Answers to questions raised by Austria in the frame of the Public Consultation for the EIA LTO Doel 12

Reminder of the ongoing procedure : The project of the Belgian State is to extend the lifetime of the Doel 1 and Doel 2 nuclear power reactors by ten years. In order to be executed, this project must be authorized by several authorities: the Belgian State and the safety authority.

The current consultation procedure concerns the authorization to be granted by the Belgian state. The outcome of this authorization process is a law allowing the lifetime extension.

Besides the law that allows the lifetime extension, there is a separate independent procedure with the safety authority where, in the framework of the periodic safety review, the long term operation is assessed and the necessary modifications need to be approved.

The operation conditions and thus the safety rules to be followed to operate the reactors lies within the responsibility of the Safety Authority.

Questions from Austria

1. **Topic:** Procedure and alternatives **Reference:** F1

Question :

Wie werden die Ergebnisse der UVP bis zum Ende der Laufzeit 2025 Berück-sichtigung finden?

Translated Question :

How will the results of the EIA be taken into account by the end of the 2025 term?

Answer :

We understand this question as how the Environmental Impact Assessments will be taken into account by the end of 2025. However, the Environmental Impact Assessment is limited to understand the impact of extending the working life of the Doel 1 and 2 nuclear reactors, over the period 2015-2025, i.e. the Project (postponement of desactivation) which is compared with the reference situation (desactivation).

2. Procedure and alternatives **Reference:** VE1

Recommendation :

Es wird empfohlen, dass die Ergebnisse der UVP in die Genehmigung der Laufzeitverlängerung einbezogen werden

Translated Recommendation :

It is recommended that the results of the EIA be included in the approval of the lifetime extension.

Answer :

The results of the Environmental Impact Assessment and the respective consultations will be sent to the federal legislator together with the preliminary draft law related to the postponement of the de-sactivation of the Doel 1 and Doel 2 nuclear reactors.

3. **Topic:** Spent fuel and radioactive waste **Reference:** F2

Question :

Wie ist der Status und der Zeitplan für die Errichtung des Zwischenlagers SF2?

Translated Question :

What is the status and timetable for the construction of the interim storage facility SF2?

Answer :

The SF² installation is not intended to be used for the storage of the spent fuel from Doel 1 and Doel 2. The SF² installation is built for the storage of the spent fuel from Doel 3 and Doel 4. See Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.6.3.2. and the answer to F3.

The SF² building has been recently licensed, with start of construction 2nd half of 2021 and completion by 2025.

4. **Topic:** Spent fuel and radioactive waste **Reference:** F3

Question :

Welche Auswirkungen könnte es auf die Zwischenlagerung der abgebrann-ten Brennelemente aus Doel haben, falls das SF2 nicht rechtzeitig in Betrieb ge-hen kann?

Translated Question :

What impact could it have on the interim storage of spent fuel from Doel if SF2 cannot be commissioned in time?

Answer :

The SF² installation is not intended to be used for the storage of the fuel from Doel 1 and Doel 2. The SF² installation is built for the storage of the fuel from Doel 3 and Doel 4. See Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.6.3.2. The fuel from Doel 1 and Doel 2 will be dry stored in fuel containers in the existing, licensed building SCG on the site of KCD which has sufficient storage room for the spent fuel of Doel 1 and Doel 2, including the LTO period.

5. **Topic:** Spent fuel and radioactive waste **Reference:** F4

Question :

Wie lange ist die Zwischenlagerung der abgebrannten Brennelemente aus Doel vorgesehen? (Auslegung des bestehenden Zwischenlagers SCG und des ge-planten Zwischenlagers SF2)?

Translated Question :

How long is the interim storage of the spent fuel elements from Doel foreseen? (Design of the existing SCG interim storage facility and the planned SF2 interim storage facility)?

Answer :

The SCG stores the spent fuel from D12; see Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.6.3.2: " *The existing capacity of the SCG is sufficient for the fuel elements produced as a result of the operation of KCD-1 and KCD-2 resulting from the Project. As a result, the SF2 project is only relevant to the operation of KCD-3 and KCD-4 and independent of the Project (LTO of KCD-1 and KCD-2).*" The duration of the storage depends on the availability of a solution for the definitive storage of spent fuel (which is in the authorities scope).

The current storage installation of SCG on the site of Doel is licensed for an unlimited period and will undergo a Periodic Safety Review every 10 years to demonstrate it is still compliant and safe for future storage of the spent fuel elements of Doel 1 and Doel 2 on site for as long as it is necessary.

6. **Topic:** Spent fuel and radioactive waste **Reference:** F5

Question :

Was ist vorgesehen, wenn zum Ende der Lebensdauer der Zwischenlager noch kein Endlager für abgebrannte Brennelemente zur Verfügung steht?

Translated Question :

What is envisaged if, at the end of the lifetime of the interim storage facilities no final repository for spent fuel elements is available?

Answer :

It is the responsibility of ONDRAF / NIRAS together with the Belgian Authorities to define the strategy and timeline for the final repository for spent fuel elements. The final repository is foreseen for 2080 at the earliest. The current foreseen lifetimes of the interim storage facilities are in line with this timing (including a margin). In case the geological repository would not be operational in time, interim storage will be prolonged. This can be realised through lifetime extension of existing facilities or through construction of a new facility.

7. **Topic:** Spent fuel and radioactive waste **Reference:** F6

Question :

Wann wird die Entscheidung Wiederaufarbeitung oder direkte Endlagerung getroffen?

Translated Question :

When will the decision be made on reprocessing or direct disposal?

Answer :

No timing has yet been fixed for this policy decision. ONDRAF/NIRAS has been given the task by the Federal Government to study the geological disposal of both spent fuel and reprocessed waste.

8. **Topic:** Spent fuel and radioactive waste **Reference:** F7

Question :

Sind für die Zwischenlagerung der radioaktiven Abfälle aus der Laufzeitver-längerung genügend Kapazitäten bei Belgoprocess vorhanden?

Translated Question :

Is there sufficient capacity at Belgoprocess for the interim storage of radioactive waste from the lifetime extension?

Answer :

The storage capacity at Belgoprocess is regularly assessed and communicated to the safety authorities, to comply with the legal requirements on the used storage capacity and on the required buffer storage capacity, taking into account future waste arisings declared by the waste producers, such as those from the Doel 1 and 2 life time extensions. This mechanism allows for timely decisions on the development of additional storage capacity, if and when needed.

