Question / Comment	Answer
Does that imply that shutting down a safety system (in preparation of its dismantling) after a NPP's final shutdown and removal of spent nuclear fuel have to be approved case-by-case?	That is correct. After the final shutdown a SSCs might have 4 different status : • SAFE : SSC 'Important to safety' and which are considered in the safety demonstration of design basis accidents. • FUNC A : SSC 'Important to safety' but not included in the SAFE category. • FUNC B : SSC not 'Important to safety' but which is requested to function. • ABAN: An SSC that is no longer required to support plant activities. The declassification from SAFE and from FUNC-A must be approved by the FANC (or Bel V). A declassification from FUNB-B or ABAN can be done by the Licensee without approval. Bel V, however, has to approve for each circuit that this can be done without approval. Please note also that spent fuel will cool in the deactivation pools for 4-6 years after final shutdown.
Do you in your country collect consumer goods and products containing radioactive substances? Do you have any restrictions on the available disposal options at the end of their useful lifetime? If yes, what are the basis for such decision?	In the licencing procedure for consumer good containing radioactive substances, collection and disposal options have to be present to allow for a positive answer.
When do you expect to have a long-term management policy for spent fuel, nuclear fuel cycle waste, non power reactor waste and decommissioning liabilities?	A first policy decision on the long-term management of the high-level and longlived waste is being prepared by the Federal government. This first decision would define the long-term management option (geological disposal) and the principles of a future participative decisional process. In the future, additional decisions will be needed to define all elements of national policy (participative decisional process, conditions of retrievabilty and monitoring, spent fuel status, site selection).
Has knowledge on the design and construction for existing facilities influenced requirements? Please also clarify which requirements would be relevant for new sites.	According to the Belgium nuclear regulation - SRNI-2011 article 4, the licensee shall identify early in the design phase of a new facility any relevant national, international or internal return of experience to elaborate the nuclear safety demonstration of new facilities. The objective is to ensure that the safety demonstration meets the nuclear safety objectives defined in the regulation and consists in an adequate level of nuclear safety considering national and international best practices. Once the facility is in operation, the licensee must continue to evaluate any relevant operating experience from similar facilities, and improve the level of safety of the facility, if considered necessary. A dedicated process has been developed many years ago by the operator and its engineering to address this concern for existing and new facilities. For example, to elaborate the safety demonstration of the new dry interim spent fuel storage facilities "SF2" – § 5.1 Doel and Tihange facilities (4) – ENGIE Electrabel took into account the relevant return of experience coming from: - its own facilities, especially some return of experience coming from the "SCG" facility – § 5.1 Doel and Tihange facilities (3). For example, the monitoring system to measure the leaktightness of the casks is similar; - International return of experience collected from others operators with similar facilities in Europe on dedicated topic, especially on topics related to external events (extreme temperatures, ….); - And return of experience coming from casks providers for some specific technical issues point out in the safety demonstration. The Licensee must also take into account any evolution of the regulatory framework. In this case, the operator had to consider the nuclear safety requirements developed by WENRA and the requirements defined by the FANC in "new nuclear safety technical requirements dedicated to new facilities" ("Règlement Technique Objectifs de Sûreté Nucléaire pour les installations de classe I"). Compared to existing facility like the SCG, we slightly reviewed for example the Defense in Depth concept to further develop the Design Extension Condition events (DBC1/2/3/4/Design extension A/Design extension B/practically eliminated) and related studies. We also applied new graded approach for external hazards as defined by the authorities in a dedicated guidance. The oversight of the construction has also been performed in accordance with new FANC guidance.

Question / Comment	Answer
What are the timeframes for the societal consultation indicated in the section on transparency and participation?	Based on experience from similar projects abroad, the time between an initial policy decision on the principle of geological disposal and the implementation of this policy may be several decades. Numerous decisions are needed to determine, in particular, the choice of host rocks to be considered, the location(s) for implementation or the roles and responsibilities of the various stakeholders. It therefore seems prudent to divide the National Policy in several parts that are part of a gradual process leading to the implementation of the solution for the long-term management of radioactive waste. The first part will specify the solution for the long-term management of the radioactive waste. The last part will concern the choice of the site(s) where the solution will be implemented. The number, timing and nature of the other parts of the Policy, such as waste retrievability, controlability of the disposal system and knowledge transfer, cannot be finally and precisely determined at this stage.
E.4.1 states that “The operation of the FANC is entirely and directly financed by the companies, organisations or persons to whom it renders services.” Are there financial provisions if companies are in bankruptcy and FANC still needs to fulfil tasks with dedicated facilities?	The largest part of the FANC financial ressources comes from taxes payed by the operator of NPPs so that banckrupty of smaller licensees would not be significant on FANC revenues and FANC has a financial reserve.
G.2.2.a) states “Due to the high heat flux involved during the irradiation time, the böhmite (a type of aluminium oxide) corrosion layer grows and thermal stresses on the cladding may cause pieces of this crust to break loose, resulting in cladding consumption. Such corrosion pits causing fission products release have already been observed. These lead to the release of gaseous and volatile fission products.” Are there solutions or precautions for this problem? What is the foreseen handling of such leaking fuel assemblies and which measures are taken to avoid or reduce contaminations and radiation exposer in the building during transfer and wet storage of leaking fuel?	Fuel elements that are unloaded from the reactor remain at least 3 months in the reactor building sored under water (decay of most of the gaseous fission products and iodine isotopes). Fission products that would be released are evacuated by the normal treatment system. After each reactor cycle all elements that have been irradiated pass the wet sipping installation. Elements for which fission product release above a certain level is detected will no longer be irradiated. They also remain stored in the reactor building for three months. By experience, it is known that once the element is sufficiently cooled, no further release occurs. After 3 months the elements can be transferred (under water) towards the storage canal outside the reactor building where they are stored for a certain time (a few years) before they are transported to ORANO La Hague for reprocessing. Elements that have been leaking will be stored for a longer time before they are evacuated (agreement with ORANO). Additionally they are packed in an tight aluminium tube before placing them in the TN-MTR transport container. This is precautionary measure is introduced due to the fact that during the transport the temperature in the transport container increases.
