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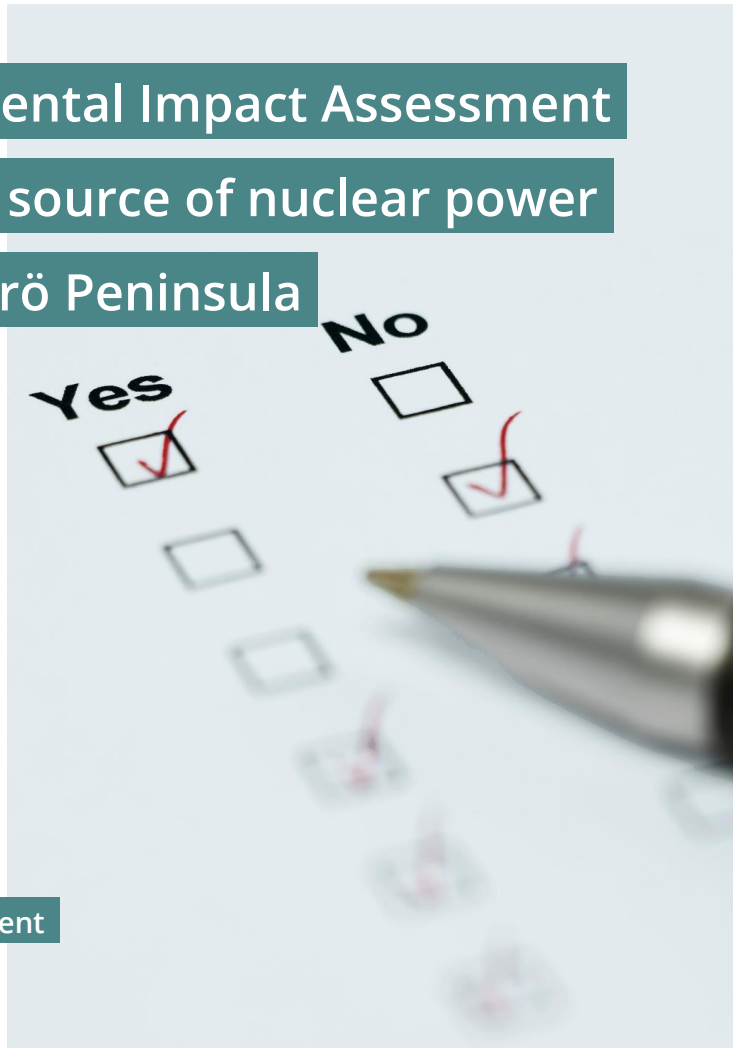
Environmental Impact Assessment for a new source of nuclear power on the Värö Peninsula

Scoping



Expert Statement

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ENVIRONMENT AGENCY AUSTRIA

ENVIRONMENTAL IMPACT ASSESSMENT FOR A NEW SOURCE OF NUCLEAR POWER ON THE VÄRÖ PENINSULA - SCOPING

Expert Statement

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1 SUMMARY

Sweden has notified Austria about the Environment Impact Assessment (EIA) procedure under the Espoo Convention and the EU EIA Directive for the project “New source of nuclear power on the Värö Peninsula”. Austria is participating in the transboundary EIA. The Federal Ministry of Agriculture and Forestry, Climate and Environmental Protection, Regions and Water Management commissioned the Federal Environment Agency to prepare an expert opinion on the submitted documents.

The documentation for the "scoping" part of the procedure is currently being assessed. Within the framework of this part of the procedure, it is being discussed what content the project proponent will have to present in the EIA report and in what detail.

The objective of Austria's participation in the EIA procedure is to minimise or prevent possible significant adverse effects of the project on Austria. The expert statement on the scoping part of the procedure sets out the requirements for the EIA report.

The project “New source of nuclear power on the Värö Peninsula” is in a very early planning stage, with eventual start of ground works expected within this decade. The project proponent (“the Developer”) Vattenfall is already initiating the activities, particularly related with the environmental impact assessment, which is required under the Swedish legal framework.

The project itself is the construction of two large nuclear reactors (NPP) or three to five small modular reactors (SMR), with a combined electrical output of up to 2,800 MWe equivalent to no more than 8,400 MW heat output. Each nuclear reactor will consist of a reactor and a turbine section. The nuclear reactors are planned to be independent of each other, but will share services such as seawater intake, maintenance workshops, waste management, etc. The nuclear reactors considered for the planned operations will be based on light water technology.

