whether those units could be at or very close to the safety requirements that are in place for advanced GIII+ designs. On the structures, systems and components level, the overall ageing management concept and its implementation as well as challenges due to obsolesce and potentially needed redesigns might be formidable. How would the 80 years old Olkiluoto 1 and 2 compare with plants that are built to new safety regulations and how ageing challenges will be addressed without jeopardising safety margins needs to be thoroughly discussed in the EIA.

Considering the previous power uprates and the one proposed as an alternative now, the reactor power will be 37,5 % higher than the original design. The cumulative effect on the structures and equipment needs to be carefully studied to assure that adequate safety margins remain in place. The EIA report needs to clearly present and fully document the impact of the power uprate on the safety of Olkiluoto 1&2.

External hazards, both natural and man made are the highest challenges for nuclear safety. Long operating life for Olkiluoto 1&2, coupled with accelerated climate change and related phenomena needs to be scrutinised. The spectrum of man induced threats, including aircraft impact, potential terrorist attack, and even threat of military which was unthinkable before the Russian war in Ukraine all need to be properly analysed. Cumulative impact of 3 units on Olkiluoto site, with possible interferences and their effects are required to be assessed in the EIA report.

The transboundary impact of potential accidental releases for Olkiluoto 1&2, supported by dedicated dispersion analysis is to be addressed in the EIA report, including the fallout and radiation doses to the population. However, the Finnish regulation defines a maximal source term of 100 TBq of Cs 137 and prescribes that the impact is to be assessed for distances of up to 1000 km. New considerations of the severe accidents are leading to the fact that the actual releases might be (significantly) higher than 100 TBq. Also, the impact in terms of the deposition in areas that are further than 1000 km from Olkiluoto site cannot be neglected, in particular in case of specific weather patterns. This has been proven in the analysis within the Flexrisk project. To enable an assessment of potential impact on Austrian territory, the EIA report needs to provide a detailed description of severe accident scenarios and respective sequences leading to radiological releases, and the resulting source term. Further, the dispersion modelling, to include areas beyond 1000 km distance and covering a range of weather needs to be addressed in the EIA report.

2 ZUSAMMENFASSUNG

Das Kernkraftwerk Olkiluoto ist eines der beiden Kernkraftwerke Finnlands und liegt in Eurajoki an der finnischen Westküste. Es umfasst drei Blöcke: Olkiluoto 1 und 2 sind Siedewasserreaktoren, die 1978 und 1980 in Betrieb genommen wurden, und Block 3, ein EPR, der 2023 den Betrieb aufnahm. Obwohl Olkiluoto 1 und 2 derzeit für den Betrieb bis 2038 lizenziert sind, erwägt der Betreiber TVO mögliche Optionen. Dazu gehören eine weitere Verlängerung der Lebensdauer um weitere 10 oder sogar 20 Jahre sowie eine weitere Erhöhung der Reaktorleistung auf 2750 MWth. TVO gibt an, dass „bereits in früheren Jahren umfangreiche und anspruchsvolle Wartungs- und Verbesserungsarbeiten an der Anlage durchgeführt wurden“. Darauf aufbauend könnte die Leistungssteigerung in Kombination mit der nächsten regelmäßigen Sicherheitsüberprüfung umgesetzt werden, die für 2028 geplant ist.

Die Verlängerung der Lebensdauer und die Leistungssteigerung von Olkiluoto 1&2 erfordern ein Lizenzierungsverfahren gemäß der finnischen Verordnung und eine Genehmigung durch STUK, Finnlands Nuklearregulierungsbehörde. Darüber hinaus ist zur Verlängerung der Betriebsdauer eine Umweltverträglichkeitsprüfung gemäß EU-Richtlinie 2014/52/EU und Espoo Konvention erforderlich. Als Vorbereitung für die zukünftige UVP hat TVO das “Environmental impact assessment Programme” entwickelt, das den geplanten Umfang und die Methodik für den zukünftige UVP-Bericht darstellt. Gemäß der EU-Richtlinie und der Espoo Konvention haben potenziell betroffene Parteien das Recht, am UVP-Verfahren teilzunehmen.

Als potenziell betroffene Partei einer grenzüberschreitenden radiologischen Freisetzung im Falle eines Unfalls in Olkiluoto 1&2 hat Österreich ein Interesse daran, am UVP-Verfahren teilzunehmen. In diesem Zusammenhang beauftragte das Österreichische Umweltbundesamt ein Expertenteam von ENCO mit der Bewertung des UVP-Programm Olkiluoto 1&2, um sicherzustellen, dass der UVP-Bericht Informationen und Erkenntnisse liefert, die eine kritische Bewertung möglicher Auswirkungen auf die Bevölkerung und die Umwelt in Österreich ermöglichen. Das Expertenteam befasste sich mit verfahrenstechnischen Aspekten der UVP, untersuchte vorgeschlagene Alternativen, prüfte die Erwägung einer Lebensdauerverlängerung auf 70 oder 80 Jahre sowie die Auswirkungen einer Leistungssteigerung auf 970 MWe. Von größtem Interesse für Österreich sind Unfälle, auch solche, die durch äußere Ereignisse verursacht werden und grenzüberschreitende Auswirkungen haben, die das österreichische Staatsgebiet beeinträchtigen könnten.

Das vorgestellte UVP-Programm stellt sicher, dass der UVP-Bericht die Anforderungen der geltenden Übereinkommen und EU-Richtlinien erfüllt. Dies ermöglicht es Österreich, die Unterlagen zu erhalten und diese zu bewerten, um mögliche Auswirkungen auf die Umwelt und die Bevölkerung zu ermitteln. Dennoch legt das UVP-Programm aus österreichischer Sicht einen zu geringen Schwerpunkt auf Maßnahmen zur Gewährleistung der Sicherheit des langfristigen Betriebs und auf die Bewertung grenzüberschreitender Auswirkungen im Vergleich zu sehr detaillierten Anforderungen für eine lokale Umweltauswirkung.

Das EIA-Programm schlägt drei verschiedene Alternativen für Olkiluoto 1&2 vor. Dazu gehört die „Null"-Alternative, bei der die Einheiten mit der aktuell lizenzierten Leistung betrieben werden und nach Ablauf der Betriebsgenehmigung im Jahr 2038 außer Betrieb genommen werden. Dann gibt es zwei Alternativen zur Lebensdauerverlängerung, eine auf 70 und eine andere auf 80 Betriebsjahre sowie eine Alternative zur Leistungssteigerung, die bereits im Jahr 2028 umgesetzt werden soll. Aus österreichischer Sicht erhöht die Verlängerung des Betriebs von Olkiluoto 1&2 um 10 oder 20 Jahre die kumulative Wahrscheinlichkeit eines Unfalls mit grenzüberschreitenden Auswirkungen. Ein erhöhter Leistungslevel führt zu einem (linearen) Anstieg des Quellterms. Die verbleibenden Sicherheitsmargen sowie alle einzuführenden Sicherheitsänderungen/-verbesserungen müssen im UVP-Bericht detailliert beschrieben werden.