A surface disposal facility for category A waste is under construction in Dessel. Is there an estimation on how much the construction, operation and closure of the facility will cost, including the 250 years monitoring time after closure?	The total cost of the surface disposal facility for category A waste is about : 2.054 MEUR (overnight cost EUR2021). The monitoring cost after closure is about 547 MEUR (overnight EUR2021). So, the total project cost including monitoring is about : 2.601 MEUR (overnight EUR2021).
1. What is today's understanding of the processes and conditions most signifant for the alkali-silica reaction (ASR)?	The research conducted on the non-conform waste confirms that the gel formation in the affected waste drums is due to an alkali-silica reaction (ASR); no other chemical process could be identified. The waste type itself (waste concentrates from Nuclear Power Plants) has such specific chemical characteristics (high salinity) that actual guidelines from construction engineering to avoid ASR are not sufficient to avoid ASR in the waste conditioning process. Also, the thermal treatment of these waste concentrates during the conditioning process affects the gel formation and together with the specific waste type it results in an outflowing gel and not in a severe cracking of the waste matrix In absence of detailed scientific knowledge all possible options for the long-term management were kept open in 2016, namely direct disposal without additional controls, direct disposal with additional controls, disposal with adapted design or full retreatment of the drums before disposal. Due to some delays in the research programme, the integration of all currently available information is still ongoing and will be finalized in the first half of 2022. The objective of this integration work is to re-analyze the four options and to check if some of those options are no longer viable and future R&D can thus be further focused on the remaining options.

Question / Comment	Answer
The report states: "ENGIE Electrabel launched the development of alternative conditioning processes for these types of waste" Question: 2. Please provide additional information on this alternative process.	For both concentrates and resins, alternative cement based conditioning processes are under development and they are expected to be qualified for mid-2025
It would be beneficial if the introduction included a statement of the prioritized challenge or challenges related to safety of nuclear and radioactive waste	This will be adressed and discussed during the Belgian national presentation at the next review meeting.
Which organization is responsible for record keeping during and following decommissioning?	The licensee has to keep track of the decommissioning activities during the whole traject, and has to send periodically related documents to the Safety Authorities, such as: - Yearly update of the dismantling safety case - Yearly progress report of the dismantling activities (activities, doses, ….) - Yearly reports concerning atmospheric discharges and/or liquid releases - Yearly reports about clearance of materials (quantities/characteristics…. At the end of the decommissioning, the licensee also has to summarise all the related activities in a final dismantling report to be transmitted and approved by FANC. This report gives an overview of the dismantling strategy, used techniques, clearance criteria and methods, quantities of radioactive waste produced, doses, REX, lessons learned, …. Also, the health physics department of the licensee has to keep records of his findings, decisions, …. related to nuclear safety. This register must be kept for 30 years, and has to be transferred to FANC when the licensee stops all its activities.
The text refers to siting considerations for existing facilities. If new facilities were to be constructed, would the requirements mentioned be continue to be relevant or would additional requirements or regulations apply?	No new nuclear site is currently envisaged. Siting of new waste disposal facilities is dealt with in section H, which are subject to specific siting requirements and processes.
ONDRAF / NIRAS has submitteed its adapted policy proposal to the Federal Government in septembre 2020 What are the adaptations?	The adapted policy proposal takes into account the results of the Strategic Environmental Assessment (SEA) procedure, in which a public consultation was organized (period April - June 2020) on the policy proposal for geological disposal in Belgium (without specifying any additional element of location) and in which official instances (amongst which the three regional governments) formulated an advice on this proposal. Belgium also received reactions form neighboring countries in this SEA procedure. Main elements from this SEA procedure that were integrated in the adapted policy proposal were : - the importance of the principle of reversibility in the decisional process, to allow flexibility in the light of future scientific, technological and societal developments and evolutions; - the importance of the involvement of all actors and stakeholders in the decisional process at the various national levels (federal, regional, local and supralocal) and in the context of transboundary impacts.
long term management policy is still to be defined what are the next steps toward a decision?	The next step is a decision by the Federal Government to be promulgated by Royal Decree.
management of the non-conform waste from NPPs (ASR affected waste) Could Belgium give more information on the R&D studies on a reconditionning process? How long will the ASR drum be stored before a safe reconditionning?	Concerning the long-term management of these non-conform drums, a dedicated research programme was launched in 2016. In absence of detailed scientific knowledge all possible options for the long-term management were kept open at that time, namely direct disposal without additional controls, direct disposal with additional controls, disposal with adapted disposal design or full reconditioning of the drums before disposal. For full reconditioning plasma treatment of these low-level waste drums is studied. RD&D will continue until a safe and accepted solution for these non-conform waste drums can be proposed. There is no specific deadline to come up with this final proposal, although there is neither the objective to postpone the proposal of a final solution. As a consequence, these non-conform drums are not foreseen for disposal in the first phase of the operation of the surface disposal facility and the dedicated interim storage facility for the non-conform drums that is being build foresees is designed for an operating lifetime of 75 years.

Question / Comment	Answer
The MOX fabrication building of Belgonucleaire were cleared and demolished in 2019 and the site in unconditionnaly released from regulatory control in 2019. What are the good pratices to be shared?	Good practices may be: - an integrated organization was set up to integrate contractors in the new Belgonucléaire organization for decommissioning; - the high degree of safety culture during operation of the plant, was maintained during decommissioning; - customized tents with protective shields were built around the gloveboxes to allow for cold and dry, hands-on cutting and dismantling; - a box school was set up to qualify all dismantling operations in a cold environment and to train the operators for the glove box dismantling; - training of the operators was very extensive, also in the controlled area, through a mentoring system that was closely monitored; - the dismantling started with a first, least contaminated building to gain experience; - a hot-to-cold strategy was applied, whereby the source term was removed as much as possible from the glove boxes before starting their dismantling; - no new buildings were constructed, to minimize the buildings to be cleared at the end of decommissioning; - very thorough decontamination of rooms and buildings allowed for clearance of the buildings, followed by conventional demolition; - complete removal of underground structures and contaminated soil, resulted in a clean site and a green field at the end of decommissioning.
The final decommissionning plan for the building B14 (2 cyclotrons) in Fleurus site was established by ONSF and approved by ONDRAF/NIRAS in october 2018. The decommissioning license was granted in August 2019. Could Belgium give more information on the end of decommissioning operations?	According to the current planning, the end of decommissioning operations is scheduled for mid-2028. The two cyclotrons will be dismantled by the end of 2023 and the ten shielded cells by the end of 2024. The dismantling of the activated concrete infrastructure (cyclotron's casemates and bunkers) will take place during the period 2024 – 2027. The deconstruction of the building will take place in 2028.