Vattenfall does not specify which reactors will be built on the site. No potential suppliers or reactor types are elaborated in the documents. The only information given on the potential reactors are the following. Construction of two large nuclear pressurized water reactors (PWR) with an approximate output of 1200-1400 MWe. Alternatively to build three to five SMRs, using boiling water reactors (BWR) or pressurized water reactors (PWR) with approximately 300-500 MWe each.

The lack of specifications of potential reactor designs enhances uncertainties about potential environmental impacts, licensing, construction, costs and timelines. Currently, there are no matching SMRs in operation anywhere in in the world. Further, there are no operating licenses granted to any SMRs of the indicated specifications. This implies that potential SMRs would be first of a kind envisaged to be built on site, which puts heavy duties on the applicant and the regulatory body. Additionally, it is not clear if Vattenfall plans to construct first

of kind large reactors, which would imply similar challenges as mentioned for SMRs.

The Expert Statement comes to the following conclusions and recommendations:

- Although the relevant EU EIA Directive and the ESPOO Convention stipulate that an environmental impact assessment procedure should begin at an early stage of the decision-making process, the considerations put forward by the developer in the scoping document appear very vague. Therefore, the fundamental question must be raised as to at what point and at what time in the decision-making process an environmental impact assessment procedure should be initiated by the operator and the competent authority.
- The next step in the process should be to narrow down the reactor types under consideration and the target output per block. For a black box procedure, involving any type of nuclear power plant the competent EIA authority should require the applicant to specify its project intentions in much detail than is currently apparent.
- It would be appropriate to show for each of the prospective reactors, regardless of their capacity, what verifiable evidence is available for the control of severe accidents and whether these meet the requirements of Swedish regulations. A maximum source term that could be used for a dispersion calculation should be documented for each of the envisaged reactors.
- If scoping documents from similar EIA procedures in other countries are used for comparison, it makes sense for the public concerned to present the regulations and provisions for the construction and operation of the planned facility and not the provisions on radiation protection. The current scoping document does not contain any such information. The EIA report should therefore include an introduction to the regulations and radiation protection provisions so that the public concerned is aware of the relevant standards for project approval in Sweden or those that will apply on the date the project is submitted.
- From an expert's perspective, information on severe accidents and the dispersion of radioactive emissions as a result of such events is of particular interest. Information on the design to be implemented, including the relevant technical specifications and safety case, is essential for the possibility of comprehensively assessing any transboundary effects of the project.
- The external events that would need to be taken into account in the accident analyses are only briefly described in the scoping document. External events pose a particular threat to a site such as the Värö peninsula with a large number of nuclear facilities, as they could have a negative impact on all plants at the site. The issue of earthquake risk and/or resulting Tsunamis in particular should be addressed in greater detail in the EIA, taking into account the latest findings and/or ongoing work.
- There is the need to calculate source terms for each of the potential designs. The (comprehensive) source terms to be used in the EIA should be verifiable based on accident analyses for the all-possible reactor options.

The potential risk, regardless of the distance, cannot be correctly assessed to refer to a 100 TBq limit as long as there is no proof that the envisaged reactors can and will comply with this limit even under unfavourable circumstances.

- With regard to the dispersion calculation, in addition to the maximum conceivable source terms for each of the envisaged reactors, the deposition to be expected under the most unfavourable weather conditions, regardless of the distance from the site, should also be determined. In addition to a consideration of the potential dose exposure for the population, the deposition above a value of 750Bq/m2 should also be shown. According to Austrian regulations (as well as those for Germany and the Czech Republic), radiation protection measures must be taken ex officio above this value. Although this does not necessarily mean a negative impact on the environment, it does mean the start of activities to assess potential adverse effects on the environment, in particular on food production. It would therefore be more than desirable for the dispersion calculation to explicitly include potential depositions and to refer to the radiation protection regulations of the potentially affected countries.
- The amount of radioactive waste generated during the operation of the plants depends on the type and number of reactors to be built. The EIA report should therefore specify the corresponding quantities of waste from operation for each of the planned reactors. The question of interim storage of spent fuel elements should also be addressed in this context. This raises the question of whether and in what form interim storage is planned at the site.