9. **Topic:** Spent fuel and radioactive waste **Reference:** VE2

Recommendation :

Um die sichere Entsorgung von radioaktiven Abfällen und abgebrann-ten Brennelementen zu demonstrieren, sollten umfangreichere Informati-onen über Kapazitäten von Zwischen- und Endlagern zur Verfügung ge-stellt werden. Weiters sollten alternative Entsorgungsoptionen vorgestellt werden, falls diese Kapazitäten nicht rechtzeitig zur Verfügung stehen soll-ten.

Translated Recommendation :

In order to demonstrate the safe disposal of radioactive waste and spent fuel, more extensive information on the capacities of interim and final storage facilities should be provided. Furthermore, alternative disposal options should be presented in case these capacities are not available in time.

Answer :

Recent information on amounts and capacities of radioactive waste and facilities can be found in the recent joint convention report (NIRAS/ONDRAF & FANC website): 6th Review Meeting of the Convention on Nuclear Safety (fgov.be). It is the responsibility of ONDRAF / NIRAS together with the Belgian Authorities to define the strategy and timeline for the safe long-term management of all the Belgian radioactive waste, including the spent fuel elements if declared as waste.

Link : *https://fanc.fgov.be/nl/system/files/be-jc-6th-review-meeting.pdf*

10.**Topic:** Long term operation of the reactor type **Reference:** F8

Question :

Was war das Ergebnis einer erneuten Inspektion der problematischen Be-reiche der Injektionsleitungen während der Revision?

Translated Question :

What was the result of a re-inspection of the problematic areas of the injection pipes during the inspection?

Answer :

The result of the re-inspection of the problematic areas of the injection pipes is that there is no degradation detected. The Safety Authority confirmed this result. Follow up inspections are foreseen during next outages. There is no impact on the conclusions of the Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2.

11.**Topic:** Long term operation of the reactor type **Reference:** F9

Question :

Was sind die aktuellen Ergebnisse zur Versprödung der Reaktordruckbehäl-ter (RDB) in Doel 1&2 (Sprödbruchübergangstemperatur RTNDT, Sprödbruchsi-cherheitsnachweis)?

Translated Question :

What are the current results on the embrittlement of the reactor pressure vessels (RPV) in Doel 1&2 (brittle fracture transition temperature RTNDT, brittle fracture safety verification)?

Answer :

As part of the LTO Study phase, done before 2015, the TLAA (Time Limited Ageing Assessment) has been made of the RPV and the results were presented to the Safety Authority who have reviewed them as part of the approval process of the LTO file and confirmed that there is no issue for extending the operating lifetime for 10 years. The results are available at the FANC (Safety Authority).

See alo Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2 §1.6.1 *"The LTO report [Electrabel, 2012] shows that the aging processes and their potential consequences are under control. It is assured that the systems, structures and components will continue to function as intended during the extended operating period. It also raises the safety level of the plants to the highest possible level."*

As part of the LTO new external dose meters were installed during the LTO outage to follow up the fluency of the Reactor Pressure Vessel. Current follow up inspections and monitoring programs confirmed the results from the TLAA, i.e. that the RTNDT is well below the PTS criteria as defined using R.G.1.99 rev 2, Regulatory Position 2. These results were shared with the Safety Authority.

Link : https://fanc.fgov.be/nl/system/files/2012-06-30-electrabel.pdf

12. **Topic:** Long term operation of the reactor type **Reference:** F10

Question :

Ist eine systematische Bewertung der Auslegungsabweichungen von Doel 1&2 von den aktuellen internationalen Sicherheitsstandards und Anforderun-gen erfolgt?

Translated Question :

Has a systematic assessment of the design deviations of Doel 1&2 from current international safety standards and requirements been carried out?

Answer :

Yes. That is the exact definition of a Periodic Safety Reviews. Under the Belgian Nuclear Safety regulations, nuclear power plant operators must conduct a Periodic Safety Review at least once every 10 years, and this following the IAEA NS-G-2.10, now superseded by IAEA SSG-25 guideline. This process was concluded for Doel 1 and Doel 2 in 2015 covering the period 2015 - 2025. Also as part of the LTO Design evaluation a detailed analysis was performed and design improvements were identified and implemented.

See Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2 §1.6.1 *"Therefore, the definition of the proposed changes is the result of a long process of study and selection from among the possible alternatives, with a view to improving nuclear safety. By improving nuclear safety, there is less chance of nuclear damage and less chance of a discharge with environmental impact. The final choice is the subject of the LTO report [Electrabel, 2012]."*

Link :

https://fanc.fgov.be/nl/system/files/2012-06-30-electrabel.pdf

13.**Topic:** Long term operation of the reactor type **Reference:** F11

Question :

Welche Sicherheitssysteme und Severe Accident Management (SAM)-Systeme werden von den Blöcken gemeinsam genutzt?

Translated Question :

Which safety systems and Severe Accident Management (SAM) systems are shared between the units?

Answer :

A number of safety systems are common for Doel 1 and Doel 2.. These are the HP – Safety Injection pumps (4 pumps in total) , the Spray pumps (4 pumps in total) , Component Cooling System (4 pumps and 4 heat exchangers grouped in pairs). For severe accident conditions, multi-unit accident events have been considered. There is a system that assigns interchangeable emergency pumps and diesels to a particular plant in case of accident.
Link : https://afcn.fgov.be/fr/system/files/2011-10-31-electrabel-kc-doel.pdf

14.**Topic:** Long term operation of the reactor type **Reference:** F12

Question :

Inwieweit wurden internationale Dokumente (IAEA, WENRA) bei der Lauf-zeitverlängerung verbindlich angewandt?

Translated Question :

To what extent were international documents (IAEA, WENRA) bindingly applied in the term extension?

Answer :

IAEA (e.g. SSG-25) and WENRA documents (e.g. WENRA RL 2008 and WENRA RL 2014) which have been implemented in the Belgian legislation are binding.

15.**Topic:** Long term operation of the reactor type **Reference:** F13

Question :

Wann werden die WENRA Referenzlevel (RL) 2014 vollständig in das belgi-sche Regelwerk implementiert? Wann wird überprüft, ob Doel 1&2 die Anforde-rungen der WENRA RL 2014 erfüllt?

Translated Question :

When will the WENRA Reference Levels (RL) 2014 be fully implemented in the Belgian regulatory framework? When will it be verified that Doel 1&2 meet the requirements of WENRA RL 2014?