Belgium has clarified the interrelation between ONDRAF/IRAS and FANC since the last report. This progress is commendable.	Thank you for your comment.
It is stated that"For over 40 years, SCK-CEN and ONDRAF/NIRAS have been studying geological disposal.....In line with the reference scenario of obtaining a licence in 2050 it describes the broad lines of actions needed in the time frame 2021-2050." Do you plan to dispose B&C waste in the same repository? If so, why not consider the intermediate depth disposal of category B waste and the deep geological disposal of category C waste? In addition, what are the main contents of the broad lines of actions needed in the time frame 2021-2050?	A policy decision in Belgium on the long-term management of high-level and/or long-lived waste is being prepared. Based on more than 40 years of research in Belgium on geological disposal in poorly indurated clays, ONDRAF/NIRAS proposes geological disposal in Belgium for these waste types. At this stage, it does not dictate co-disposal of B and C waste, so both options, one single facility or two separate facilities, remain open. The R&D roadmap for geological disposal foresees the following main phases: 1. societal interaction phase to establish the future decisional process; 2. potential site screening phase; 3. final site characterization phase; 4. preparation of the license application phase. RD&D priorities in the coming years are as follows: 1. develop a generic safety case in order to train the ONDRAF/NIRAS staff members and start interaction with the safety authorities on regulatory requirements, guidance and expectations; 2. evaluate potential host rocks in Belgium based on the safety attributes agreed upon with the safety authorities; 3. societal research in support of a public debate to be launched, which should lead to a transparent decisional process for the coming milestones and decisions ; 4. guarantee the continuity of knowledge on Belgian waste and geological disposal, with still a focus on geological disposal in poorly indurated clays for research purposes as this has been studied for more than 40 years and a specific underground research laboratory in such a clay formation is available in Belgium. However, the transfer of knowledge to potential other host rocks is taken into account whenever possible and next phases in the project are being prepared.

Question / Comment	Answer
It is stated that "The user/holder can either transport these sources to ONDRAF/NIRAS as declared radioactive waste or, if it is stipulated in the contract, he can return them to the supplier/producer." How does ONDRAF/NIRAS manage/dispose the disused sealed sources?	The sources are transported to our waste processing facility (Belgoprocess, Dessel) for treatment and conditioning. The treatment process can be compaction, followed by conditioning with a cement mortar in a waste drum, or direct emplacement in a waste drum with cement mortar conditioning. In some cases sources are dismantled and the source capsules are placed in shielded containers, which are then placed in a waste drum with cement mortar conditioning. The choice of treatment and conditioning is made on the basis of the source characteristics (isotope, activity, dose rate, presence of contamination, dimensions). The goal of the treatment process is to reduce the volume of waste as much as possible, while restricting the exposure of operators to radiation and withing the limits of our treatment facilities. After treatment, the resulting waste is embedded in a concrete matrix in a 400 liter drum, which are stored at our waste processing facility pending final disposal. Due to their generally high specific activity, radioactive sources are not considered for surface disposal as low-level radioactive waste, but are intended for future geological disposal.
Please briefly describe the process of verification of the compliance with regulatory requirements regarding the employer of outside workers. What kind of document the regulatory authority does grant for the employer of outside workers?	The regulatory body grants no documents for outside workers. Management of subcontractors is a responsibility of the licensees. Outside workers must have a similar protection as workers of the licensee, in particular for dosimetry follow-up and requirements. A "dosimetry passport" is in place for outside workers, to ensure a follow-up of dosimetry within different facilities/licensees. See section VI of chapter 3 of GRR-2001 (http://www.jurion.fanc.fgov.be/jurdb-consult/consultatieLink?wettekstId=7460&appLang=fr&wettekstLang=fr). Other requirements for subcontractors and protection of outside workers also exist in the law of well-being at work (1996).
Does exist in the legal and regulatory framework provisions on the existing of strategy for management of RW from emergency? The licensee is obliged to develop and to implement a strategy for management of RW from emergency?	Yes, the Radiological and Nuclear Emergency Plan contains provisions to elaborate a framework for RW in emergency situations. This has to be agreed between the regulator and the RW agency.
Programme for geological disposal: Considering the principle to avoid imposing undue burden on future generations, the roadmap of the programme for geological disposal produced by ONDRAF/NIRAS in 2019-2020 is an important element of the implementation of the reference scenario that foresees obtaining a license in 2050. Since the national report has already been produced one year ago, could you provide an update of any progress that has been achieved with regard to the roadmap?	A policy decision in Belgium for the long term management of high-level and/or long-lived waste is in preparation. Based on more than 40 years of research in Belgium on geological disposal in poorly indurated clays, ONDRAF/NIRAS proposes geological disposal in Belgium for these waste types. An update of the roadmap will be performed when a policy decision is taken.
At present, Belgium has given up the use of nuclear energy to generate electricity and no longer builds new nuclear power plants. However, in order to meet the needs of domestic development, the use time of some nuclear power plants has been extended. Is there any possibility of extending the use time of nuclear power plants in the future? Wether the decommissioning for nuclear facilities only rely on a national policy nor on the basis of the results of periodic safety reviews?	On 18/03/22 the belgian government decided on the possibility to extend the exploitation of Doel 4 and Tihange 3 power plants with 10 years and will now discuss this with the operator Electrabel. Up to now the results of periodic safety reviews allowed to continue the exploitation of nuclear power plants.
At present, your country has put forward a series of remedial measures and built a special storage facility for the management of unqualified waste barrels. Does this facility have corresponding acceptance standards for unqualified waste barrels, or only accept the waste barrels that generate ASR? How does your country carry out the identification and quantity statistics of unqualified waste barrels?	Storage building 167X (the construction of which is on-going), is a purpose build storage facility for conditioned waste packages which are affected by ASR. Conditioned waste packages which no longer respect waste acceptance criteria due to a chemical reaction like ASR, are identified by measures put in place by the waste acceptance system developed by ONDRAF/NIRAS. These measures include a periodic visual inspection of individual waste packages and routine inspections carried out in the storage facilities. The visual inspection is limited to the exterior of the waste packages and documented using digital photographs. Waste packages showing visual non-conformities may undergo further inspections (e.g. opening of the packages and thermal imaging).