Eine Verlängerung der Lebensdauer auf über 60 Jahre würde Olkiluoto 1&2 zu den ersten Gen-II-Anlagen in Europa mit einer so langen Betriebsdauer machen. Dies wirft die Frage nach dem erforderlichen Sicherheitsniveau auf, ob diese Einheiten den Sicherheitsanforderungen für fortgeschrittene GIII+-Designs entsprechen oder diesen zumindest sehr nahekommen könnten. Auf der Ebene der Strukturen, Systeme und Komponenten können das Gesamtkonzept des Alterungsmanagements und seine Umsetzung sowie die Herausforderungen aufgrund der Obsoleszenz und möglicherweise erforderlichen Neugestaltungen gewaltig sein. Die Frage, wie die 80 Jahre alten Anlagen Olkiluoto 1 und 2 mit Anlagen verglichen werden können, die nach neuen Sicherheitsvorschriften gebaut wurden, und wie den Herausforderungen der Alterung begegnet werden kann, ohne die Sicherheitsmargen zu gefährden, muss in der UVP ausführlich erörtert werden.

Unter Berücksichtigung der bisherigen Leistungssteigerungen und der jetzt als Alternative vorgeschlagenen Leistungssteigerung wird die Reaktorleistung 37,5 % höher sein als bei der ursprünglichen Auslegung. Die kumulativen Auswirkungen auf die Strukturen und die Ausrüstung müssen sorgfältig untersucht werden, um sicherzustellen, dass ausreichende Sicherheitsmargen bestehen bleiben. Der UVP-Bericht muss die Auswirkungen der Leistungssteigerung auf die Sicherheit von Olkiluoto 1&2 klar darlegen und vollständig dokumentieren.

Äußere Gefahren, sowohl natürliche als auch vom Menschen verursachte, sind die größten Herausforderungen für die nukleare Sicherheit. Die lange Betriebsdauer von Olkiluoto 1&2 in Verbindung mit dem beschleunigten Klimawandel und damit verbundenen Phänomenen muss untersucht werden. Das Spektrum der vom Menschen verursachten Bedrohungen, darunter die Auswirkung von Flugzeugabstürzen, potenzielle Terroranschläge und sogar die Gefahr eines militärischen Angriffs, der vor dem russischen Krieg in der Ukraine undenkbar war, muss ordnungsgemäß analysiert werden. Die kumulativen Auswirkungen von drei Blöcken am Standort Olkiluoto sowie mögliche Beeinträchtigungen und deren Auswirkungen müssen im UVP-Bericht bewertet werden.

Die grenzüberschreitenden Auswirkungen möglicher unfallbedingter Freisetzungen von Olkiluoto 1 und 2, unterstützt durch eine spezielle Ausbreitungsanalyse, sollen im UVP-Bericht berücksichtigt werden, einschließlich der Strahlendosen für die Bevölkerung. Allerdings definiert die finnische Verordnung einen maximalen Quellterm von 100 TBq von Cs 137 und schreibt vor, dass die Auswirkungen für Entfernungen von bis zu 1000 km zu bewerten sind. Neue Überlegungen zu schweren Unfällen führen dazu, dass die tatsächlichen Freisetzungen (deutlich) über 100 TBq liegen könnten. Auch die Auswirkungen in Bezug auf die Deposition in Gebieten, die weiter als 1000 km vom Standort Olkiluoto entfernt sind, können nicht vernachlässigt werden, insbesondere im Fall spezifischer Wetterbedingungen. Dies wurde in der Analyse im Rahmen des Flexrisk-Projekts nachgewiesen. Um eine Abschätzung möglicher Auswirkungen auf das österreichische Staatsgebiet zu ermöglichen, muss der UVP-Berichteine detaillierte Beschreibung der schweren Unfallszenarien und der jeweiligen Abläufe, die zu radiologischen Freisetzungen führen, sowie den daraus resultierenden Quellterm liefern. Darüber hinaus muss die Ausbreitungsmodellierung, die Gebiete über 1000 km Entfernung und eine Reihe von Wetterbedingungen abdeckt, im UVP-Bericht behandelt werden.

CONTENTS

3 INTRODUCTION AND OVERVIEW

The Teollisuuden Voima Oyj (TVO) is the Finnish operator of nuclear power plants, owner of the three units of the Olkiluoto plant located at the community of Eurajoki on the Finnish west coast. Units 1 and 2 are boiling water reactors that entered operation in 1978 and 1980, respectively. The third unit on the site, O3 is an EPR reactor that was commissioned in 2023. O1 and O2 are well operated plants, that is confirmed by a high availability (capacity factor of 93 to 97%) and generally low number of operational events.

The original design lifetime of the O1 and O2 was set to 40 years, which expired in 2018. Even before reaching the end of the design life, the licensed lifetime was extended to 60 years, meaning that the current license to operate the plant will expire in 2038. For the initial lifetime extension, an EIA has not been developed, which would have assessed an impact on the environment including the transboundary impact.

In addition to the life extension, units O1 and O2 were subject to a power increase that occurred in phases. The initial power uprate (increase) from the original 660 MWe to 710 MWe was implemented in 1984, and then to 840 MWe in 1998. Those two power increases were achieved by raising the power of the reactor, from the original power level of 2000 MWth to the current power level of 2500 MWth. In the period 2005-6 and then 2010-12, the improvement of the turbine and related systems added to the efficiency of the plant, increasing the effective power level to 890 MWe per unit.

Recognising a continuous need for energy production, the operator of Olkiluoto units TVO is considering its options for the units O1 and O2. The options considered are a further extension of the lifetime of the units for an additional 10 or even 20 years, as well as an additional increase of reactor power (to 2750 MWth) and a resulting increase of the power level to 970 MWe. TVO states that "*extensive and demanding maintenance and improvement work has already been performed at the plant in earlier years*". Building upon those, the power uprate might be implemented in combination with the next period safety review that is scheduled to take place in 2028.