Answer :

The WENRA RLs 2014 have been fully implemented in Belgian Law,in the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations. This Royal Decree provides the modalities including the transitory regime to be compliant with its requirements.

The Royal Decree of 19th February 2020 requires the operators to carry out studies by June 2022 in order to determine whether its requirements are met.

Besides, after the Fukushima Accident, design improvements were identified through the Belgian Stress Tests, which were a precursor for WENRA RL 2014, and these design improvements are already implemented.

16. **Topic:** Long term operation of the reactor type **Reference:** F14

Question :

Sind inzwischen die Empfehlungen und Vorschläge der SALTO-Mission aus 2017 vollständig umgesetzt?

Translated Question :

Have the recommendations and suggestions of the 2017 SALTO mission been fully implemented?

Answer :

In the framework of the SALTO mission in February 2017, the IAEA review team raised 13 recommendations and suggestions for improvement.

(See information on the FANC website: https://afcn.fgov.be/fr/content/lafcn-publie-le-rapport-salto-de-doel-1-et-2)

In June 2019, a SALTO Follow-Up mission was conducted by IAEA to review the progress in the resolution of these issues.

The conclusions of this review were the following:

- 1 issue was assessed as insufficient progress to date
- 8 issues were assessed as satisfactory progress to date
- 4 issues were assessed as issue resolved

(See information on the FANC website: https://fank.fgov.be/de/news/internationale-experten-haben-bei-doel-1-und-2-eine-sicherheitsueberpruefung-durchgefuehrt)

All eight issues with 'satisfactory progress' have been resolved as foreseen in the final stage of the LTO outages of Doel 1 and Doel 2.

For the one issue with 'insufficient progress' at the time of the SALTO Follow-Up mission, a specific action plan has been put in place to take into account the formulated remarks by IAEA.

This action plan and the final resolution of all related actions has been presented to and approved by the FANC in May 2020.

In September 2020, the FANC has informed the IAEA LTO Program Manager about this evaluation and thus the final closure of the action plan in the framework of the SALTO mission.

Link :

https://fanc.fgov.be/nl/system/files/2019-11-14-doel-salto-fu-final-report-2-redacted-vdef.pdf

17.**Topic:** Long term operation of the reactor type **Reference:** F15

Question :

Welche technisch möglichen Verbesserungen zur Erfüllung moderner Si-cherheitsanforderungen wurden für Doel 1&2 im Rahmen der Laufzeitverlänge-rung als nicht „vernünftig machbar" angesehen?

Translated Question :

What technically feasible improvements to meet modern safety requirements were not considered "reasonably practicable" for Doel 1&2 under the lifetime extension?

Answer :

For all identified Main Safety Issues (MSI), analyses were performed to identify technically feasible solutions to tackle the issue and to select the best possible solution, taking into account the criterion called Core Damage Frequency (CDF) reduction and other criteria such as technical feasibility and associated costs (see Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.7.1*). "This process is made with the Safety Authorities. For the details of the chosen solutions, we refer to the LTO Doel 12 Technical Report as mentioned in the references of the EIA*".

The only proposed improvement which was not reasonably practicable to be implemented, was the separation of the DC power supplies. It would be difficult to achieve this separation since it would require changes throughout the whole plant.
The PSA result demonstrates that this electrical base concept of Doel 1-2 does not contribute significantly to the CDF.
Link :

https://fanc.fgov.be/nl/system/files/2012-06-30-electrabel.pdf

18.**Topic:** Long term operation of the reactor type **Reference:** F16

Question :

Welche Maßnahmen standen auf der „Long List of Concerns“? Welche Maßnahmen standen auf der „Short List of Main Safety Issues“ und welche da-von wurden umgesetzt? Nach welchen Kriterien wurde das jeweils entschieden?

Translated Question :

Which measures were on the "Long List of Concerns"? Which measures were on the "Short List of Main Safety Issues" and which of these were implemented? What criteria were used to decide on each of these?

Answer :

The selection of the Main Safety Issues (MSI) is a process based on safety studies, including a criterion called Core Damage Frequency (CDF) reduction (see Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, § 3.4.7.1) together with other criteria such as technical feasibility and associated costs. This process is made with the Safety Authority. For the details of the chosen implemented solutions, we refer to the LTO Doel 12 Technical Report as mentioned in the references of the Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2.

Link :

https://fanc.fgov.be/nl/system/files/2012-06-30-electrabel.pdf

19. **Topic:** Long term operation of the reactor type **Reference:** F17

Question :

Wurden bereits alle Maßnahmen aus dem Aktionsplan für das LTO-Projekt umgesetzt?

Translated Question :

Have all the measures in the action plan for the LTO project already been implemented?

Answer :

Yes all the actions have been implemented, the status is available on the FANC website in the end status report LTO Doel 12.

Link :

https://fanc.fgov.be/nl/system/files/2020-05-29-10010965229-00-bijlage_-syntheserapport-lto-d12-v0-200429-def.pdf)

20. **Topic:** Long term operation of the reactor type **Reference:** VE3

Recommendation :

Es wird empfohlen, technisch verfügbare Sicherheitsverbesserungen zur Verhinderung von Unfällen umzusetzen.

Translated Recommendation :

It is recommended to implement technically available safety improvements to prevent accidents.

Answer :

This principle is embedded in the Belgian Nuclear Regulatory Framework, as part of the "nuclear safety objective" defined in the Royal Decree of 9 October 2018 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations. Also, each NPP is subject to a Periodic Safety Review at least every 10 years where potential improvements to further prevent accidents can be identified. This process is reviewed and challenged by the Belgian Safety Authority. As part of the PSR (following IAEA NS-G-2.10 now superseded by IAEA SSG 25) the selected Needs and Opportunities for Improvement are identified and implemented as part of the PSR implementation plan, for which a timetable is developed, and approved by the Safety Authority.

Link : https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

21.**Topic:** Long term operation of the reactor type **Reference:** VE4

Recommendation :

Es wird empfohlen, alle Anforderungen des WENRA Referenzlevels F zu erfüllen. Bei Abweichungen sollten die Gründe dafür erläutert werden.

Translated Recommendation :

It is recommended that all requirements of WENRA Reference Level F be met. In case of deviations, the reasons should be explained.

Answer :

The operator will comply with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011, featuring all WENRA reference levels, in accordance with the modalities as set by the Royal Decree.