Question / Comment	Answer
In recent years, Belgium has carried out many decommissioning activities, including the decommissioning of reprocessing plants, fuel element plants and research reactors. What advanced decontamination technologies have been adopted during the process? How to deal with waste materials such as concrete after release?	In most cases, conventional decontamination technologies are used like scabbling, sand blasting and chemical decontamination. A more advanced decontamination technology was developed by SCK CEN based on electro-chemical and ultrasound cleaning of materials. Some contaminated metallic waste is sent for melting in a foreign dedicated facility for decontamination and recycling (e.g. Cyclife in Sweden). In Belgium, it is possible to perform conditional clearance (release) or unconditional clearance of waste materials. In both cases, the radiological impact of the waste on a representative member of the public should not exceed 10 µSv/year, taking the relevant exposure scenarios into account. In cases of conditional clearance, an authorization based on a radiological impact study is issued by the regulator FANC on the basis of article 18 of the GRRS-2001.
It is stated that "During a routine inspection in 2012 of conditioned low-level waste packages in storage at Belgoprocess, a yellow gel-like material was found on the outer surface of the lid of a waste package.....The gel-like substance was found on the whole of the surface of the concrete matrix."Will the presence of these substances affect the stability of the final disposal of the solidified body? How to deal with the yellow gel-like material?	Preliminary research at that time indicated that the gel-like material was probably the result of an alkali-silica reaction inside those drums. Concerning the long-term management of these non-conform drums, a dedicated research programme was launched in 2016. In absence of detailed scientific knowledge all possible options for the long-term management were kept open at that time, namely direct disposal without additional controls, direct disposal with additional controls, disposal with adapted disposal design or full reconditioning of the drums before disposal. Due to some delays in the research programme, the integration of all currently available information is still ongoing and will be finalized in the first half of 2022. The objective of this integration work is to re-analyze the four options and to check if some of those options are no longer viable and future R&D can thus be further focused on the remaining options.
It is stated that "In 1998, SCK CEN signed a contract with COGEMA (now ORANO NC) for the reprocessing at la Hague of the spent fuel that will be generated until BR2 stops operating. This was however suspended in 2006 and its continuation required a bilateral agreement between France and Belgium, signed on signed 25 April 2013 and ratified in 2014." Why the contract was suspended? What's the difference between the contract signed in 1998 and the bilateral signed in 2013?	As mentioned in the text the contract was suspended due to change in the French legislation. The French legislation requires a bilateral agreement between France and Belgium before to resume the transport for reprocessing.
As presented in figure 12 on page 59, compared to the 2017 National report, the Strategic Development part with 7 employees was created in the organization of the Bel V. What is the specific role of the Strategic Development part?	Due to the phase out of the Belgian nuclear units scheduled for 2025, the regulatory activities of Bel V are likely to decrease over the coming years; these will also require the development / reinforcement of certain skills and competences. This is why Bel V has created a new Strategic Development department to face these new challenges by developing new activities and strengthening the skills and competences necessary to ensure its future.
This sub-section mentions that "..... and the related cost evaluation are updated every 3 years to take the present economic conditions into account, the last one in 2019." How much is the estimated cost for decommissioning of each NPP unit in 2019? Is there any change from last review? What relevant operating experience (OE) is considered? Please describe the reason for consideration of the OE.	After the 2019 update, the provision for the cost of the Decommissioning, consisting of the Post Operationnal Phase and the Dismantling, of the 7 NPP's operated by Electrabel in Belgium on the sites of Doel and Tihange was 5740 MEUR. In 2018, before this up date, the provision for the decommissioning costs was 4910 MEUR. The main changes that have been included in the 2019 update were : - The integration in the dismantling of projects and modifications that have been realized since the last evaluation - The update of the costs for authorities - The integration of the latest return of experience and feed back - The financial calculation is based on declining discount rates to obtain a conservative estimate of the amount to be provisioned today in order to cover future expanses. In 2018 the provision was calculated with a discount rate of 3.5%, in 2019 with 3%. The relevant operating experience considered is mainly the lessons learned from the decommissioning of the NPP's in Germany. In that country a large number of power and prototype reactors, research reactors, and nuclear fuel cycle facilities have already been decommissioned. 8 nuclear power plants were shut down in 2011 with the remaining to follow in stages until 2022. Several facilities have already been dismantled completely, i.e. the plants were demolished and the sites were released and recultivated. Practical experience with decommissioning is available.

Question / Comment	Answer
This sub-section introduces the funding mechanism on research reactor decommissioning and spent fuel management. It mentions that "All dismantling costs for installations built and in operation before 1989 are covered by a special 'Technical Liabilities Fund', which is secured by the Federal State and managed by ONDRAF/NIRAS. All new technical liabilities after January 1989 are financed by the SCK CEN by means of setting up the necessary provisions." Why did the funding mechanism change after 1989? Has the fund been collected successfully so far?	After the final shutdown in 1986 of the BR3 reactor at the SCK CEN, decommissioning of the reactor had to be started. Due to lack of financing at the SCK CEN, the Federal state decided to take the full financial responsibility for the decommissioning of all the nuclear installations present at the site of SCK CEN at the end of 1988. Both funding mechanisms have operated successfully so far.
As stated on Page 89, "A preliminary decommissioning plan must be established at the design stage of new installations." One of the objectives of this decommissioning plan is to assess the costs generated by those operations. What operations are considered in the costing of decommissioning? What are the data sources of costs? How the uncertainties of costing are reduced?	The considered cost objects for a preliminary decommissioning plan are : - PRE-DECOMMISSIONING OPERATIONS o Preparation of decommissioning plan & licensing o Radiological surveys for planning and licensing - DECONTAMINATION AND DISMANTLING ACTIVITIES o On site decontamination activities o Dismantling activities o Workshop decontamination activities o Clearance special techniques o Radiological clearance measures o Nuclear recycling techniques o Personnel training - WASTE PROCESSING, STORAGE AND DISPOSAL (All-in costs: treatment & conditioning, interim storage, disposal, transport, on site management wastes, waste packages, ..) - SECURITY, SURVEILLANCE AND MAINTENANCE - SITE CLEAN-UP AND LANDSCAPING (including Demolition or restoration of buildings) - PROJECT MANAGEMENT, ENGINEERING AND SITE SUPPORT - OTHER COSTS (Taxes, Insurance, Authorities, Contingency, etc..) - EXTERNAL MANAGEMENT COSTS These cost calculations (based on unit costs and costs based on a percentage of other activities) are mainly based on feedback from completed and ongoing decommissioning projects in Belgium (Belgoprocess, SCK CEN, Belgonucléaire, FBFC-International, Research Reactor Thetis - University Gent, etc….). NIRAS/ONDRAF has developed his own database and tool for these calculations ("Decommissioning Management System", including "Inventories", "Unit costs decommissioning techniques", "Unit costs Wastes"). The experience is that the inventory (radiological, chemical and physical status) has a very important impact on the uncertainties. For older facilities, this has an important impact due to the lack of an accurate inventory (not all installations can be accessed, no destructive sampling is possible, import back-ground radiation so that accurate characterization measurements are not always possible, lack of information of incidents during exploitation, etc..). For recent new facilities, there is a more accurate follow-up and all measures will be taken to limit these uncertainties as much as possible.