A further lifetime extension of units OL1 and OL2 as well as an additional envisaged power uprate require a thorough licensing process, as defined in the Finnish regulation and as controlled by STUK, Finland's nuclear regulatory authority. In order for the permission to operate beyond 2038, an environmental impact assessment is needed in accordance with the EU directive 2014/52/EU and the Espoo Convention. In order to prepare for the EIA report, TVO prepared the environmental impact assessment programme (draft Scoping Document), dated January 2024. It presents the concept and possible alternatives and discusses the assessments that needs to be undertaken. The EIA programme discusses the alternatives that are being considered, the implementation schedule and interactions with other activities. Further, the EIA programme presents the process and stages to be attained within the EIA, including, what is interesting from the Austrian perspective, possibilities for international participation. The EIA Programme depicts the current state of the environment, defines impacts to be assessed in about 20 specific areas and associated methods to be used for each of the areas. The EIA programme lists the uncertainty factors for the analysis, addresses the prevention and mitigation of harmful acts and summarises the project license and pending processes under the Finnish regulation.

The EIA programme is well developed and follows the same structure and impact areas being assessed as seen lately in the other cases where the EIA has been developed for NPP life extensions, like e.g., for the Loviisa plant in Finland. The general information that is expected to be presented in the Scoping phase (i.e., the presentation of the EIA programme) is well covered and is in line with the applicable regulations and international requirements.

Being a potentially affected party in a case of a radiological release from the Olkiluoto plant, Austria has an interest to participate in the EIA procedure. In this respect, the Environment Agency engaged an expert team of ENCO to assess the EIA programme. The team prepared an expert statement in relation with the proposed programme and its scope, with emphasis on the areas that might be of relevance for aspects of nuclear safety and the radiological impact on Austria, in case of abnormal operation of the plants.

The aim of Austrian assessment of the EIA Programme for Olkiluoto 1 and 2 lifetime extension is to list required information and analysis to be undertaken and documented in the EIA Report to be prepared at next stage of the EIA procedure. In this, the emphasis is to be able to critically assess a possible impact on the population and environment in Austria, with the specific goal to minimise or even eliminate any possible adverse impact on Austria that might occur due to the implementation of planned activities.

4 PROCEDURAL ASPECTS OF THE EIA

Treatment in the EIA programme

The procedural aspects of the EIA are defined in the Espoo and Aarhus Conventions, of which all EU member states are signatories. Furthermore, in the EU, the EU Directive 2011/92/EU is establishing the requirements and the procedural steps. Especially relevant for the nuclear plants and their lifetime extension, the "Commission Notice regarding application of the Environmental Impact Assessment Directive (Directive 2011/92/EU of the European Parliament and of the Council, as amended by Directive 2014/52/EU) to changes and extension of projects - Annex I.24 and Annex II.13(a)" defines main requirements and principles that are to be fulfilled by the environmental impact assessment programme.

Furthermore, the "Guidance on the applicability of the (Espoo) Convention to the lifetime extension of nuclear power plants" is applicable.

The EIA programme for the Olkiluoto 1&2 lifetime extension reflects on the regulatory documents and other requirements for the activities that are to be implemented.

Discussion

The EIA programme provides the overall information on the procedures to be followed in the EIA process as well as in the specific discussions on the international level to take place once the EIA report is presented. Those are in line with the requirements of the Conventions and with applicable EU Directives and will allow Austria to receive the documents and assess those in order to determine possible impact on the environment and population.

Conclusions and requirements for the EIA Report

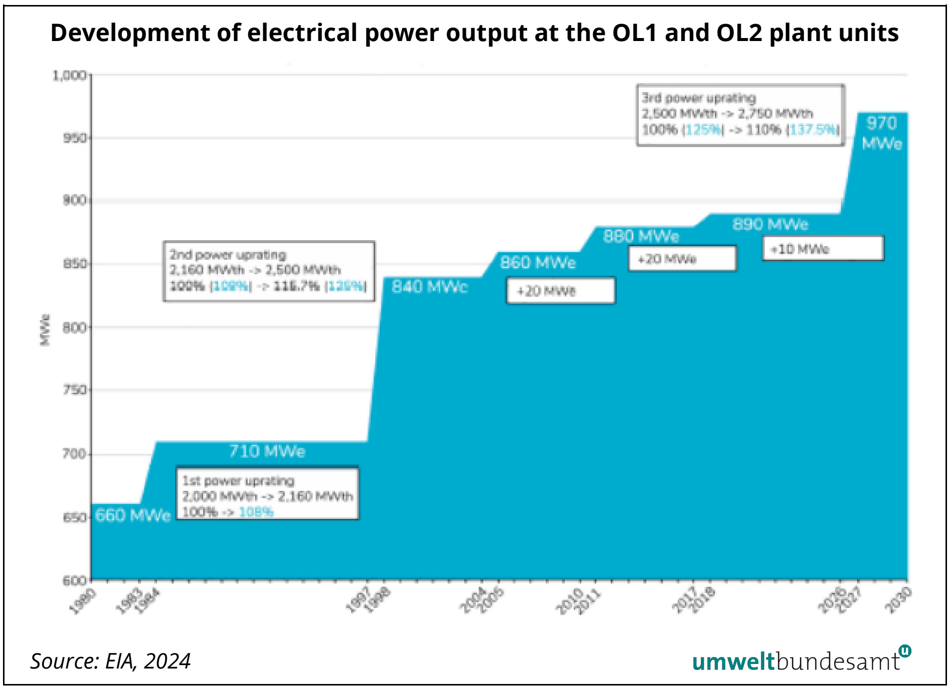
The development of the EIA report and the communication, as presented in the EIA programme is from the Austrian perspective acceptable. Nevertheless, from Austrian perspective the descriptions in particular related with the expected activities to assure safety level of Olkiluoto units 1 and 2 throughout extended period of operation as well as on the higher power level are insufficient, even considering that the reviewed document is only the EIA programme. The same applies for the descriptions/justification of the transboundary impact. This is a strong contract to a high level of details in description of the local environmental impact.

5 ALTERNATIVES

Treatment in the EIA programme

The Olkiluoto units 1 and 2 are Boiling Water Reactors (BWR) designed by ASEA ATOM of Sweden. Construction of the units started in the mid-1970ties and the units were commissioned in 1978 and 1980, for units 1 and 2 respectively. The units are an early 2nd generation of nuclear power plants built in accordance with the prevailing regulation of that time.

Figure 1: Power upratings at Olkiluoto's OL1 and OL2 units



Each unit was originally designed with a thermal power of the reactor of 2000 MWth and an electricity output of 660 MWe. The power of the reactor was upgraded in two stages, initially in 1984 to 2160 MWth and then between 1994 and 1998 to 2500 MWth, resulting in an electric output of 840 MWe. It has to be noted that an increase in power output on the BWR type reactors is easier to achieve than for the PWR and many BWR's internationally have increased power significantly. The electricity output of the units was further increased in 3 stages in the years 2005-6 and 2010-12 for an additional 50 MWe, by increasing efficiency of the turbine. Since the last power uprate, both units operate at 890 MWe nominal power.