2 ZUSAMMENFASSUNG

Schweden hat Österreich über das Umweltverträglichkeitsprüfungsverfahren (UVP) gemäß dem Espoo-Übereinkommen und der EU-UVP-Richtlinie für das Projekt „Neue Kernkraftquelle auf der Halbinsel Värö“ informiert. Österreich beteiligt sich an der grenzüberschreitenden UVP. Das Bundesministerium für Land- und Forstwirtschaft, Klima- und Umweltschutz, Regionen und Wasserwirtschaft hat das Umweltbundesamt mit der Erstellung eines Gutachtens zu den vorgelegten Unterlagen beauftragt.

Die Unterlagen für den Teil „Scoping“ des Verfahrens werden gegenständlich geprüft. Im Rahmen dieses Teils des Verfahrens wird diskutiert, welche Inhalte der Projektantragsteller im Umweltbericht vorlegen muss und wie detailliert diese sein müssen.

Ziel der Beteiligung Österreichs am UVP-Verfahren ist es, mögliche erhebliche nachteilige Auswirkungen des Projekts auf Österreich zu minimieren oder zu verhindern. In der Fachstellungnahme zum Scoping-Teil des Verfahrens werden die Anforderungen an den Umweltbericht festgelegt.

Das Projekt „Neue Kernkraftquelle auf der Halbinsel Värö“ befindet sich noch in einem sehr frühen Planungsstadium, der Baubeginn ist für die zweite Hälfte der 2020er Jahre vorgesehen. Der Projektentwickler Vattenfall hat bereits mit den Aktivitäten begonnen, insbesondere im Zusammenhang mit der Umweltverträglichkeitsprüfung, die gemäß den gesetzlichen Bestimmungen in Schweden erforderlich ist.

Das Projekt selbst umfasst den Bau von zwei großen Kernreaktoren (Kernkraftwerk) oder drei bis fünf kleinen modularen Reaktoren (SMR) mit einer Gesamtleistung von bis zu 2.800 MWe, was einer Wärmeleistung von maximal 8.400 MW entspricht. Jeder Kernreaktor wird aus einem Reaktor und einem Turbinenbereich bestehen. Die Kernreaktoren sollen voneinander unabhängig sein, aber gemeinsame Einrichtungen wie Seewasserentnahme, Wartungswerkstätten, Abfallentsorgung usw. nutzen. Die für den geplanten Betrieb in Betracht gezogenen Kernreaktoren werden auf Leichtwassertechnologie basieren.

Vattenfall gibt nicht an, welche Reaktoren an dem Standort gebaut werden sollen. In den Unterlagen werden keine potenziellen Lieferanten oder Reaktortypen genannt. Die einzigen Informationen zu den potenziellen Reaktoren sind die folgenden. Der Bau von zwei großen Druckwasserreaktoren (PWR) mit einer Leistung von ca. 1200-1400 MWe. Alternativ, der Bau von drei bis fünf SMR mit Siedewasserreaktoren (BWR) oder Druckwasserreaktoren (PWR) mit jeweils etwa 300 bis 500 MWe.

Das Fehlen von Angaben zu möglichen Reaktortypen erhöht die Unsicherheit hinsichtlich der potenziellen Umweltauswirkungen, der Genehmigung, des Baus, der Kosten und des Zeitplans. Derzeit gibt es weltweit keine SMR in Betrieb. Darüber hinaus wurden für SMR mit der angegebenen Leistungsbandbreite keine Betriebsgenehmigungen erteilt. Dies bedeutet, dass potenzielle SMR die ersten ihrer Art wären, die an diesem Standort gebaut werden sollen,

was eine große Herausforderung für den Antragsteller und die Aufsichtsbehörde darstellt. Darüber hinaus ist unklar, ob Vattenfall plant, die ersten großen Reaktoren dieser Art zu bauen, was ähnliche Herausforderungen wie bei den SMR mit sich bringen würde.

Die Expertenstellungnahme kommt zu folgenden Schlussfolgerungen und Empfehlungen:

- Obwohl die einschlägige EU-UVP-Richtlinie und die Espoo-Konvention vorsehen, dass ein Umweltverträglichkeitsprüfungsverfahren in einer frühen Phase des Entscheidungsprozesses beginnen sollte, erscheinen die Überlegungen des Betreibers Vattenfall im Scoping-Dokument nach wie vor sehr vage. Daher muss die grundlegende Frage gestellt werden, zu welchem Zeitpunkt und zu welchem Zeitpunkt im Entscheidungsprozess ein Umweltverträglichkeitsprüfungsverfahren vom Betreiber und der zuständigen Behörde eingeleitet werden sollte.
- Der nächste Schritt sollte darin bestehen, die in Betracht gezogenen Reaktortypen und die angestrebte Leistung pro Block einzugrenzen. Bei einem Black-Box-Verfahren, das jede Art von Kernkraftwerk umfasst, sollte die zuständige UVP-Behörde vom Antragsteller verlangen, seine Projektabsichten wesentlich detaillierter darzulegen, als dies derzeit der Fall ist.
- Es wäre daher mehr als angemessen, für jeden der in Frage kommenden Reaktoren, unabhängig von ihrer Leistung, darzulegen, welche nachprüfbaren Nachweise für die Beherrschung schwerer Unfälle vorliegen und ob diese den Anforderungen der schwedischen Genehmigungsvorschriften für Kernanlagen entsprechen. Für jeden der geplanten Reaktoren sollte ein maximaler Quellterm dokumentiert werden, der für eine Ausbreitungsberechnung verwendet werden könnte.
- Werden Scoping-Dokumente aus ähnlichen UVP-Verfahren in anderen Ländern zum Vergleich herangezogen, ist es für die betroffene Öffentlichkeit sinnvoll, die Vorschriften und Bestimmungen für den Bau und Betrieb der geplanten Anlage darzulegen und nicht die Bestimmungen zum Strahlenschutz. Das vorliegende Scoping-Dokument enthält keine solchen Informationen. Der UVP-Bericht sollte daher eine Einführung in die Vorschriften und Strahlenschutzbestimmungen enthalten, damit die betroffene Öffentlichkeit über die für die Genehmigung des Projekts in Schweden maßgeblichen Normen oder die zum Zeitpunkt der Vorlage des Projekts geltenden Normen informiert ist.
- Aus Sicht der Experten sind Informationen über schwere Unfälle und die Ausbreitung radioaktiver Emissionen infolge entsprechender Ereignisse von besonderem Interesse. Informationen über die zu realisierende Auslegung, einschließlich der relevanten technischen Spezifikationen und Sicherheitsnachweise, sind für die Möglichkeit einer umfassenden Bewertung der grenzüberschreitenden Auswirkungen des Projekts unerlässlich.
- Die externen Ereignisse, die in den Unfallanalysen berücksichtigt werden sollten, werden im Scoping-Dokument nur kurz beschrieben. Externe Ereignisse stellen eine besondere Gefahr für einen Standort wie Ringhals dar, an dem sich eine Vielzahl von kerntechnischen Anlagen befinden, da

sie negative Auswirkungen auf die gesamte Anlage oder alle Anlagen am Standort haben könnten. Insbesondere die Frage des Erdbebenrisikos und/oder der daraus resultierenden Tsunamis sollte in der UVP unter Berücksichtigung der neuesten Erkenntnisse und laufenden Arbeiten näher behandelt werden.

- Es sollten für jeden in Frage kommenden Reaktor nachvollziehbare und dokumentierte Quellterme verwendet werden, welche auf Unfallanalysen beruhen. Das potenzielle Risiko kann unabhängig von der Entfernung nicht richtig eingeschätzt werden, wenn auf einen Grenzwert von 100 TBq verwiesen wird, solange nicht nachgewiesen ist, dass die geplanten Reaktoren diesen Grenzwert auch unter ungünstigen Umständen einhalten können und werden.
- Bei der Ausbreitungsberechnung sind neben den maximal denkbaren Quelltermen für jeden der geplanten Reaktoren auch die unter ungünstigsten Wetterbedingungen zu erwartenden Depositionen unabhängig von der Entfernung vom Standort zu ermitteln. Neben der Berücksichtigung der potenziellen Dosisbelastung der Bevölkerung ist auch die Deposition oberhalb eines Wertes von 750 Bq/m² nachzuweisen. Nach österreichischen Vorschriften (wie auch denen für Deutschland und die Tschechische Republik) sind oberhalb dieses Wertes von Amts wegen Strahlenschutzmaßnahmen zu ergreifen sind. Dies bedeutet zwar nicht zwangsläufig eine Beeinträchtigung der Umwelt, aber den Beginn von Aktivitäten zur Bewertung potenzieller nachteiliger Auswirkungen auf die Umwelt, insbesondere auf die Lebensmittelproduktion. Es wäre daher mehr als wünschenswert, wenn die Ausbreitungsberechnung potenzielle Depositionen ausdrücklich berücksichtigen und auf die Strahlenschutzvorschriften der potenziell betroffenen Länder verweisen würde.
- Die Menge der während des Betriebs der Anlagen anfallenden radioaktiven Abfälle hängt auch von der Art und Anzahl der zu bauenden Reaktoren ab. Im UVP-Bericht sollten daher für jeden der geplanten Reaktoren die entsprechenden Abfallmengen aus dem Betrieb angegeben werden. In diesem Zusammenhang ist auch die Frage der Zwischenlagerung abgebrannter Brennelemente zu klären. Dabei stellt sich die Frage, ob und in welcher Form eine Zwischenlagerung am Standort geplant ist, unabhängig davon, ob ein solches Verfahren einem separaten UVP-Verfahren unterliegen würde.