As stated on Page 90, "Several mechanisms exist to consult neighbouring countries in case they are likely to be affected by a new facility, and provide them, with general data relating to the facility: The licensing process foresees the consultation of neighbouring countries even at local level." What are the existing mechanisms? What data is provided? How the local level is consulted? Do neighbouring countries participate in the monitoring of effluents from nuclear facilities?	The consultation mechanism is compliant with the EC Directives 2011/92/UE and 2014/52/UE, and Article 37 of EURATOM Treaty. The provided information is similar to that provided for the consultation in Belgium, including the whole license application and the environmental impact assessment report, which are also available on the FANC website. Bilateral consultations between the FANC and the foreign nuclear regulatory authorities are organized. The public and local authorities from the concerned municipalities may take part to the (public) consultation. Neighbouring countries do not participate in the monitoring of effluents. Since 2012, the radioactive releases from all Belgian nuclear and waste facilities with their calculated radiological impact are published annually on the FANC web site : http://afcn.fgov.be/fr/chercher?keyword=rejets&=Appliquer

Question / Comment	Answer
As stated in Page 126, "Organizing the transport of orphan sources on a yearly basis has several advantages with respect to the optimization of packaging and the costs for transport and waste treatment. In addition, an accumulation of radioactive sources at non-nuclear facilities is avoided." What methods or techniques have been used to optimize the cost of packaging, transportation and waste disposal? Please give some examples.	Storing orphan sources on the site where they are detected and organising one transport per year and per site, allows for the more efficient filling of waste drums, and less transports and administration overall than in the scenario where every orphan source would be immediately transported to the waste treatment facility after detection. At the same time, this strategy avoids the accumulation of orphan sources at a non-nuclear facility during several years. Otherwise, no specific cost optimisation techniques are applied.
Section F.3.2.b (page 70) states that under the Integrated Management System, “documented and described were all the processes in a process modeling tool with the focus on the interaction between the processes, the roles and responsibilities and the interaction with Belgoprocess and other stakeholders.” Have these results been published?	The processes and process documentation are described in a process modelling tool that was purchased for internal use. The information and descriptions also serve to explain the processes to stakeholders and auditors and can be integrated into several reports. However, the results have not been published.
Could you please clarify what are the established activity limits providing RW release from regulatory control? How this RW type is managed?	Activity limits providing unconditionnal RW release from regulatory control are exemption and clearance levels as specified in EC Directive 2013-59/Euratom, transposed in GRR-2001. Surface activity levels are defined in a FANC technical regulation (see http://www.jurion.fanc.fgov.be/jurdb-consult/consultatieLink?wettekstId=29474&appLang=fr&wettekstLang=fr), also based on EC publications. This waste is no more considered as radioactive waste and is managed as any non-radioactive waste. In application of article 18 of the GRR-2001 a licensee can apply for a conditional release of RW i.e. for a well defined waste management route and handling of the RW. The licensee has to demonstrate that the criteria in annex 1B of GRR-2001 are fullfiled a.o. a demonstration that the dose of the practice remains below 10 µSv/y.
There are three licensed storage facilities in Belgium for radium-bearing RW. Could you please clarify whether the waste will be retrieved from these facilities and put in final disposal? Are there acceptance criteria for the disposal of radium-bearing RW?	It is indeed foreseen to retrieve the waste from the licensed storage facilities and to put it in a final disposal facility. The next years (2022- 2024) a policy propsal for the long-term mamanegment by disposal for the radium-bearing radioactive waste will be prepared by ONDRAF/NIRAS. The waste acceptance criteria for the disposal of radium-bearing radioactive waste will be developed by ONDRAF/NIRAS after a national policy for disposal of this waste has been established.
What key studies have been planned to select a site and construct a geological disposal facility for RW, and to develop its safety case?	A policy decision in Belgium for the long term management of high-level and/or long-lived waste is in preparation. Based on more than 40 years of research in Belgium on geological disposal in poorly indurated clays, ONDRAF/NIRAS proposes geological disposal in Belgium for these waste types. A RD&D roadmap has been established, identifying the major milestones to achieve in the coming years. As a potential host rock has not yet been selected , RD&D priorities in the coming years are as follows: 1. develop a generic safety case in order to train the ONDRAF/NIRAS staff and start interaction with the safety authorities on regulatory requirements, guidance and expectations ; 2. evaluate potential host rocks in Belgium based on the safety attributes agreed with the safety authorities; 3. societal research in support of a public debate to be launched, which should lead to a transparent decisional process for the coming milestones and decisions for the long term management of these types of waste; 4. guarantee the continuity of knowledge on Belgian waste and geological disposal, with still a focus on geological disposal in poorly indurated clays for research purposes as this has been studied for more than 40 years and a specific underground research laboratory in such a clay formation is available in Belgium. However, the transfer of knowledge to potential other host rocks is taken into account whenever possible.