The original design life of the Olkiluoto units was 40 years, in line with other Gen II units that were constructed around the same time, envisaging the end of the lifetime in 2018 and 2020. In 2011 the technical assessments and justification needed for the extension of the lifetime until 2038 were undertaken. The lifetime extension licence was applied for and finally granted by the Finnish government in 2018, allowing the units to operate until 2038.

The extension of the lifetime of Olkiluoto 1 and 2 until 2058 would correspond to the operating lifetime of 80 years. The lifetime extension for 20 years beyond already licenced 60 years, i.e., a design life of up to 80 years has been considered by other units, mainly in the US, where several such a requests are being prepared. In Europe, the lifetime extension beyond 60 years is now being considered for e.g., Borssele in the Netherlands and Beznau in Switzerland, though decisions have not yet been taken. Respective analyses have not been performed nor the application for such has been submitted for Borssele and Beznau. Therefore, Olkiluoto units 1 and 2 would therefore be the first European plants to ask for such a lifetime extension and also the first BWRs in the EU to consider such a long operating life, possibly also with relatively high power increase.

In order to allow for the lifetime extension for 70 or even 80 years (depending on the variant chosen) Olkiluoto units 1&2 need to undertake extensive analysis as well as specific inspection and testing to ascertain that the plant safety level could be maintained for the extended lifetime. Furthermore, as experienced other lifetime extensions, some specific (e.g. one -time) inspection on critical structures or components might be necessary, along with the likely change/replacement of some of the equipment. Only upon all of those being completed and submitted to the Finnish nuclear regulator, it might be expected that the regulator would issue a permission (licence) for the extended operation. The EIA programme document indicates that some of the analysis are already on going, but does not provide any details as to what those are or which parts of the overall programme of analysis and inspections are at present being worked at.

The final EIA programme shall therefore establish formal requirements on the information to be provided in the EIA related with the analyses and inspection programme. It shall further specify which elements of these has already been accomplished and which are still to be implemented, including a timeline when each of those activities are expected to be completed.

The EIA programme examines 3 different alternatives that are expected to be addressed in the EIA process:

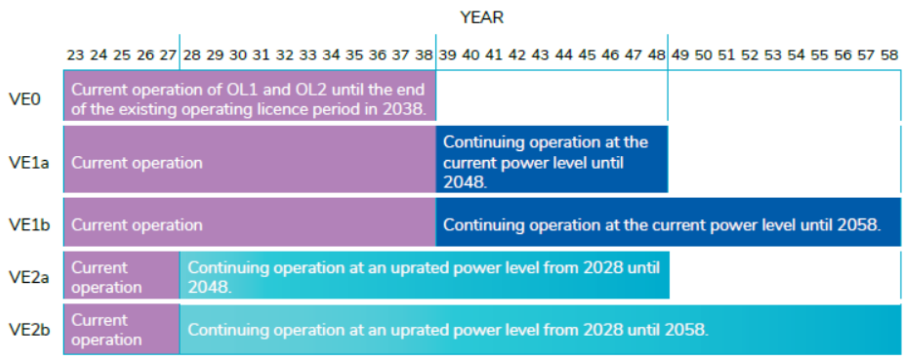
The **ZERO alternative**, within which the O1 and O2 units are to be shut down in 2038, after 60 years of operation, on the date of the expiry of the current license

The **life extension alternative**, with two options, one with 10 years extension (i.e., until 2048) and another with 20 years extension (i.e., until 2058) so an operating lifetime of 70 and 80 years respectively.

The **power uprate alternative**, from the current 2500 MWth reactor power level and 890 MWe electricity generation to a 2750 MWth reactor power level and 970 MWe electricity generation.

For the variants with life extension and power uprate there are different possibilities, VE1 being extending the lifetime at the current power level, and then variant A and B denoting the extension of the lifetime for 10 or 20 years respectively. The variant with a power uprate, VE2 envisages the implementation of the power uprate activities to take place already in 2028, coinciding with the next periodic safety review (PSR) which is required to be undertaken by that time. As in the previous one, there are the alternatives A and B, denoting the life extension until 2048 and 2058 respectively.

Figure 2: Alternatives examined in the EIA procedure and their preliminary planned schedule



Source: EIA, 2024

Discussion

While the concept for different alternatives are clearly described and graphically depicted in a very clear and understandable way (as represented in the Graphic No. 2), the EIA programme document provides very little information in relation to what each of the alternatives would entail in the terms of technical requirements, eventually needed modernisation, improvements or changes of the design or the acceptance of the regulator.

In terms of the impact on the immediate environment of the operation up to 2038, as licensed now, the impact is as expected/predicted. It has to be noted that there was no EIA undertaken for the initial lifetime extension for the Olkiluoto units 1&2. In terms of the transboundary impact and eventual impact on Austria the EIA programme does not say anything but indicate that the impact will be assessed, with a fixed source term and up to distances of 1000 km from Olkiluoto site. Nevertheless a potential impact on Austria could be seen from the estimates by the Flex risk project[1], where in a case of a maximum release and specific western pattern (North west weather, which is not that unusual) a ground deposition above the initial Austrian intervention level (or 750 Bq/m2) might occur.

In terms of the environmental impact, the Table 2 in the EIA programme summarises all of the environmental impacts that are to be examined, together with the methodologies to be deployed in the analyses as well as the area of the re-

[1] FLEXRISK (2013): The Project „flexRISK“: Flexible Tools for Assessment of Nuclear Risk in Europe; http://flexrisk.boku.ac.at/en/projekt.html

view (i.e. Distance from the plant). Nevertheless, as discussed later in in this report, in terms of "joint impact" (meaning all three units that are now in operation at the Olkiluoto site), the areas affected is limited to the surroundings, effectively excluding a transboundary impact in a case of an event affecting all three units. Furthermore, there is no information on the methodology for the transboundary impact, except that "the assessment would be based on separate analyses and modelling".

In case of a power uprate, there would naturally be a larger amount of heat to be transferred into the environment. In terms of radioactive releases, naturally, a higher power level will lead to somewhat higher operational releases. Nevertheless, the operational releases are limited by the plant's operational Technical Specification. The release records shows that Olkiluoto 1 and 2 releases are well under the maximum that is allowed per Technical Specification. The increase of power which would lead to somewhat higher releases is expected to remain within the technical specification limits.

The situation is a bit different in the terms of releases in accidents and in particular in severe accidents. In a case of an environmental release caused by a severe accident, as there is a higher power of the core, for the same sequences it might be expected to lead to a proportionally higher source term. Another important consideration is the capability of the system and structures that are designed to prevent radioactive release, i.e how would a higher power level (cumulative almost 40% higher than the design power) reflect on the containment, whether there would be (significant) reduction of safety margins. Those aspects need to be assessed in detail and described in the EIA report.