22.**Topic:** Long term operation of the reactor type **Reference:** VE5

Recommendation :

wird empfohlen, die folgenden weiteren Informationen zur Verfü-gung zu stellen:

a. Detaillierte Beschreibungen der Sicherheitssysteme, einschließlich Angaben zu Anforderungen an die wichtigen sicherheitsrelevanten Systeme und Komponenten. Darüber hinaus detaillierte Beschrei-bung der Maßnahmen, die zur Beherrschung schwerer Unfälle bzw. zur Abmilderung ihrer Folgen getroffen wurden.

b. Angaben zu den angewandten nationalen Anforderungen und inter-nationalen Empfehlungen.

c. Nachvollziehbare Darstellung und Gesamtbewertung aller Abwei-chungen vom aktuellen Stand von Wissenschaft und Technik. Diese Darstellung sollte beinhalten:

 Alle Abweichungen von den heutigen Anforderungen an Redun-danz, Diversität und Unabhängigkeit der Sicherheitsebenen.

 Unvollständigkeit der verwendeten Datenbasis und Anlagendoku-mentation.

 Darstellung aller sicherheitstechnischen Bewertungen bzw. Para-meterfestlegungen durch persönliche Begutachtungen ("enginee-ring judgement").

 Abweichungen vom Stand von Wissenschaft und Technik hinsicht-lich der verwendeten Nachweisverfahren, der technischen Ab-schätzungen und Berechnungsverfahren.

Verfügbare Sicherheitsmargen für die einzelnen sicherheitsrele-vanten Komponenten (insbesondere für die Reaktordruckbehälter) und deren jeweilige alterungsbedingte Veränderungen gegenüber dem Ausgangszustand.

Translated Recommendation :

It is recommended to provide the following additional information:

a. Detailed descriptions of the safety systems, including information on requirements for the important safety-relevant systems and components. In addition, detailed description of the measures taken to control serious accidents or to mitigate their consequences.

b. Information on the national requirements and international recommendations applied.

c. Comprehensible presentation and overall evaluation of all deviations from the current state of science and technology. This representation should include:

° Any deviations from current requirements for redundancy, diversity, and independence of safety levels.

° Incompleteness of the data basis and plant documentation used.

° Presentation of all safety-related evaluations or parameter definitions by personal assessments ("engineering judgement").

° Deviations from the state of the art in science and technology with regard to the verification methods used, the technical estimates and calculation methods.

° Available safety margins for the individual safety-relevant components (in particular for the reactor pressure vessels) and their respective age-related changes compared to the initial state.

Answer :

This request for information is very broad, not specific enough to allow a concrete response and is likely to involve undisclosable classified information. In any case, it goes beyond the scope of the EIA.

As explained in the preamble of this document, the procedure and the information relating to the safety of installations is the responsibility of the Belgian Safety Authority. Such information is included in the safety report.

The safety report and the EIA follow different objectives. The safety report aims to validate compliance with the safety national and international requirements and recommendations which define all the technical and organisational measures that must be taken at all stages of the design, construction, operation and decommissioning of the plant of nuclear installations in order to avoid accidents and to limit their consequences if they should nevertheless occur. The EIA aims to study the environmental impacts that the project is likely to have both in normal operation and in accidental situations.

23.**Topic:** Accident analysis **Reference:** F18

Question :

Wie lauten die Quellterme der in der PSA Level 2 berechneten auslegungs-überschreitenden Unfälle?

Translated Question :

What are the source terms of the design-basis accidents calculated in PSA Level 2?

Answer :

The PSA Level 2 of Doel 1/2 considers the following categories for grouping the source terms of all accidental scenarios :

- small releases less than 0.01% of the initial core inventory
- medium releases between 0.01% and 0.1% of the initial core inventory
- large releases between 0.1% and 1% of the initial core inventory
- very large releases above 1% of the initial core inventory

Besides, these categories are assessed for the different classes of radionuclides released.

24.**Topic:** Accident analysis **Reference:** F19

Question :

Was ist die technische Begründung für den BDBA, der für die Berechnung möglicher grenzüberschreitender Auswirkungen gewählt wird? Wieso wird die-ser Unfall als abdeckend – auch für den Absturz eines Flugzeugs – angesehen?

Translated Question :

What is the technical justification for the BDBA chosen for the calculation of possible cross-border effects? Why is this accident considered to cover also the crash of an aircraft?

Answer :

See justification developed in Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.7.1.

Calculations demonstrating the representative character of the radiological source term of the selected scenario for the BDBA sequences, using the different available PSA models, were made and reviewed by the Safety Authority, to demonstrate the appropriate choice of the BDBA (Complete Station Black-Out, CSBO). The representative character of the radiological source term and radiological consequences of this BDBA scenario compared to the scenario of a realistic accidental airplane crash was also demonstrated and shared with the Safety Authority.

For all other accident analyses mitigation measures are implemented to decrease the accident probability and consequences.

25.**Topic:** Accident analysis **Reference:** F20

Question :

Wie soll ein Durchschmelzen des Fundaments infolge eines Kernschmel-zunfalls verhindert werden?

Translated Question :

How is a meltdown of the foundation due to a core meltdown to be prevented?

Answer :

In the early 2000, severe accident management guidelines have been implemented to mitigate core meltdown accidents. At the same period a cavity flooding device has been installed at units D12 to allow water from the sump to enter the reactor cavity pit to enable quenching the corium in case of a severe accident leading to a potential vessel failure.
Link : https://afcn.fgov.be/fr/system/files/2011-10-31-electrabel-kc-doel.pdf

26.**Topic:** Accident analysis **Reference:** F21

Question :

Warum wird im Rahmen der UVP kein Unfallszenario mit Containment-By-pass berechnet?

Translated Question :

Why is no accident scenario with containment bypass calculated in the EIA?

Answer :

See justification on the envelope case, in Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.7.1 and answer to question F19. Concerning accident scenario with Containment bypass, in case of DEC-B, it has been demonstrated that this scenario is practically

eliminated as requested by the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations.

27.**Topic:** Accident analysis **Reference:** F22

Question :

Wurde im Rahmen des UVP-Verfahrens der Absturz eines repräsentativen kommerziellen Linienflugzeugs und eines repräsentativen Militärflugzeugs ana-lysiert oder wurde stattdessen ein alternatives Ereignis in Betracht gezogen? Welche Flugzeuge wurden als repräsentativ bestimmt?

Translated Question :

Did the EIA process analyze the crash of a representative commercial airliner and a representative military aircraft, or was an alternative event considered instead? Which aircraft were determined to be representative?