Due to the risk of alkali-silica-reactions,ENGIE Electrabel halted the conditioning of evaporator concentrates and ion exchange resins on its Doel site,what progress has made on the development of alternative conditioning processes?	For both concentrates and resins, alternative cement based conditioning processes are under development and they are expected to be qualified for mid-2025

Question / Comment	Answer
As stated on page 48, the EIA and SAR is required in the license application of nuclear facilities based on the article 6 of GRR-2001. What are the requirements of the content and format of these reports? What is the focus of the review?	The format and content of the EIA is consistent with the EU directives 2001/92/EU and 2014/52/EU, and in the relevant cases, with article 37 of the EURATOM treaty. The table of content of the SAR is derived from the WENRA -RHWG and WGWD reference levels. Elements of review include legal requirements, international norms and guides (IAEA) and good practices. An important reference is the FANC technical regulation on "Safety demonstration", which gives radiological objectives for different plant abnormal states (incidents, accidents of design basis and design extension).
Is Synatom not a licensee according to the Nuclear Legislation and therefore under the regulatory control of FANC?	Synatom is not a licensee according to the Nuclear Legislation because it does not operate any nuclear facility. It is a subsidiary of the power plant operator Electrabel, in which the Belgian State has special voting rights (golden share) in the board of governors. Synatom is the owner of the spent fuel of the Belgian nuclear power plants. Hence, its management is their competence and legal responsibility. Synatom has to comply with the obligations in respect of financial provisions for the management of the spent fuel, as set in the law of 11 April 2003 (“on the provisions for the decommissioning of nuclear power plants and the management of fissile material irradiated in these plants”). A Governmental commission, in which the FANC is represented as advisory member, has been established to supervise this decommissioning and spent fuel managment fund.
Are there requirements in the legal or regulatory framework concerning periodic safety reviews other than for Class I facilities?	No, there is no requirement for periodic safety review for lower risk facilities. However, licenses for these facilities are delivered by the FANC for a limited time, of maximum 15 years. After this term, the license has to be renewed, and consequently the safety of the installations is reassessed.
Which organization will be responsible for the planned 250 year long monitoring of the disposal facility for category A waste, i.e. the (current) licensee or will there be another form of institutional control?	NIRAS/ONDRAF will be responsible for the monitoring during the institutional control period.
Are control rods stored together with the fuel assemblies in the spent fuel facilities? Where are core instruments, e.g. neutron detectors, and similar ILW stored?	Control rods: The control rods are currently stored in the spent fuel pools of the units. They will not be stored in the DE/SCG buildings in the spent fuel casks, but it is intended to cut them and load them in special casks (Mozaik-type) for the mid-term storage. For the long term storage, the control rods (“category B” waste) will be loaded in thin shell containers (to be confirmed later). Non fuel and non control rods: For instance, the thimbles for flux plot are separated as “category A” (disposed of in the surface repository) & “category B” (stored together with the control rods). For the other elements related to non fuel and non control rods: same approach: the waste characterization will allow to determine their management route.
editorial comment: surface dosrate for waste packages should be <2 mSv/h (0.2 mSv/h), see L.2.1.d, p. 140	Thank you for this correction.

Question / Comment	Answer
Concerning the short-term management of the non-conform waste in the dedicated storage facility foreseen at the Belgoprocess site (storage building 167), could Belgium provide more details on the licensing process of this storage facility and about the storage safedty requirements (confinement, shieldings etc..)? Will non-conform drums be stored as is, or are there any special measures in place? Concerning the long-term management, it is reported that ONDRAF/NIRAS is currently studying four options and that in 2021 an integration of the information and research results obtained is foreseen. Could Belgium provide an update on this analysis? / At page 14 it is reported "For short-term management of (potentially) ASR-affected waste drums from the Doel NPP, a dedicated storage facility will be constructed at the Belgoprocess site (storage building 167), designed for an operating lifetime of 75 years, in order to isolate the non-conform waste drums."	Building 167X is being constructed to store the non-conform waste packages that are ASR-affected (gel outflow or increased risk of outflow). These packages will be stored such that they can be individually inspected and monitored (inspection camera on a telescope which is mounted on a bridge crane) and that interventions on these packages can be carried out. The bridge crane with telescope and camera can move through the storage building such that every stored 400-litre package can be inspected. A minimum of one inspection per package per year is the basis of design, which can be adjusted or increased if needed. Building 167X consists of two area's: one area where the waste is stored and another attached building next to the storage area for the technical facilities. The storage area consists of two storage halls for the 400-litre waste packages of low-level conditioned waste, and an intervention room for handling non-conform packages with a possible gel outflow. Buildings 167X is a Class I nuclear storage facility. The nuclear licence for the construction and operation of such facility is a Royal Decree. The nuclear licence specifies the conditions and requirements to be met in order to be able to build and subsequently operate the installation. The licence is valid for an indefinite period, with periodic (10-yearly) safety reassessments. Building 167X requires an environmental licence granted by the Flemish Region. The environmental licence covers the urban development section and the environmental section. The building 167X is subject to the EIA obligation (Flemish Government Decree 10/12/2004). For building 167X , a separate certification file for physical protection (security) will also be drawn up, in accordance with the legislation on the physical protection of radioactive material (Royal Decree 17/10/2011). In case gel leakage is detected by the camera system, the 400 litre package, stored in a rack, can be easily removed from the storage area with only a few other packages to be removed in the stack, due to the storage in racks. The rack and package is then taken to the intervention cell where manual cleaning with appropriate tools is performed. After cleaning the package and rack, these will be moved back to the storage area for further inspection in time, possible with more than one standard inspection per year. Concerning the long-term management of these non-conform waste packages, a dedicated research programme was launched in 2016. In absence of detailed scientific knowledge all possible options for the long term management were kept open at that time, namely direct disposal without additional controls, direct disposal with additional controls, disposal with adapted disposal design or full retreatment of the drums before disposal. Due to some delays in obtaining the research results, the integration is currently still ongoing and will be finalized in the first half of 2022. The objective of this integration work is to re-analyze the four options and to check if some of those options are no longer viable and future R&D can thus be further focused on the remaining options.
Could Belgium give more information about the dose limits for members of the public and for workers?	Dose limits for member of the public and workers are compliant with the EU Directive 2013/59/Euratom, i.e. 1mSv/y for the members of the public and 20mSv/y for the workers. Dose constraints are usually used, prescribed by the Regulatory Body or defined by the licensee hiself as part of the optimization principle. For example, ENGIE internal policy limits the dose for workers at 10mSv/y.