As a higher thermal power of the core would eventually lead to a higher amount of radioactivity being released, meaning that with the same weather patterns, such might lead to a higher impact e.g., ground deposition in Austria.

The reviewer does recognise that the issue of "10%" higher source term is somewhat theoretical. While the increase in the source term is real, i.e. there will be more radioactive materials (all isotopes) to be potentially released, in the terms of transboundary impact, this change might be smallish in comparison with the uncertainties that are related with accident progression (which directly impacts the source terms) as well as with dispersion modelling (weather dependent). Those uncertainties are easily an order of magnitude higher than the impact of the power increase. Still with all things being equal, higher reactor power would lead to higher impact. Therefore a thorough analysis, in particular addressing possible "cliff edge" effects related with e.g. containment that might lead to a significant increase of severity of critical severe accident sequences needs to be addressed in the EIA report.

When considering that Oliklouto 1&2 units would operate for 20 more years as compared to be shut down in 2038, with all other things being equal this clearly add to a cumulative probability of an accident leading to as well as to the effects of a transboundary impact due to a power increase. Furthermore, even considering that all of the analyses would show there are remaining margins for safety available, given ageing in the course of longer operation and given the higher power and thus energy content of the reactor core, cumulative potential impact might be (visibly) higher. This is an important consideration to be addressed in the EIA.

The impact of the lifetime extension is also relevant for the generation of radioactive waste, where both longer operating lifetime and higher power level will lead to an increase in the generation of LILW as well as to a more pronounced increase of the total amount of spent fuel. It is nevertheless recognised that the storage/disposal capacity for the LILW at Olkiluoto site is available (or will be available when needed) and that the the Posiva SNF geological disposal facility is expected to have a full operational licence issued soon. Nevertheless, with the extension of the lifetime of Olkiluoto an extension of the capacity of Posiva is also required.

Further to a complete lack of any technical details (also discussed later in this report) that would be establishing a basis for the decision making on the lifetime extension by 10 or 20 years, as well as for a possible power uprate, there is no information how and on what basis the choice between the alternatives would be made. Considering that TVO was publicly saying that it might consider alternatives, e.g. the construction of a 4th unit at the Olkiluoto site, but possibly other sources of electricity, those being alternative nuclear (SMR?) or even non-nuclear, the issue of possible alternatives, the decision making related with choosing one over another as well as the impacts of each needs to be thoroughly addressed in the EIA report.

Requirements for the EIA Report

1. For each of the alternative, the EIA report shall provide the detailed discussion on the technical basis, the safety assessment, the impact assessments as well as the basis and criteria that is being used to evaluate the alternatives that are being considered
2. Alternatives like new NPPs or non-nuclear electricity sources are also to be considered as an option

The EIA should provide the technical description of the plant as it is and as expected for each alternative including the information on requirements for safety.

6 LIFETIME EXTENSION TO 70/80 YEARS

Treatment in the EIA programme

The Olkiluoto 1&2 units are designed and constructed in accordance with the regulations and design criteria that were in place in the 1970's. At that time the lifetime of a nuclear plant (and this was so for most of the Gen II nuclear plants in the western world) was set to 40 years, with some additional limitations, e.g. the "transient budget" for critical components and structures, etc. The 40 years lifetime had (some) technical basis in the projection of ageing of specific components but also with a consideration at that time that after about 40 years the plants would likely be replaced by new modern ones. Recognising that the degradation/wear of the components and structures at nuclear plants is slower than it was expected and/or that much of the equipment could be replaced, the operators of NPPs started to consider the extension of the lifetime. The extension to 60 years is now the norm for the western design plants and most of the NPPs in operation have been or are currently subject to the assessment that would allow them to operate up to 60 years.

In 2011 Olkiluoto units have been evaluated, and various activities including inspections took place to enable the units to extent their lifetime for 20 years (beyond 40 years design life). In 2018 a licence to extend the lifetime for 20 years was granted by the Finnish Government.

Unlike a lifetime of 60 years, a licence extension to 70 or 80 years is still a novelty. In Europe, none of the plants have applied for, nor obtained, the extension of the lifetime beyond 60 years.

The EIA programme document does not establish any relevant details as to what the life extension from the current 60 to a future 70 to 80 years would entail. The discussion is limited to a high-level statement indicating that the facility and its equipment need to fulfil regulatory requirements. Furthermore, the EIA programme states that for the lifetime extension to 70 or 80 years, the status of equipment and structures and operational capabilities needs to be assessed. This might be implemented by an ageing management programme, which needs to be in place and implemented before 2038, when the current license is expiring. This might lead to the replacement of some equipment and/or requalification of the equipment that is to remain until the end of the lifetime. The EIA programme mentioned that for the extended lifetime, the basic nuclear safety principles that are now applicable will be observed. This is nevertheless somewhat a challenge to comprehend in particular for the wider audience (e.g. population in Austria), given that it is not explained how the Olkiluoto units 1 and 2 would be upgraded to be compliant with the nuclear safety principles of today.

The EIA programme indicate that any improvement work needed to extend the lifetime of the Olkiluoto units would be performed "inside" the plant and no additional construction would be needed. Similarly, there are no expectations for changes in the operation as compared with the current status. The only impact (mentioned when discussing the alternatives) would be an increase of the amount of spent nuclear fuel and a relatively small increase in the LILW generated by the plant. Both of those are said not to be a problem because of already available SNF and waste storage/disposal facilities at the Olkiluoto site.

Discussion

The experience accumulated in the operation of Gen II plants internationally has shown that there might be a way to extend the lifetime of nuclear plants beyond 60 years, i.e., to 80 years. No NPP in Europe obtained a lifetime extension to 80 years.

The EIA programme does not provide any details in terms of the regulatory requirements for such a lifetime extension in Finland.

There are two issues related with the regulatory aspect of lifetime extension. One is that the need to establish the requirements that will assure that the adequate safety justifications are in place so that the plant could operate safely, with all available equipment being fit for intended function until the last day of licensed operation.

Another issue is the general safety level for the operation of a plant that (will be) 80 years old. In general, the current safety requirements are (much) more demanding than those that have been in place when the Olkiluoto units 1&2 have been designed and constructed in nineteen seventies. The safety requirements for nuclear reactors today establish a much stricter criteria as to what is acceptable related with severe accidents that might lead to offsite releases. From the perspective of Austria, severe accidents, leading to off-site releases and transboundary impacts are the most important issues to be addressed. Simply assuring that a safety of the plant remained "as designed" until the end of 70 or 80 years of lifetime is not enough. When a plant is in operation for 80 years, all measures has to be taken to assure that this plant is of a safety level that is comparable to plants that are built to current safety requirements and standards.