3 INTRODUCTION AND OVERVIEW

Sweden has notified Austria about the Environment Impact Assessment (EIA) procedure under the Espoo Convention and the EU EIA Directive for the project “New source of nuclear power on the Värö Peninsula”. Austria is participating in the transboundary EIA. The Federal Ministry of Agriculture and Forestry, Climate and Environmental Protection, Regions and Water Management commissioned the Federal Environment Agency to prepare an expert opinion on the submitted documents.

The documentation for the "scoping" part of the procedure is currently being assessed. Within the framework of this part of the procedure, it is being discussed what content the project applicant will have to present in the EIA report and in what detail.

The objective of Austria's participation in the EIA procedure is to minimise or prevent possible significant adverse effects of the project on Austria. The expert statement on the scoping part of the procedure sets out the requirements for the EIA report.

The project “New source of nuclear power on the Värö Peninsula” is in a very early planning stage, with eventual start of ground works expected within this decade. The project proponent (“the developer”) Vattenfall is already initiating the activities, particularly related with the environmental impact assessment, which is required as per the legal framework in Sweden.

The notification document also aims at specifying information that is suitable to be included in the project’s environmental impact documentation. The notification document was released in March 2025, and is available for public comments.

The permit application covers the development and operation of the facility. Vattenfall’s planned operations in Varberg requires permit according to the Environmental Code (1998:808) for environmentally hazardous operations, as well as further permission based on other Swedish legislations.

The project area is located in the southwestern coast of Sweden at the Värö Peninsula in Varberg municipality, approximately 50km south of Gothenburg. The site will be shared with the existing Ringhals NPP. Of the four NPPs at Ringhals site, two are operational, while two are in decommissioning phase.

The project itself is the construction of two large nuclear reactors (NPP) or three to five small modular reactors (SMR), with a combined electrical output of up to 2,800 MWe, equivalent to up to 8,400 MW heat output. Each nuclear reactor will consist of a reactor and a turbine section. The nuclear reactors are planned to be independent of each other, but will share services such as seawater intake, maintenance workshops, waste management, etc. The nuclear reactors considered for the planned operations will be based on light water technology.

Vattenfall does not specify which reactor types will be built on site, neither potential suppliers are elaborated in the documents. The only information given on the potential reactors are the following:

- Construction of two large nuclear pressurized water reactors (PWR) with an approximate output of 1200-1400 MWe.
- Alternatively to build three to five SMRs, using boiling water reactors (BWR) or pressurized water reactors (PWR) with approximately 300-500 MWe each.

The lack of specifications of potential reactor designs enhances uncertainties about potential environmental impacts, licensing, construction, costs and timelines. Currently, there are no matching SMRs in operation anywhere in in the world. Further, there are no operating licenses granted to any SMRs of the indicated specifications. This implies that potential SMRs would be first of a kind envisaged to be built on site, which puts heavy duties on the applicant and the regulatory body. Additionally, it is not clear if Vattenfall plans to construct first of kind large reactors, which would imply similar challenges as mentioned for SMRs.

The statement on page 11, "the construction and installation of each nuclear reactor is estimated to take around four to six years. The small modular reactors described in Section 3.2 require less time for construction and commissioning than large reactors" is not discussed in detail. This statement refers to assumptions that have been recently made, but cannot be confirmed by real experience.

4 PROCEDURAL ASPECTS OF THE EIA

Although the relevant EU EIA Directive and the Espoo Convention stipulate that an Environmental Impact Assessment procedure should begin at an early stage of the decision-making process, the considerations put forward by the developer Vattenfall in the scoping document appear very vague. Therefore, the fundamental question must be raised, at which point in the decision-making process an Environmental Impact Assessment procedure should be initiated by the developer and the competent authority.