Could Belgium give more information on updates for the policy of BR1 spent fuel / At page 28 the Report describes the situation at 31 December 2019 about the BR1 reactor: it is still using its first fuel load and there is not yet a policy for its management.	The situation is currently unchanged. There is no national policy for the BR1 spent fuel which is still using its first fuel load. The reactor fuel is metallic uranium with an aluminum cladding and could still be operated as such for a few decades. Considering its chemically reactive nature, the long-term management of this spent fuel requires a specific solution which is still being studied.

Question / Comment	Answer
Could Belgium provide more details on ongoing process for Dessel surface disposal facility, in particular, about: - the design criteria (has a technical guide been developed?); - the public consultation; - the actual situation of this process and a timetable for future phases for the construction and operation of the facility. / At page 29 it is reported: "... The preliminary technical projects, developed from proposals drafted by ONDRAF/NIRAS, were integrated into larger projects (preliminary integrated projects), comprising a significant societal aspect. In its decision, the Council of Ministers specifically requested that ONDRAF/NIRAS continue to develop the integrated surface disposal project in Dessel, maintain the existing participative process and even extend it". Therefore, it is clear that the process for the design, construction and operation of a disposal facility for the category A waste is in a well advanced phase.	• the design criteria The design process consists of three stages. In a first stage, the design inputs (DI) are described. These are the specific elements that should be provided and the conditions that should be met, in order to develop a safe disposal system. In total, 27 design inputs have been derived from several sources: o requirements set in the regulatory framework, i.e. - the Belgian regulatory framework; - FANC guidelines, such as the guideline on earthquakes; - policy decisions, such as the eventuality of retrievability; - inputs from local stakeholders, such as the presence of a fixed roof structure during disposal operations; o the safety concept, particularly the different safety functions; o the design choices, such as the use of standardized monoliths as disposal packages; o the waste in itself – for example, care should be taken that the materials used are compatible with the waste. The safety objective and strategic safety orientations are met by establishing design inputs from the regulatory framework and the safety concept, among other things. In a second stage, each design input is transcripted towards one or several design requirements (DR) for the systems, structures and components (SSCs) important to nuclear safety. These are practicable instructions for a designer, such as desired characteristics of specific SSCs. In a third stage, it is verified which design requirements apply to the different SSCs important to nuclear safety. On this basis, conformity criteria are established. During implementation (at the construction site or during production) of the SSCs, these allow to check that the design requirements are met. The above is detailed in the safety report; a summary in English is available (Summary of the safety report for the near surface repository for category A waste at Dessel, Belgium - NIROND-TR 2019-12 E). • the public consultation Since the actual realisation of the repository is approaching, ONDRAF/NIRAS and the partnerships STORA (Dessel municipality) and MONA (Mol municipality) have drawn up an interim balance of the fulfilment of the conditions in 2019. A 'societal contract' was drawn up outlining the joint vision of ONDRAF/NIRAS, STORA and MONA on the further realisation of the project. It is a reaffirmation of ONDRAF/NIRAS' - and by extension, STORA and MONA's - commitment to permanently fulfil the conditions set at the time of acceptance of the disposal project. A commitment which, for that matter, spans several generations. This document should be seen as an important guide with concrete agreements. It sets out the course for a certain period and contains clear long-term promises. At the same time, there must be room to adjust the direction - taking into account the influence of changing insights or circumstances and under the condition of a joint agreement. A certain flexibility is necessary for the success of the project in all its facets. The 'societal contract' also explicitly states that permanent participation is a basic condition for accepting the repository and that its realisation is a shared responsibility in view of complying with the following basic principles: (1) knowledge and memory, (2) support and critical view, (3) openness and transparency, (4) independence and autonomy, (5) dialogue and interaction with the population. The evolution from designing together (co-design) to realising together (co-creation) is already in full swing, to culminate in the joint management (co-operation) of various project components, without prejudice to the role and legal responsibilities of each party involved. In order to adapt the role and operation of the partnerships to this changing situation and to a changing social environment, the organisation and internal operation of the partnerships is currently undergoing a thorough review and is being adapted to a new mission statement and to evolutions in the project and in (local) society. This is to ensure that the partnerships can fulfil their role as active, independent, low-threshold, transparent and open consultation platforms in the future and can help give substance to the basic principles for long-term participation. • the actual situation of this process and a timetable for future phases for the construction and operation of the facility. We plan to have a nuclear construction license in Q2/2023 and construction will start Q1/2024.

Question / Comment	Answer
Could Belgium explain if there are specific arrangements to ensure radiation protection for outside workers, that usually are exposed to radiation to various facilities?	Outside workers benefit from the same protection as a licensee worker. This includes health surveillance, individual protection means, radiation protection training and dosimetry. A "dosimetry passport" is in place for outside workers, to ensure a follow-up of dosimetry within different facilities/licensees. Arrangements also exist for workers working abroad. See section VI of chapter 3 of GRR-2001 (http://www.jurion.fanc.fgov.be/jurdb-consult/consultatieLink?wettekstId=7460&appLang=fr&wettekstLang=fr).
Could Belgium give more details about the workers and workplaces classification?	Worker classification: non-exposed workers (dose <1mSv/y) and exposed workers (dose <20mSv/y) Workplace classification: controlled area (dose >6mSv/y or contamination risk), supervised area (1mSv/y < dose < 6mSv/y), non-classified zones (same limit as for the public). See Chapter 3 of GRR-2001
As it is stated in the reference, fractures in the cemented waste matrix were discovered in 2018. Could you inform us regarding the findings of the analyses, and whether the ASR-gel mentioned earlier in the report (seen in A.2.2.) has any relevance in this regard, and if so, what kind of?	The analyses have yet to be performed due to delays in the transport of the drums to the research facility. Transport took place in February 2022, the analyses and interpretation of results are planned for 2022.
Have human activities as accidents of internal origin been considered on the discussed sites, and preventative measures taken? / Activities such as sabotage, or acts of staff with malicious intent.	Internal initiator events /failures have been taken into account in the design and for the operation of the considered facilities regardless of the origin (human or material) of the failure. Human activities (transports, aircarft, fire, explosions, ..) have been takent into account as external hazard. Since 2011, legislation regarding physical protection (security) is in place. Licensee of Class I facilities have to elaborate a physical protection plan which must be appoved by the FANC.
In relation to exempt/clearance waste, please, could Belgium provide information on limits and conditions to classify exempt/clearance waste? / At page 23 of the National Report the waste classification of radioactive waste is reported.	Cleared/exempted waste is no more considered as radioactive waste, and consequently not categorized as type A,B or C waste. Clearance and exemption levels are consistent with the EU Directive 2013/59/EURATOM.