Answer :

An alternative event was considered as it was demonstrated by safety studies that the aircraft crash accident is covered by the CSBO scenario with regards to the radiological consequences, see Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, §3.4.7.1. This demonstration has been shared with the Safety Authority. The aircraft characteristics are legally classified due to information related to the physical protection of the NPP.

28.**Topic:** Accident analysis **Reference:** F23

Question :

Ist bereits und wird eine DEC-B-Analyse durchgeführt, um vernünftig machbare Maßnahmen zu identifizieren, um die Folgen signifikanter Brenn-stoffschäden oder Bedingungen abzuschwächen, die zu frühen oder großen ra-dioaktiven Freisetzungen führen könnten, soweit solche Schäden oder Zustände nicht mit einem hohen Grad an Vertrauen als extrem unwahrscheinlich einge-stuft wurden?

Translated Question :

Has a DEC-B analysis been and will be performed to identify reasonably feasible measures to mitigate the consequences of significant fuel damage or conditions that could result in early or large radioactive releases, to the extent such damage or conditions have not been determined to be extremely unlikely with a high degree of confidence?

Answer :

A DEC-B analysis has been performed and is under instruction with the Safety Authority in accordance with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations.

29.**Topic:** Accident analysis **Reference:** VE6

Recommendation :

Es wird empfohlen, die WENRA-Sicherheitsziele für neue KKW zu ver-wenden, um vernünftig machbare Sicherheitsverbesserungen für Doel 1&2 zu identifizieren. Auch wenn die Wahrscheinlichkeit eines Unfallszenarios sehr gering ist, sollten alle zusätzlichen, vernünftig machbaren Sicherheits-verbesserungen zur Verringerung des Risikos umgesetzt werden. Es wird empfohlen, für diesen Ansatz das Konzept des praktischen Ausschlusses für Unfälle mit frühen oder großen Freisetzungen zu verwenden.

Translated Recommendation :

It is recommended that the WENRA safety objectives for new NPPs be used to identify reasonably feasible safety improvements for Doel 1&2. Even if the probability of an accident scenario is very low, all additional reasonably feasible safety improvements to reduce the risk should be implemented. It is recommended that the concept of practical exclusion for accidents with early or large releases be used for this approach.

Answer :

As part of the LTO Design area, one of the pillars is a benchmark with New NPP's. The analysis (https://fanc.fgov.be/nl/system/files/2015-07-03-electrabel.pdf) has lead to some improvement projects which were implemented as part of the Doel 1and Doel 2 LTO programme, in line with WENRA safety objectives. Besides, as mentioned previously, design improvements identified in the Belgian Stress Tests performed after Fukushima, were also implemented.

As explained above, the WENRA RLs 2014 have been fully implemented in Belgian Law,in the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations. This Royal Decree provides a transitory regime to be compliant with its requirements. The Royal Decree of 19th February 2020 requires the operators to carry out studies by June 2022 in order to determine whether its requirements are met.

30.**Topic:** Accident analysis **Reference:** VE7

Recommendation :

Es wird empfohlen, die folgenden Informationen über Störfallanaly-sen und die Ergebnisse der PSA (Level 1 und 2) bereitzustellen, um nach-vollziehbar beurteilen zu können, ob Österreich potenziell betroffen ist:

- Kernschadenshäufigkeit (CDF) und Häufigkeit großer (früher) Freisetzun-gen (L(E)RF)
- Beitrag interner Ereignisse sowie interner und externer Gefährdungen zu CDF und L(E)RF
- Anteil der Kernschmelzunfälle, die zum Containmentversagen führen

 Liste der auslegungsüberschreitenden Störfälle (BDBAs) und der zuge-hörigen Quellterme

 Quellterme der BDBAs einschließlich Freisetzungen aus den Brennele-mentlagerbecken

 Zeitspannen zur Wiederherstellung der Sicherheitsfunktionen nach dem Verlust der Wärmeabfuhr und/oder Stations-Blackout und Cliff Edge-Ef-fekten.

 Maßnahmen, die zur Beherrschung schwerer Unfälle oder zur Minde-rung ihrer Folgen ergriffen wurden

Translated Recommendation :

It is recommended to provide the following information on incident analyses and the results of the PSA (Level 1 and 2) in order to be able to comprehensibly assess whether Austria is potentially affected:

* Core damage frequency (CDF) and large (early) release frequency (L(E)RF).

* Contribution of internal events and internal and external hazards to CDF and L(E)RF.

* Proportion of core meltdown accidents leading to containment failure

* List of beyond design basis accidents (BDBAs) and associated source terms.

* Source terms of the BDBAs including releases from the fuel pools

* Time periods to restore safety functions after loss of heat dissipation and/or station blackout and cliff edge effects.

* Measures taken to control major accidents or mitigate their consequences

Answer :

The Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, § 3.4.7.1 contains the expected radiological consequences for Austria in an accidental situation and the methodology that led to this result.

31.**Topic:** Accidents due to external events **Reference:** F24

Question :

Wurden im Rahmen des UVP-Prozesses und/oder im Rahmen der Verlän-gerung der Betriebserlaubnis für Doel 1&2 (LTO) die ursprünglichen Ausle-gungsgrundlagen in Bezug auf die Einwirkung von Naturgefahren systematisch überprüft?

Translated Question :

As part of the EIA process and/or as part of the extension of the operating license for Doel 1&2 (LTO), has the original design basis been systematically reviewed with respect to the impact of natural hazards?

Answer :

As part of the Belgian regulations, each NPP is subject to a Periodic Safety Review at least every 10 years. This process is reviewed and challenged by the Belgian Safety Authority. As part of the PSR (following IAEA NS-G-2.10 now superseded by IAEA SSG 25) the selected Needs and Opportunities for Improvement are identified and implemented as part of the PSR implementation plan, including with respect to the impacts of natural hazards. See also answer to F25.

Link : https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

32.**Topic:** Accidents due to external events **Reference:** F25

Question :

Wurden im Rahmen des UVP-Prozesses und/oder im Rahmen der Verlän-gerung der Betriebserlaubnis (LTO) für Doel 1&2 und/oder anderen Projekten neue Gefährdungsanalysen für Naturgefahren am Standort durchgeführt?

Translated Question :

Have new hazard analyses for natural hazards at the site been carried out as part of the EIA process and/or as part of the extension of the operating license (LTO) for Doel 1&2 and/or other projects?