The report considers either two large nuclear power plants or several smaller SMRs to be build. An assessment of the environmental impact of nuclear power plants, both in normal operation and in the event of a severe accident, depends largely on the type of reactor(s) selected, their inventory and evidence of accident mitigation designs and strategies among other factors. A more detailed description of the reactor selection process itself as well as the corresponding nuclear regulations to be fulfilled is not provided in the scoping document.

The early stage of the decision-making process, combined with significant uncertainties in the details of the project, does therefore not allow for a proper assessment of the environmental impact of the envisioned project.

However, this expert statement is based on the very vague status quo that is provided in the scoping documents. In the further procedure, in particular with regard to the definition of the information to be submitted in the EIA report, extensive evidence would therefore have to be provided in case the developer has not specified its project in more detail in the meantime.

It would therefore be appropriate to show for each of the prospective reactors, what verifiable evidence is available for the control of severe accidents and whether the requirements according to the Swedish nuclear licensing regulations are met. A maximum source term that could be used for a dispersion calculation should be documented for each of the envisaged reactors.

Austria has already participated in several nuclear-related procedures in the past. This has also provided knowledge of existing documents that have been made publicly available elsewhere (for example in Czech Republic, Slovakia and Poland) as part of an EIA scoping procedure.

Even a cursory comparison of these scoping documents with the one under discussion in this expert statement shows that the developer elsewhere were able to present the selection of reactor types in question in much greater detail. In each case, a detailed distinction was made between boiling water reactors and pressurized water reactors. Additionally, large power plants and SMRs were not considered as equivalent alternatives elsewhere.

As already noted, the next step in the decision-making process should be to narrow down the reactor types under consideration and define the target output per block. For a black box procedure, involving any type of nuclear power

plant the competent EIA authority should require the applicant to specify its project intentions in much detail than currently apparent.

5 EXTERNAL EVENTS AND MULTIPLE UNITS ON SITE

The Värö Peninsula hosts two operational reactors, two reactors in decommissioning, and up to five reactors are planned to be constructed. The analysis of accident situations for each of the reactor types under consideration must therefore also analyse possible negative interactions between nuclear installations at the site.

Events threatening all or several reactors at the site cannot be ruled out. There is no question that this would be an extremely low probability event (except maybe in a case of an external hazard simultaneously affecting all units, i.e. Fukushima type scenario).

Nevertheless, due to the potentially large impact, at least a qualitative description of potential events affecting the safe operation of the reactors or causing accidents at multiple units at the site should be presented in the EIA.

External events should be described in a comprehensive manner. External events pose a particular threat to a site with a large number of nuclear facilities such as Värö Peninsula, as they could have a negative impact on all plants at the site. The risk of earthquakes and/or resulting tsunamis in particular should be addressed in greater detail in the EIA, taking into account the latest findings and ongoing studies. Historical earthquakes and tsunamis[1] should be taken into account, when assessing the risk.

The latest IAEA documents should be used when assessing external hazards in the EIA. The latest WENRA document on safety requirements for new reactors (RHWG 2013) should also be taken into account.

A focus of the EIA should also be on the long-term effects of climate change. Climate-related effects such as the rise of the sea level or the increase of both water and air temperature might strongly affect the safety requirements of the facility during its planned service life of up to 80 years. These changed environmental conditions and corresponding additionally safety hazards need to be addressed in order to guarantee a high safety level throughout the entire service life.

A comprehensive site analysis helps to reduce the probability of a severe accident with significant environmental impact. Against this background, the environmental impact assessment should contain at least the following information:

- Results of current studies on earthquakes, flooding and extreme weather conditions;
- Methodology used to determine the relevant external events;

[1] Mörner NA. Tsunamis in Sweden: Occurrence and Characteristics. Tsunami. InTech; 2016. Available from: http://dx.doi.org/10.5772/63956

- List of external events to be considered (including justification) and their characteristics;
- Information on the combinations of external events considered;
- Information on the safety margins required in the design of the nuclear power plant (in particular with regard to earthquakes and flooding);
- Information on the interactions with existing nuclear facilities at the site and the possible consequences. (Radiological releases at one unit, challenging the operation of other units, or events that might cause large-scale destruction would need to be addressed.)

It is particularly important that accident scenarios described in the EIA comprehensively cover all possible reactor options.

6 SAFETY AND SEVERE ACCIDENTS

By comparing scoping documents from similar EIA procedures in other countries, it makes sense to present the rules and regulations governing the construction and operation of the planned facility to the concerned public, rather than the provisions on radiation protection. However, the current scoping document does not contain any information of this kind.