Therefore, if a nuclear plant is to remain in operation for 80 years after it has been originally licensed, it is obviously that the safety requirements for it are at, or close to, the level that would be required for new reactors, i.e., Generation II or even GEN III+. In the EIA programme there are neither indicators whether the Finnish regulatory requirements would establish such high, demanding safety criteria, nor whether the Olkiluoto 1&2 units would be able to fulfil those.

Furthermore, during the extended lifetime of 20 years, meaning that the units would remain operational up to 2058, expected changes in the environment could have negative impact on both safety and operation. While the discussion in the EIA programme indicates that the impact from external events (sea level rise, flooding, seismic) is not expected to change, given the increasing velocity of the climate change that might not be true anymore for such a long extension of the lifetime. The most recent scientific assessments are predicting not just more extreme and more frequent severe weather but other issues that would negatively impact the operation of the plant, like increase temperature of the sea water, increased organic material in the water etc. All of those, taking into the account the critical changes of parameters need to be carefully assessed when considering the extension of the lifetime until 2048 or even longer to 2058.

Obviously, any lifetime extension for Olkiluoto would need to comply with the regulatory requirements as issued by STUK at the time of the application for life extension. Complying with the regulatory requirements might include major changes and safety upgrades, possibly way above those that are mentioned in the EIA programme document. Beyond mentioning the diesel driven injection system to be built to serve both units, the EIA programme does not offer any indication what those possible modifications might be and how those would be fulfilled – or indeed whether it would feasibly be achieving the level of safety that is expected from nuclear plants that would be operational in 2058. Nevertheless, all these questions needs to be fully addressed in the EIA report, to enable the assessment as to what impact to the environment (including, most critically for Austria, impact in case of severe accidents) might be caused by the lifetime extension.

The lifetime extension and required safety level of units to operate in 2058 need to be put into the perspective of e.g. new Gen III units or those that might be licensed in the near future. The Olkiluoto Unit 3 is an EPR, which complies with the advances design requirement like EUR document or WENRA Safey objectives for new reactors. How would the 80 years old Olkiluoto 1 and 2 compare with plants that are built to newer regulations needs to be thoroughly discussed in the EIA. At least the EIA needs to provide a fully justified discussion as to how would the Olkiluoto units 1&2, with extended lifetime and increased power level, fulfil the WENRA objectives for new reactors- which are to be operated at that time. It is not acceptable that the Olkiluoto units remain in operation with their safety level (and margins) being only compliant with the standards and criteria to which those were originally designed. The EIA report needs to thoroughly address this issue and offer the assurance of compliance with new safety requirements and applied to contemporary NPPs.

Even if the equipment is well maintained, some equipment (and possibly structures as well, also the cabling, etc.) would be coming to the end of their useful lifetime, no longer assuring the safety functions those are designated to. There would be equipment that, due to ageing processes, might no longer be fit for purpose. Such equipment would need to be replaced. However, due to obsolesce, there is an increased challenge that specific pieces of equipment or spare parts would not be available. In such cases, a redesign with dedicated analysis (including safety analysis) would be necessary as the replacement would not anymore be like-for-like. This would require possibly selection of different equipment, redesign of systems and structures, detailed safety assessments/justification to be performed, and appropriate regulatory approval through the licensing process.

All of these are raising challenges, which are increasingly complex as the lifetime is extended further. The discussion as to how the operator TVO will be dealing with obsolescence and related challenges shall be included in the EIA report.

Requirements for the EIA Report

Regarding the ageing management programme, the following issues should be presented in the EIA Report – related for each of the envisaged variants:

1. The concept of how the operator TVO would deal with the technical ageing management challenges, including the listing of activities to be undertaken needs to be explained;
2. Plans for dealing with (increased) obsolesce of equipment for 80 years of operation;
3. The EIA Report should detail design changes that are necessary to enable the lifetime extension;
4. The approach for the fulfilment of the regulatory requirements set by STUK for the lifetime extension beyond 60 years is to be presented;
5. The action plan for the implementation of the analysis for the PSR, which is relevant for the lifetime extension to 70/80 years;
6. The remaining issues and remedial measures should be explained;
7. The EIA report shall address the concept how the safety level for lifetime extension assures that the Olkiluoto units 1 and 2 are reaching (to be judged against) the safety objectives set for new reactors;
8. Numerical values in terms of the CDF, LERF and /or other available metrics should be provided.

7 POWER UPRATE TO 970 MWE

Treatment in the EIA programme

Two of the variants envisage an increase of the power of the Olkiluoto units from current 2500 MWth to 2750 MWth, i.e. by 10%. The power uprate, if such a variant would be selected, is expected to be implemented during the 2020's, meaning before the present operating license expires in 2038. It looks like the concept is that the power uprate would be prepared and eventually licensed within the PSR that is to be performed in 2028.

There is preciously little information in the EIA programme on the power uprate. It is described that the power uprate for 2500 MWth will be achieved by increasing the main circulation through the reactor from the current 8360 to a new value of 10.000 kg/sec. The increased feed flow will increase the steam generation, allowing for a higher load on the turbine, meaning higher generation of electricity, i.e. 970 MWe. The EIA programme indicates that the increase in thermal power (by increasing the flow through the reactor) could be achieved by "modifications and reparameterization" of existing systems without changing their functionality. There are no details as to the modifications to be implemented and even less of the "reparameterization", or what kinds of parameters would be affected.

The only modification that is specifically mentioned is the one to add the diesel powered make up system that will be located externally to the current building. The Diesel driven make up system is needed to accommodate for the flooding of the reactor core in case of a total loss of power, making other systems unavailable. In such a case a diesel driven system will inject the water. Naturally, due to the increased power, the need for cooling water is increased, leading to a need of an additional system.

Among planned modifications, the new battery energy storage system is mentioned, to supply the power to the national grid. There is no mentioning whether the energy contained in the battery storage might be available and used for emergencies in case of a, e.g. station blackout (SBO).

Discussion

The power uprate that is being considered is 250MWth, meaning about 10% on the previous power of the reactor. However, this power uprate comes on top of two earlier power uprates, one in the 1980's and then in the 1990's, when the thermal power was increased by 160 and 340 MWth respectively. An additional 50 MWe was gained by the modifications on the turbine side, so it is not relevant for the discussion here.