Please, could Belgium provide an estimation of the costs, per cubic meter, for the near surface disposal of LLW and ILW? / At page 68 of the National Report it is reported about the “nuclear liabilities inventory” performed by ONDRAF/NIRAS.	The cost per m^3 of waste conditioned for surface disposal (i.e. waste drums or bulk waste emplaced in concrete containers, where m^3 refers to the external volume of the concrete containers or monoliths) is about 18 kEUR.
Could Belgium describe if in the procedure are considered measures to prevent accidental merging of sources in metal scrap facilities? And in the case, which provisions? / At page 126 it is mentioned that FANC, ONDRAF/NIRAS and the certified inspection body have worked out a procedure for managing orphan sources.	Non nuclear industrial facilities processing material flows with a risk of containing orphan sources, like metal scrap facilities, have to meet minimum requirements regarding staff training, vigilance measures and action plan if a source is detected. The facilities with a risk of being confronted with an orphan source are obliged to install a portal monitor system. (Royal Decree on the tracing of radioactive substances in certain material and waste flows and concerning the management of facilities sensitive to orphan sources). Every incoming and outgoing material batch must be screened for the presence of radioactive substances. Companies, with a significant risk of melting radioactive sources have grapples equipped with a radiation detection system and/or have detection systems on the filter dust discharge. The tasks of the involved parties (FANC, ONDRAF/NIRAS, certified radiation expert) are described in a procedure. The FANC organizes yearly training courses to inform employees from the concerned sector about the procedure to follow in case of detection of an orphan source.

Question / Comment	Answer
Could Belgium clarify if only class I facilities have to set up internal emergency plan? What about category II and III? / In paragraph F.5:1 is reported: “Article 16 of the Royal Decree of 30 November 2011 requires each licensee of a Class I facility to set up an internal Emergency plan. This article specifies the objectives, the preparation and organisational issues. Arrangements with external organisations (fire rescue, hospitals, police,...) have to be concluded. It also states that adequate on-site emergency infrastructure needs to be provided and that the internal emergency plan needs to be exercised at least once per year. “	Yes, only Class I facilities are obliged by the regulations (SRNI-2011) to maintain such an internal emergency plan, althrougth this can be required, possibly on different form (such as maintaining intervention teams) as license condition for other specific facilities/activities. Class II and III facilities shall also organize permanent duty call to a Health physics expert (Radiation protection expert) or to a recognized Health Physics organization in case of incident/accident.
The report states, “Partitioning and Conditioning (P&C) and Partitioning and Transmutation (P&T) of spent nuclear fuel could potentially optimize geological disposal and enhance its long term safety of the HLW [high-level waste] management by reducing the radiotoxicity timespan and/or thermal output of the HLW to be disposed of, within the framework of advanced and sustainable energy production cycles.” Please elaborate on the P&C and P&T approach.	Belgium will study if and to what extend Partitioning & Conditioning (P&C) and Partitioning and Transmutation (P&T) could potentially contribute to reducing the quantities of long-lived radionuclides (actinides) in high-level waste to be disposed of in a future geological disposal facility. This however does not include all the existing and currently foreseen high-level and long-lived waste for which P&C and P&T is considered unfeasible. The P&C and P&T research programme, in which the Myrrha project of SCK CEN is the central element, aims at studying the potential of these technologies in optimizing the use of a future geological disposal. It is not interfering with the policy proposal for geological disposal, as a geological disposal facility will be needed for the already existing and unavoidable high-level and long-lived radioactive waste in Belgium.
The report states, “A new safety culture was developed.” Please identify specific areas where improvement was needed and what changes were made to the safety culture.	In 2021, a plan of action (with objectives and scope) for ten domains of importance for safety culture was developed with the aim to concretizing safety culture and its application in the organization. For each domain, an assessment was made to define the current maturity level and to define the actions needed to reach the desired level. Improvements were made regarding the content of governance documents, in defining safety objectives, in structuring the risk management system (process risks and strategic risks), in describing and documenting processes related to safety and in structuring and optimizing the control system. Areas of focus are a specific communication strategy for safety culture, a training strategy and the description of all roles and responsibilities. As a baseline measurement, an internal online survey was organized in 2021 on the safety policy and culture in the organization. In addition, several internal employees and external stakeholders were interviewed to clarify the results of the survey. After implementation of the above actions, a new survey will be organized to check the evolution.
The U.S. commends Belgium for developing a strong and structured Nuclear and Radiological Emergency Plan in 2018 that integrates lessons learned, international requirements, and involvement with stakeholders.	Thank you for your comment.

Question / Comment	Answer
How was the "reflex zone" seen in the referred section defined, furthermore how, and what type of scenarios were found considerable enough to be activation criteria (other than the given example)? What was the regulatory approach to defining, developing, and planning the fourth notification level and the reflex zones?	The Royal Decree of March 1st, 2018 establishing the Nuclear and Radiological Emergency Plan for the Belgian Territory provides the legal framework for the definition of the reflex phase. The scenarios, criteria and perimeters associated with the various installations are drawn up by the authorities and regulatory bodies (FANC & Bel V) in consultation with the operators of each of the nuclear facilities concerned. They are then integrated into the operational documentation of the operators and the Federal Evaluation cell (CELEVAL). The types of scenarios For Class I radiological and nuclear installations taken into account are the following: Loss of primary coolant (LOCA) with complete failure of the safety injection system (IS); Total loss of cooling (power venting); Confirmation of actual or suspected breach of integrity of one of the nuclear buildings ; Instantaneous stack release above a certain critical activity. Taking into account the guiding principles laid down in the nuclear emergency plan (mentioned above), the regulatory approach for defining the 4 notification levels and the reflex zone was proposed by the safety authorities, in consultation with the operators and administrative authorities responsible for the nuclear and radiological emergency plan for the Belgian territory (national Crisis Center), and is based on 4 steps 1. Identification of scenarios that could lead to a release ; 2. For each scenario identified, evaluation of the radiological consequences on the basis of pre-established hypotheses 3. On the basis of the results of the radiological consequence assessment, comparison with the intervention guide levels for the population and possible sensitivity analyses 4. Determination of the criteria for notification of significant events (specific to each site concerned).