Answer :

As part of the Belgian regulations, each NPP is subject to a Periodic Safety Review (PSR) at least every 10 years. This process is reviewed and challenged by the Belgian Safety Authority. The PSR contains a chapter dedicated to SF7 Hazards(following IAEA NS-G-2.10, now superseded by IAEA SSG 25) : *"The objective of the review of hazard analysis is to determine the adequacy of protection of the nuclear power plant against internal and external hazards with account taken of the actual plant design, actual site characteristics, the actual condition of SSCs and their predicted state at the end of the period covered by the PSR, and current analytical methods, safety standards and knowledge."* This assessment was performed in 2015 as part of the PSR - LTO for Doel 1 and Doel 2 and submitted to the Belgian Safety Authority. According to the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations, complementary analyses have been performed, including with respect to the impacts of natural hazards.

Link :

https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

33.**Topic:** Accidents due to external events **Reference:** F26

Question :

Falls neue Gefährdungsanalysen durchgeführt wurden: haben diese die ursprüngliche Auslegung der Anlagen bestätigt, oder wurden sicherheitsrele-vante Nachrüstungen notwendig?

Translated Question :

If new hazard analyses have been performed: did they confirm the original design of the equipment, or were safety-related retrofits necessary?

Answer :

The complementary analyses done following the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations lead mainly to the confirmation of the design basis or design extension conditions from previous PSR and Stress tests (seism, external flooding, extreme weather conditions) and some procedural improvements regarding extreme temperature were identified and implemented.

34.**Topic:** Accidents due to external events **Reference:** F27

Question :

Wurden bei der Auslegung von Doel 1&2 Einwirkungen von extremen me-teorologischen Ereignissen, besonders für Starkregen (Flash Flood), Ereignisse mit einem durchschnittlichen Wiederholungszeitraum von 10.000 Jahren be-rücksichtigt?

Translated Question :

Has the design of Doel 1&2 taken into account impacts from extreme meteorological events, especially for heavy rain (flash flood) events with an average recurrence interval of 10,000 years?

Answer :

Yes this has been taken into account. See PSR report on FANC website, as well as the "National final report on the stress tests of nuclear power plants" issued by FANC in September 2020. (see paragraph 3.1.3).

Link :

https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

https://afcn.fgov.be/fr/system/files/best-2020.pdf

35.**Topic:** Accidents due to external events **Reference:** F28

Question :

Entspricht die Auslegung der Kapazität des Drainagesystems des Standorts den Anforderungen, die sich aus einem Starkregen (Flash Flood) mit einer Wie-derkehrperiode von 10.000 Jahren ergeben?

Translated Question :

Does the design capacity of the site's drainage system meet the requirements resulting from a flash flood with a 10,000-year return period?

Answer :

This subject has been considered in frame of PSR and BEST. See PSR report on FANC website, as well as the "National final report on the stress tests of nuclear power plants" issued by FANC in September 2020. (see paragraph 3.1.3) *"At Doel, the licensee finalized its re-evaluation of the impact of heavy rains in 2014 and concluded that the site is satisfactorily protected against the potential impact of heavy rains."*

Finally requirements resulting from a flash flood with a 10,000-year return period has been successfully readdressed in frame of the project that has as objective to get compliancy with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations (considering a.o. WENRA RL 2014).

Link :

https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

https://afcn.fgov.be/fr/system/files/best-2020.pdf

36.**Topic:** Accidents due to external events **Reference:** F29

Question :

In den UVP-Unterlagen wird die Wahrscheinlichkeit eines Deichbruchs an der „kritischsten Stelle“ mit einer Wahrscheinlichkeit von einmal in 1.700 Jahren und die daraus resultierende Fluthöhe am Standort mit bis zu 60 cm Wasser-tiefe angegeben. Sind diese Werte im Einklang mit den Sicherheitserwartungen der WENRA (2021) in Bezug auf Naturgefahren, besonders mit der Festlegung der Eintrittswahrscheinlichkeit von 10-4 pro Jahr für Auslegungsstörfälle?

Translated Question :

In the EIA documents, the probability of a dike breach at the "most critical location" is given as once in 1,700 years and the resulting flood height at the site is given as up to 60 cm water depth. Are these values consistent with WENRA's (2021) safety expectations for natural hazards, particularly with the establishment of a 10-4 per year probability of occurrence for design basis accidents?

Answer :

Yes this is compliant. It is an outcome of the complementary analysis done as part of the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for nuclear installations.

Link :

https://afcn.fgov.be/fr/system/files/best-2020.pdf

37.**Topic:** Accidents due to external events **Reference:** F30

Question :

Ist der untersuchte „repräsentative auslegungsüberschreitende Störfall“ auch für auslegungsüberschreitende Erdbebenbelastungen repräsentativ? Wie groß ist die Sicherheitsmarge der Auslegung des Containments und der Anlagen zur gefilterten Entlüftung des Containments relativ zum Auslegungserdbeben?

Translated Question :

Is the investigated "representative beyond-design-basis accident" also representative for beyond-design-basis earthquake loads? What is the safety margin of the containment design and the containment filtered venting systems relative to the design-basis earthquake?

Answer :

Yes, the analysis of the maximum credible earthquake (MCE) has been performed. The results of the MCE determination for the Doel site is below 0,1 PGA. Indeed it has to be noted that the particular characteristics of subsoil layers between bedrock and surface make it impossible to go above >0,1g PGA..

As such there are significant safety margins on the containment design and the containment filtered venting systems relative to the design-basis and beyond design basis earthquake.

38.**Topic:** Accidents due to external events **Reference:** VE8

Recommendation :

Es erscheint unsicher, ob bei der Standortsicherheitsanalyse alle für den Standort relevanten Naturgefahren berücksichtigt wurden, wie das von WENRA (2021) gefordert und von WENRA (2015) weiter erläutert wird. Das Expert_innenteam empfiehlt die Verwendung der „Nicht erschöpfen-den Liste der Naturgefahren“ (WENRA 2015) als Ausgangspunkt, um sicher-zustellen, dass alle standortspezifischen Gefahren, die Doel 1&2 betreffen, berücksichtigt werden.

Translated Recommendation :

It appears uncertain whether all natural hazards relevant to the site have been considered in the site safety analysis, as required by WENRA (2021) and further explained by WENRA (2015). The expert team recommends using the "Non-Exhaustive List of Natural Hazards" (WENRA 2015) as a starting point to ensure that all site-specific hazards affecting Doel 1&2 are considered.