It is known that the BWRs, due to their specific technological processes, are capable of producing more power by an increase in the flow of feedwater for the reactor and other tweaks in the processes. Indeed, many BWRs increased their power this way, sometimes significantly, as compared with the original design power level. In some cases and for smaller power increases, that was possible by using the “reserves” in the system and components. Nevertheless, at one point, the physical limitations, from, e.g. steam piping and valves to other equipment in the power conversion system as well as safety systems that are designed to cope with transients and other emergencies cannot cope anymore.

Apart from stating that the “flow through the reactor would be increased by about 10 %”, the EIA programme does not state anything related to how the power level would be achieved and which modifications and component replacements would be needed. Even more, it does not even mention any of the safety aspects of such an increase, except an additional diesel driven make up water system (which is one system to support both units). While the reactor and safety systems might have had reserves in their capacity in the original design, it is hard to believe that these reserves were such to allow for a 37,5 % thermal power increase. That means that at least some of the in-built reserves would be reduced, possibly undermining safety of the plant. To compensate for the reduced margins, specific safety focused modification are likely to be needed.

The power uprate of 37,5 %, with the reactor vessel, fuel geometry and circulating pumps remaining the same, may appear to be a rather additional load on all of the components and/or structures. There is no indication in the EIA programme as to the extent that TVO would be developing a safety case to assure that the safety level remains within the required framework. One can assume that the Finnish nuclear regulator STUK would be carefully reviewing the analysis undertaken before issuing its approval for such a power uprate. Nevertheless, the fact remains that from the safety margins that existed in the original design, at least some may be reduced with the past power uprate and even more so with the proposed one. The reduction of the safety margin, assurance that there are no cliff edge events and the post-uprate safety margin all need to be clearly presented and fully documented in the EIA report.

Requirements for the EIA Report

Regarding the ageing Power uprate programme, the following issues should be presented in the EIA Report:

1. The concept for the power uprate, changes in the fuel or core design or management;
2. A detailed list of the modifications that are necessary for increasing the reactor power to 2750 MWth;
3. The details of the safety case where the margins are estimated, showing that the remaining margins are sufficient in compliance with the safety requirements in place;
4. A discussion on the safety upgrade and resulting safety level in respect to the safety objectives of new reactors for the case of 10 and 20 years of lifetime extension;
5. The list of the analyses that will be done within the PSR (due 2028) that would justify the safety margin with the power uprate;
6. Impact of the power uprate for the plant’s SSCs that are subject to ageing management in the view of lifetime extension.

8 EXTERNAL EVENTS AND MULTIPLE UNITS ON SITE

Treatment in the EIA programme

The EIA programme describes the Olkiluoto site in fine detail, also providing the maps of the island as well as of the surrounding areas and waters. The Olkiluoto island currently houses 3 (operational) units, as well as operating SNF/radioactive waste facilities. A decision in principle was issued by the Finnish government to allow for the construction of a 4^{th} unit, which in the meantime expired.

The EIA programme mentions that the joint impact of 3 units in operation at the Olkiluoto site will be assessed in the EIA report. This however seems to be short of considering the safety impact, e.g. accidents affecting multiple units that might lead to off-site consequences. Further, apart from mentioning that Olkiluoto units 1 and 2 are "equipped with systems to manage a severe accident", it does not offer any substance for this statement. Nevertheless, it is known, e.g. from the Post Fukushima stress test (ref [9]) and the Finnish National action plan (ref [10]), that there were several requirements for additional analysis and justification, including, e.g. for the capabilities to deal with multi-unit accidents. The stress test assessment was done in 2012, long before the unit 3 became operational.

The EIA programme indicates that the EIA report will assess the impact of potential incidents and accidents based on "authority requirements", and that those will be described on a "general level". From the Austrian perspective, the assessment of severe accidents, initiating events, its propagation and its releases, e.g. due to a simultaneous damage to multiple "features" of the plant including safety systems and structures, are of high interest.

While the authors have no doubts that TVO is diligently assessing the potential impact of external hazards, the EIA programme does not specify that those would be receiving due attention. The impact of external hazards has been assessed during the stress test, when the additional analysis of high and low temperatures, tornadoes and downpours as well as high seawater impact have been addressed. The EIA programme does not say anything about any new analysis that, given that climate change is accelerating, is expected to be causing more frequent severe weather and likely accelerated sea level rise, would assess the impact on the site. This is of particular importance when considering that the Olkiluoto 1 and 2 units may remain in operation up to 2058, when the weather phenomena and in particular the shoreline relief might look very different than today.

The EIA does not mention external events of human origin, those being, e.g. large-scale fires in the vicinity, dangerous goods transport on waterways as well as aircraft crashes and terrorist attacks. It is understood that the latter might not be publicly discussed, but general information could be provided. The others should definitely be addressed to enable an assessment of the vulnerabilities.

The Russian war in Ukraine showed for the first time that a civilian nuclear plant could be subject to military activities, like the Zaporizhzhia plant now is. While this might still be "unthinkable" and could remain a low probability event, it is not any more seen as an impossible event, and likely needs to be assessed at least to a certain extent. A scenario where the Olkiluoto plants are attacked, simply cannot be neglected any more. While, such a scenario could be handled in an enveloping fashion, and its details could remain confidential, at least an indication on the potential consequences needs to be assessed.

Discussion

The EIA programme provides practically no information on the planned assessment in relation with external impact, nor on the interaction for the multiple units at the site. In particular, there is no discussion on man-made events, that could possibly be critical when considering the risks to the environment.

The importance of external hazards cannot be underestimated. Most studies addressing NPPs have shown that in terms of the risk (probability x consequence) the external impact hazards dominates the risk, in particular as related with off-site impact. This is why the external events need to be thoroughly analysed and their consequences assessed. In this, attention needs to be paid to the actual expected impact. It is obvious that the climate change-induced conditions are accelerating and that the assessment regarding severe weather as well as the sea water rise undertaken in 2012 might no longer be appropriate for 2058, which is the expected end of the lifetime of Olkiluoto Units 1 and 2. The EIA process is a good opportunity to perform such an assessment.

Among the external events, the man-made events are important to be assessed. The aircraft crash impact was likely assessed during the stress test (confidential part), and could be requiring updates. It is unknown whether the screening of other man-made events, including terrorist attacks and alike, has been undertaken. The risk of military activities either related with a direct targeting of NPPs or a situation where, due to military intervention, normal operation of plants is not possible, needs to be at least considered on a high level. The Russian invasion of Ukraine suggests that such events cannot be excluded any more.

Finally, Olkiluoto is a site with multiple units. Units 1 and 2 share some facilities and for the power uprate, a shared diesel driven make up system is planned. The impact of shared systems and in general the conditions of events and accidents impacting Olkiluoto 1 and 2 but possibly also Olkiluoto 3, which is not sharing any systems but is co-located, is important to be assessed.