The EIA report should therefore include an introduction to the regulations and radiation protection provisions, so that the public concerned is aware of the relevant standards for project approval in Sweden.

Information on the design to be implemented, including the relevant technical specifications and safety evidence, is essential to comprehensively assessing any transboundary effects of the project.

Therefore, the following requirements should apply to the content of the EIA report:

- The basic design features and safety level of the proposed designs on which the reference projects are based should be described systematically and in greater detail in order to provide a more accurate picture of the individual alternatives.
- More detailed information on the design against external natural and civilization impacts and on the requirements for key safety-related systems and components (including instrumentation and control) should be included in the EIA report.
- Information on ongoing projects with the reactor types listed as international references should be as comprehensive and up to date as possible. Any problems encountered in the projects should also be presented in full.

The Swedish competent authority should request the developer to specify the number of reactors and reactor types (boiling water reactor or pressurised water reactor) as far as possible when submitting the EIA report. The EIA documentation should contain the following information for each reactor type envisaged:

1. Meaningful technical description of the entire plant
2. Development status achieved:
    a. Reference plants under construction or in operation, with comprehensive, up-to-date presentation
    b. Certifications available
    c. Approvals and reviews by licensing authorities in other countries and status of these reviews
3. Basic data on the operation of the plant:
    d. Operating life
    e. Fuel element replacement cycle
    f. Expected availability
    g. Burn-up
    h. Expected MOX content

4. Descriptions of the safety systems, including information on the degree of redundancy and spatial separation of the individual facilities, as well as requirements for important safety-relevant systems and components
5. Information on the use of diverse facilities, in particular in safety control technology. Description of approaches to avoid or control CCF computer-based safety control technology
6. Information on the reserves of the individual designs with regard to external natural and civilizational influences beyond the design level (e.g. with regard to different load-time diagrams in the event of an aircraft crash)
7. Description of design basis accidents
8. Description of the design extension conditions (DEC) considered
9. Presentation of project-specific methods for demonstrating the practical exclusion of early or large releases
10. Presentation of measures to control severe accidents or mitigate their consequences
11. Analysis whether the various reference solutions already comply with the relevant European and international standards, in particular the requirements of WENRA and the IAEA
12. Discussion of the differences between country-specific regulatory requirements with regard to the design of structures, systems and components
13. Conclusion and requirements for the EIA report

For Austria, the analyses of possible incidents and accidents at the planned nuclear power plants are the most important part of the transboundary EIA procedure. However, the information on this subject in the scoping document is incomplete.

The (comprehensive) source terms to be used in the EIA should be verifiable based on existing accident analyses for the possible reactor options. In any case, the EIA should contain a comprehensible justification for the source terms used. As a matter of principle, possible beyond-design-basis accidents should be presented in the EIA regardless of their probability of occurrence.

The EIA report should contain the following information in order to enable a comprehensible assessment of the possible impact on Austria:

- Results of PSA analyses (Levels 1, 2 and 3) for each possible reactor option:
  - Probabilities/frequencies of core damage (CDF) and severe accidents with (early) large releases (LRF or LERF), including probability distribution (quantiles);
  - Specification of the contributions of internal triggers, internal and external events, as well as the proportions from operation and shutdown and from severe accidents in the fuel element storage pool to CDF, LRF and LERF;
  - Specification of the most important accident scenarios, including accidents in the fuel element storage pool;

    - Detailed description of measures to control severe accidents and mitigate their consequences;
    - Source terms for the most important release categories, including possible releases from the fuel element storage pool.
- A comprehensible description of the dispersion calculations and the determination of radiation doses for malfunctions and accidents:
    - Specification of the methods and programmes selected for the dispersion calculations;
    - Specification of the input parameters used in the dispersion calculation (source term, release height and duration, meteorological data) and their justification;
    - Specification of the results of the propagation calculations in the form of radiation doses and soil contamination (in particular the radionuclides Cs-137 and I-131);
    - Presentation of the probability distribution of the results, not just the calculated mean values.
    - In addition, it should be specified which international documents (IAEA, WENRA, EUR) are binding for the project.

It is particularly important that the accident scenarios described in the EIA comprehensively cover all possible reactor options.

7 TRANSBOUNDARY IMPACT

The transboundary impact for a release was calculated with a source term of 100 TBq as part of the scoping documents. However, the potential risk, regardless of the distance, cannot be correctly assessed as long as there is no proof that the envisaged reactors can and will comply with this limit of 100 TBq even under unfavourable circumstances.