Answer :

In compliance with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for nuclear installations, the “Non-exhaustive list of Natural Hazards" (WENRA 2015) has been considered as a starting basis in the site safety analysis.

39.**Topic:** Accidents due to external events **Reference:** VE9

Recommendation :

Es erscheint unsicher, ob bei der Bewertung des Standorts auch alle Gefahrenkombinationen berücksichtigt wurden, wie das von WENRA (2021) gefordert und von WENRA (2015) weiter erläutert wird. Das Ex-pert_innenteam empfiehlt die Verwendung eines Gefahrenkorrelationsdia-gramms (z.B. Decker & Brinkman 2017) als Ausgangspunkt, um sicherzu-stellen, dass alle relevanten Kombinationen berücksichtigt werden.

Translated Recommendation :

It appears uncertain whether all hazard combinations have been considered in the assessment of the site, as required by WENRA (2021) and further explained by WENRA (2015). The expert team recommends the use of a hazard correlation diagram (e.g. Decker & Brinkman 2017) as a starting point to ensure that all relevant combinations are considered.

Answer :

In compliance with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for nuclear installations, hazard combinations have been taken into account for the assessment of the site, considering further independent, correlated, induced combinations of events.

The methodology is based on the ANSI/ANS 2.12: "Guidelines for combining natural and external man-made hazards at power reactor sites" uses a combination of deterministic and probabilistic arguments to obtain a list of screened in combinations of events. The probabilistic criterion is also used to characterize the combinations.

40.**Topic:** Accidents due to external events **Reference:** VE10

Recommendation :

Das Expert_innenteam empfiehlt die Neubewertung der Eintritts-wahrscheinlichkeit extremer Niederschläge, die zur Überflutung des Stand-orts führen, und den Vergleich der Ergebnisse mit der Kapazität des Drai-nagesystems. Die Niederschlagsintensität entsprechend der Eintrittswahr-scheinlichkeit von 10-4 pro Jahr sollte als Auslegungsgrundlage für die Ka-pazität des Abwassersystems herangezogen werden.

Translated Recommendation :

The expert team recommends re-evaluating the probability of occurrence of extreme precipitation leading to flooding of the site and comparing the results with the capacity of the drainage system. The rainfall intensity corresponding to the occurrence probability of 10-4 per year should be used as a design basis for the capacity of the drainage system.

Answer :

Yes this has been taken into account. See the "National final report on the stress tests of nuclear power plants" issued by FANC in September 2020. (see paragraph 3.1.3)

"At Doel, the licensee finalized its revaluation of the impact of heavy rains in 2014 and concluded that the site is satisfactorily protected against the potential impact of heavy rains."

Link : https://afcn.fgov.be/fr/system/files/best-2020.pdf

41.**Topic:** Accidents due to external events **Reference:** VE11

Recommendation :

Das Expert_innenteam empfiehlt die Aufrüstung der Kapazität der Abwassersysteme, um sicherzustellen, dass Niederschlagsintensitäten mit Eintrittswahrscheinlichkeiten von 10-4 pro Jahr nicht zu (a) dem Eindringen von Wasser in Gebäude führen, in denen sicherheitsrelevante Systeme und Komponenten untergebracht sind, (b) Überflutung der Untergeschoße solcher Gebäude führen.

Translated Recommendation :

The expert team recommends upgrading the capacity of the

drainage systems to ensure that precipitation intensities with probabilities of occurrence of 10-4 per year do not result in

(a) water intrusion into buildings housing safety-related systems and components,

(b) flooding of the basements of such buildings

Answer :

Yes this has been verified. See the "National final report on the stress tests of nuclear power plants" issued by FANC in September 2020. (see paragraph 3.1.3)

"At Doel, the licensee finalized its revaluation of the impact of heavy rains in 2014 and concluded that the site is satisfactorily protected against the potential impact of heavy rains."

Finally requirements resulting from a flash flood with a 10,000-year return period has been successfully readdressed in frame of the project that has as objective to get compliancy with the Royal Decree of 19th February 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations (considering a.o. WENRA RL 2014).

Link : https://afcn.fgov.be/fr/system/files/best-2020.pdf

42.**Topic:** Accidents due to external events **Reference:** VE12

Recommendation :

Das Expert_innenteam empfiehlt bei der Bewertung der Überflu-tungsgefahr durch die Schelde alle Kombinationen von relevanten, die Fluthöhe bestimmenden Prozessen wie etwa Flusshochwasser, Springti-den, Sturmfluten und Wellen zu berücksichtigen. (WENRA 2016a)

Translated Recommendation :

The expert team recommends considering all combinations of relevant flood height determining processes such as river floods, spring tides, storm surges and waves when assessing the flood risk from the Scheldt. (WENRA 2016a)

Answer :

Initial analyses have been performed as part of the Belgian Stress tests, and were complemented with additional studies in compliance with the Royal Decree of 19th Februrary 2020 which modifies the Royal Decree of 30 November 2011 on the Safety Requirements for Nuclear Installations considering the combinations as mentioned.

Link : https://fanc.fgov.be/nl/system/files/2015-11-30_ebl-psrii-doel-12-lto-synthese-report.pdf

43.**Topic:** Accidents due to the involvement of third parties **Reference:** F31

Question :

Was sind die Anforderungen an den Schutz von Doel 1&2 in Bezug auf den absichtlichen Absturz eines Verkehrsflugzeugs?

Translated Question :

What are the requirements for the protection of Doel 1&2 with respect to the intentional crash of a commercial aircraft?

Answer :

A specific analysis has been performed on this topic as part of the Belgian Stress Tests, and requirements are defined by the Safety Authority (information is legally classified due to information related to the physical protection of the NPP).

The resistance of Doel 1 and Doel 2 against representative airplanes has been demonstrated. Additional measures against consequences of aircraft crash have been implemented following the Belgian Stress Tests.

44.**Topic:** Accidents due to the involvement of third parties **Reference:** F32

Question :

Gegen welche Angriffe von außen müssen das Reaktorgebäude und an-dere sicherheitsrelevante Gebäude ausgelegt sein? Ist dieser Schutz trotz nach-teiliger Alterungseffekte noch gewährleistet?

Translated Question :

Against which external attacks must the reactor building and other safety-relevant buildings be designed? Is this protection still guaranteed despite adverse aging effects?