Requirements for the EIA Report

The EIA Report should contain the following information on possible external impacts at the site:

1. Assessment of the severe weather conditions, as well as sea water rise/site floods with consideration of new trends in climate change and the fact that Olkiluoto 1 and 2 may operate up to 2058;
2. An assessment of the man-made external events;
3. A summary of outcomes of the assessment of man-made external events like aircraft crashes, terrorism or sabotages, including insider events and terrorist attack;
4. An enveloping consideration of a possible impact of military actions against the Olkiluoto site and its facilities;
5. Assessment of a combination of external events, including consideration of multiple plants on the site;
6. For each of the external event assessments, information on the safety margins, cliff-edge effects and eventually needed/planned safety improvements, needs to be presented;
7. Thorough analysis of the possible events affecting multiple units on the site, with a view on the enveloping radiological release source term.

9 TRANSBOUNDARY IMPACT

Treatment in the EIA programme

The EIA programme discussed the transboundary impacts in a section devoted to defining the impacts to being assessed and the assessment methods for the full EIA. Section 6.18, Incidents and accidents, will be assessed as "imaginary accidents" (which is understandable, as the probability of several accidents is indeed very low) and its consequences. This assessment will be performed "pursuant to section 22 of the Nuclear energy decree (161/1988)" which specified that the amount of radioactive releases is limited to 100 TBq of Cs-137. Furthermore, the impact is calculated up to 1000 km from the Olkiluoto site.

It is recognised that the value of 100 TBq has been prescribed in the regulation, which also says that the probability of exceeding that value is extremely small. However, the consequence of a catastrophic release due to a severe accident may be expected to be significantly higher than 100 TBq. In the case of the Fukushima accident, the estimate for release of Cs-137 was 17 PBq. In particular, the postulated event affecting multiple units and scenarios that may lead to damage to plant systems and structures could easily lead to a release in excess of 100 TBq. It is recognised that the probability of such accidents is very or extremely low, but those cannot be practically excluded, in particular when the scenarios including external man-made events are considered.

In terms of the dispersion modelling that is to be assessed within the EIA, the EIA programme calls for a "1000 KM distance from Olkiluoto", within those distances from the site the fallout and radiation doses will be estimated, based on the "modelling results and research data". While it is correct that the impact beyond 1000 km is generally small, from the Austrian perspective it cannot be excluded. As it has been shown in the Flexrisk study, the impact at distances beyond 1000 km from the site may be visible, in particular in the deposit of Cs 137 on the ground. In the case of Austria, the initial intervention level starts with deposits above 750 Bq/m2, which, as shown in the Flexrisk calculation, could be exceeded in specific weather circumstances.

Discussion

The EIA programme confirms that the EIA report will undertake an analysis of the transboundary impact. The transboundary impact is to be assessed, reflecting the dispersion analysis, in terms of the fallout and radiation doses to the population. Regardless of the accident sequences/scenario the impact is to be assessed for a source term that includes release of 100 TBq of Cs 137 for distances of up to 1000 km.

In the view of this reviewer, this is not sufficient. We do understand that the 100 TBq is a limit value prescribed by the regulation in Finland. Nevertheless, the new considerations of the severe accidents are leading to the fact that the actual release might be (significantly) higher than this value. This might be particularly relevant for Olkiluoto 1 and 2, which although equipped with a filtered containment vent, might be vulnerable due to the containment being less strong than, e.g. Olkiluoto 3. In case of severe accident cases by external hazards, that might be a decisive difference which might lead to a source term (release) higher than 100 TBq.

This is especially relevant for sequences where all three plants on the site might be affected by an event, that being an external event or, even worse, a terrorist or military attack on the plant. In our view, as the critical or an enveloping source term, the 100 TBq is not appropriate.

The 1000 km range has been selected and the transboundary impact estimated in other Finnish EIAs (e.g. EIA for Loviisa lifetime extension), but also used for estimating impact in some other nuclear EIAs. The assumption behind this value (in addition to being a nice round number) is that beyond that range it is expected that there will be very little impact, e.g. below any level requiring intervention. Austria is beyond a 1000 km distance from the Olkiluoto site. However, as the Flexrisk analysis has shown, depending on the weather (and due to the specific Austrian geography, where in a case of the weather coming for the north east, the Alps will be the place where the rain will cause a washout of radionuclides), parts of Austria might see the impact in terms of the ground deposition, that is higher than the initial value of the intervention level, which starts at 750Bq per m2. Therefore, from the Austrian perspective, it would be very useful to have a dispersion modelling covering the area all the way to the Alps. In this way the appropriate impact (or lack of it) on Austrian territory could be assessed.

Requirements for the EIA Report

The EIA Report should contain the following information as relevant for the transboundary impact that might affect Austria:

1. List of accidents and incidents analysed to establish the source term;
2. Detailed description of severe accident scenarios and their sequences, and the resulting estimated source terms for each of those (not just Cs 137, but other relevant radionuclides for transboundary impact);
3. Detailed description of the assumptions taken when modelling accident sequences addressing source term, including duration of a release, levels of release, energy, etc.;
4. Thorough presentation of the dispersion modelling, including the weather parameters taken (covering a range of weather situations as well as the determination of radiation impacts (deposits, doses to the population, etc));
5. Discussion on relevant assumptions for the dispersion calculation and their justification;
6. Resulting probability distribution of the radiological impact, covering all cases;

10 GLOSSARY

AMP .... Ageing Management Programme

Bq .... Becquerel

BWR.................................... Boiling Water Reactor

CDF .... Core damage frequency

DBA .... Design Basis Accident

DEC-A/B .... Design Extension Condition

EIA .... Environmental impact assessment

EU .... European Union

IAEA .... International Atomic Energy Agency

LERF .... Large early release fraction

LILW.................................... Low- and Intermediate Level radioactive Waste

LTE...................................... Lifetime Extension

LTO .... Long Term Operation

MW .... Megawatt

MWe .... Megawatt electric

MWth .... Megawatt thermal

NacP .... National Action Plan

NPP..................................... Nuclear power plant

PBq .... Petabecquerel

PSR .... Periodic safety review

RAW.................................... Radioactive Waste

RL.. Reference Level

SG .... Steam Generator

SNF .... Spent Nuclear Fuel

SSC .... System Structures & Components

STUK................................... Säteilyturvakeskus – Finnish nuclear regulator

TBq .... Terabecquerel

TPR .... Topical Peer Review

TVO .... Teollisuuden Voima Oyj – Betreiberfirma von O1 & 2

WENRA .... Western European Nuclear Regulators‘ Association

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ISBN 978-3-99004-754-5