With regard to the dispersion modelling, in addition to the maximum conceivable source terms for each of the envisaged reactors, the deposition to be expected under the most unfavourable weather conditions, regardless of the distance from the site, should also be determined. In addition to a consideration of the potential dose exposure for the population, any deposition above a value of 750 Bq/m2 should also be shown. According to Austrian regulations (as well as those for Germany and the Czech Republic), radiation protection measures must be taken ex officio above this limit. Although this does not necessarily imply a negative impact on the environment, it marks the start of activities to assess potential adverse effects on the environment, in particular on food production.

It would therefore be desirable for the dispersion calculation to explicitly include potential depositions and to refer to the radiation protection regulations of the potentially affected countries.

It is noted that the source term value of 100 TBq has been prescribed also in the Swedish legislation, though it is a kind of “safety goal” rather than an actual physical limit of what could be released during a severe accident. In the view of the experts, the discussion on the severe accidents contained in the EIA report should not necessarily select the most limiting (highest imaginable) release category. There are accident scenarios that would have a (significantly) lower probability, but would lead to a release that is 1-2 orders of magnitude higher than the 100 TBq used in the transboundary assessment. Just as comparison, in the Fukushima accident, the estimate for release of Cs-137 was about 17 PBq.

It is stated in the scoping document that the modelling uses conservative assumptions to assess the fallout and resulting radiation doses. This statement cannot be confirmed by the experts

It is therefore recommended that the EIA report should describe the amount of radioactivity released in case of a severe accident – including a failure of containment and/or filtered venting (if foreseen).

With using this source term for a release during a severe accident, the dispersion model should not only describe the doses for the population concerned, but also the deposition imaginable using weather data for the minimum of one year.

The distance of approximately 940 km between Ringhals and Austrian territory nominally exceeds the suggested radius of the Ingestion and Commodities Plan-

ning Distance (ICPD) defined in the IAEA general safety requirements. This radius is defined as "Area around a facility for which emergency arrangements are made to take effective emergency response actions following the declaration of a general emergency in order to reduce the risk of stochastic effects among members of the public and to mitigate non-radiological consequences as a result of the distribution, sale and consumption of food, milk and drinking water and the use of commodities other than food that may have contamination from a significant radioactive release." [IAEA Safety Standard: Preparedness and Response for a Nuclear or Radiological Emergency, GSR Part 7]

Nevertheless, the EIA report is focusing on the doses to an individual person, rather than other parameters of specific interest to Austria, in particular the deposition of radionuclides (Cs) on the ground. It is also worth noting that contamination can have different effects depending on the time of year and land use. Even if the doses to the population from a possible radioactive release are small, the fact that protective measures have to be activated classifies a nuclear accident in a plant that is relatively distant from Austrian territory still as an important event.

Historical data on the Chernobyl and Fukushima accidents show that accidents may have consequences far beyond those predicted during the planning process. Therefore, planning for an emergency should consider possible effects of a large-scale accident with a potential for contamination even far beyond emergency planning zones and distances defined for a specific nuclear facility.

In conclusion, 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. This should be done for each of the envisaged reactors and reactor types. If more than one unit is concerned, accidents and their releases at multiple units should be calculated as well.
2. Detailed description of severe accident scenarios and their sequences, and the resulting estimated source terms for each of those (not just for 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;
5. Calculation of possible deposits of radionuclides in Bq/m2, additionally to the resulting doses to the population;
6. Discussion on relevant assumptions for the dispersion calculation and their justification;
7. Resulting probability distribution of the radiological impact, covering all cases;

8 SPENT FUEL AND RADIOACTIVE WASTE

The amount of radioactive waste generated during the operation of the plants strongly depends on the types and number of reactors to be built.

The EIA report should therefore specify the corresponding quantities of waste from operation for each of the planned reactors.

The question of interim storage of spent fuel elements should also be addressed. This raises the question of whether and in what form interim storage is planned at the site.

9 GLOSSARY

Bq ..... Becquerel

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

MW ..... Megawatt

MWe ..... Megawatt electric

MWth ..... Megawatt thermal

NPP ..... Nuclear power plant

PBq ..... Petabecquerel

SSC ..... System Structures & Components

SMR ..... Small and Modular Reactor

TBq ..... Terabecquerel

WENRA ..... Western European Nuclear Regulators' Association

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