Answer :

This information is legally classified due to information related to the physical protection of the NPP

45.**Topic:** Accidents due to the involvement of third parties **Reference:** F33

Question :

Was waren die wesentlichen Ergebnisse der IAEO-Mission International Physical Protection Advisory Service (IPPAS), die 2019 durchgeführt wurde?

Translated Question :

What were the main outcomes of the IAEA's International Physical Protection Advisory Service (IPPAS) mission conducted in 2019?

Answer :

This information is legally classified due to information related to the physical protection of the NPP

46.**Topic:** Accidents due to the involvement of third parties **Reference:** F34

Question :

Wie wird die derzeitige Bedrohungslage für kerntechnische Anlagen in Bel-gien bewertet, welche Bedrohungsstufe besteht aktuell und was bedeutet dies für Doel 1&2?

Translated Question :

How is the current threat level for nuclear facilities in Belgium assessed, what is the current threat level and what does this mean for Doel 1&2?

Answer :

This information is legally classified due to information related to the physical protection of the NPP.

47.**Topic:** Accidents due to the involvement of third parties **Reference:** VE13

Recommendation :

Im UVP-Verfahren sollten die allgemeinen Anforderungen in Bezug auf den Schutz gegen den absichtlichen Absturz eines Verkehrsflugzeugs und andere Terror- und Sabotageakte dargestellt werden.

Translated Recommendation :

The EIA process should present the general requirements related to protection against the intentional crash of a commercial aircraft and other acts of terrorism and sabotage.

Answer :

This information is legally classified due to information related to the physical protection of the NPP A specific analysis has been performed on this topic as part of the Belgian Stress Tests, and requirements are defined by the Safety Authority.

Link :

https://fanc.fgov.be/nl/system/files/specificaties_stress_tests_fanc.pdf

48.**Topic:** Accidents due to the involvement of third parties **Reference:** VE14

Recommendation :

In Anbetracht der besonderen Bedrohungssituation in Belgien sollte den möglichen Unfällen durch Dritte (Terroranschläge oder Sabotageakte) eine hohe Priorität eingeräumt werden. Der Schutz vor potenziellen Cy-berangriffen und Innentätern sollte verbessert werden.

Translated Recommendation :

In view of the particular threat situation in Belgium, high priority should be given to potential accidents by third parties (terrorist attacks or acts of sabotage). Protection against potential cyber attacks and internal perpetrators should be improved.

Answer :

This information is legally classified due to information related to the physical protection of the NPP

49.**Topic:** Cross-border effects **Reference:** F35

Question :

Was ist der größte Quellterm, der in den probabilistischen Sicherheitsana-lysen (PSA) ermittelt wurde (unabhängig von seiner Wahrscheinlichkeit)?

Translated Question :

What is the largest source term identified in the probabilistic safety analyses (PSA) (regardless of its probability)?

Answer :

Given the answer to F18, the largest source term identified in the PSA Level 2 is associated to very large releases, meaning more than 1% of the initial core inventory.

50.**Topic:** Cross-border effects **Reference:** F36

Question :

Wie lauten die Ergebnisse der Ausbreitungsrechnung für diesen Quellterm? Es wird ersucht, diese Ergebnisse auch für österreichisches Staatsgebiet vorzu-legen. Es wäre zu begrüßen, wenn die Ergebnisse der Ausbreitungsrechnung mit dem österreichischen Katalog der Gegenmaßnahmen (siehe auch Tabelle 3: Werte für die landwirtschaftlichen Gegenmaßnahmen A07 (BMLFUW 2014), und mit dem österreichischen Gesamtstaatlichen Notfallplan (BMK 2020) vergleich-bar wären.

Translated Question :

What are the results of the dispersion calculation for this source term? It is requested to present these results also for Austrian territory. It would be welcome if the results of the dispersion calculation were comparable with the Austrian catalog of countermeasures (see also Table 3: Values for agricultural countermeasures A07 (BMLFUW 2014), and with the Austrian overall national emergency plan (BMK 2020).

Answer :

Detailed results are provided for neighbour countries of Belgium. (see Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2, § 3.4.7.1). At further distance, these coefficients are lower and resulting doses insignificant

“

Reference accident		Dose at the Dutch border [mSv]	License limits [mSv]
LOCA	Effective dose	0.28	2.7
	Thyroid dose	5.4	5.4
FHA at the fuel basin	Effective dose	0.46	1.5
	Thyroid dose	5.4	8.0
CSBO	Effective dose	0.45	none
	Thyroid dose	0.19	none

For the countries of France, Germany, Luxembourg, and the United Kingdom (bordering Belgium), dose calculations were performed based on the calculations done for the Dutch border based on the design-based accidents FHA and LOCA. These calculations show that the doses would be reduced by a factor of about 65 for France, 80 for Germany,120 for Luxembourg and 130 for the United Kingdom compared to the results at the Dutch border. For other countries that are further than 1000 km away from KCD-1 and KCD-2 (such as Sweden, Austria, Poland, Czech Republic, Denmark, and Ireland), the impacts are limited by the impacts evaluated at the Luxembourg border, i.e., at least 120 times lower than at the Dutch border, thus implying a nonsignificant radiological impact due to the design-based accidents [Tractebel, 2020d].”

The calculated effective dose at Luxembourg border for the CSBO based on the above, leads to the value of 0,00375 mSv. This calculated effective dose will be lower at the Austrian border because of further dilution effects due to the distance. Comparing this value at the Luxembourg border (conservatively) with the Austrian Emergency Plan, where the limit is 1 mSv over 2 days for persons younger than 18 years and pregnant woman (table 23) shows that no measures would have to be taken.

51.**Topic:** Cross-border effects **Reference:** VE15

Recommendation :

Es wird empfohlen, die grenzüberschreitenden Auswirkungen für ei-nen schweren Unfall mit Versagen des Containments bzw. mit Contain-ment-Bypass sowie für einen schweren Unfall mit einem Brennelement-schaden im Lagerbecken zu berechnen, und zwar unabhängig von deren ermittelter Eintrittswahrscheinlichkeit, solange diese physikalisch möglich sind.

Translated Recommendation :

It is recommended to calculate the transboundary impacts for a severe accident with containment failure or containment bypass and for a severe accident with fuel pool damage, regardless of their determined probability of occurrence, as long as they are physically possible.

Answer :

Calculations are made for envelope scenarios, in a deterministic way (regardless of event probability) as well as using the PSA models, leading to insignificant doses at further distance. (Environmental Impact Report : Doel Nuclear Power Station for the LTO of Doel 1 and Doel 2 § 3.4.7.1 and further)